ARROW IV
INFORMATION MANUAL

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Arrow IV

PA-28RT-201

HANDBOOK PART NO 761 730

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APPLICABILITY

Application of this handbook is limited to the specific Piper PA-28RT-201 model airplane designated by serial number and registration number on the face of the title page of this handbook.

This handbook cannot be used for operational purposes unless kept in a current status.

REVISIONS

The information compiled in the Pilot's Operating Handbook will be kept current by revisions distributed to the airplane owners.

Revision material will consist of information necessary to update the text of the present handbook and/or to add information to cover added airplane equipment.

I. Revisions

Revisions will be distributed whenever necessary as complete page replacements or additions and shall be inserted into the handbook in accordance with the instructions given below.

1. Revision pages will replace only pages with the same page number.
2. Insert all additional pages in proper numerical order within each section.
3. Page numbers followed by a small letter shall be inserted in direct sequence with the same common numbered page.

II. Identification of Revised Material

Revised text and illustrations shall be indicated by a black vertical line along the outside margin of the page, opposite revised, added or deleted material. A line along the outside margin of the page opposite the page number will indicate that an entire page was added.

Black lines will indicate only current revisions with changes and additions to or deletions of existing text and illustrations. Changes in capitalization, spelling, punctuation or the physical location of material on a page will not be identified.

ORIGINAL PAGES ISSUED

The original pages issued for this handbook prior to revision are given below:

Title, ii through vii, 1-1 through 1-21, 2-1 through 2-11, 3-1 through 3-18, 4-1 through 4-26, 5-1 through 5-33, 6-1 through 6-48, 7-1 through 7-30, 8-1 through 8-17, 9-1 through 9-28, 10-1 through 10-2.

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-28RT-201 Arrow IV Pilot's Operating Handbook, REPORT: VB-1130 issued September 14, 1979.

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 (PR800905)	1-3	Revised para. 1.3 (b).	
	1-4	Revised para. 1.7 (c) (1), (2).	
	2-3	Revised para. 2.7 (d) (1),(2),(4) (5), 2.7 (e) and 2.7 (f).	
	2-4	Revised para. 2.9 (c).	
	2-10	Added placard.	
	3-11	Revised para. 3.13.	
	4-i	Revised Table of Contents.	
	4-9	Revised Normal Procedures checklist.	
	5-3	Revised para. 5.5 (a) (6).	
	5-6	Corrected spelling.	
	5-7	Revised para. 5.5 (f)(1), (g)(1).	
	5-9	Revised List of Figures.	
	5-17	Revised fig. no.	
	5-26	Revised fig. 5-29.	
	5-28	Revised fig. 5-33.	
	5-33	Revised Title.	
	6-i	Revised Table of Contents.	
	6-4	Revised fig. 6-3.	
	6-12	Revised fig. 6-15.	
	6-12a, 6-12b, 6-12c,	Added pgs; added new info.	
	6-12d,	Added pg.	
	6-13	Revised para. no.	
	6-15	Revised item 9.	
	6-19	Added items 63 and 65.	
	6-23	Revised item 101; Relocated items 103 and 105 to pg. 6-24.	
	6-24	Relocated items 103 and 105 from pg. 6-23.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 (PR800905) (cont)	6-27	Relocated and renumbered item to pg. 6-28; added new items 163 and 165.	
	6-28	Relocated items to pg. 6-29; added new item 167; added item from pg. 6-27; renumbered items.	
	6-29	Relocated items to pg. 6-30; added items from pg. 6-28; renumbered items.	
	6-30	Relocated items to pg. 6-31; added items from pg. 6-29.	
	6-31	Relocated items to pg.. 6-32; added items from pg. 6-30.	
	6-32	Relocated items to pg. 6-33; added items from pg. 6-31.	
	6-33	Relocated items to pg. 6-34; added items from pg. 6-32.	
	6-34	Relocated items to pg. 6-38; renumbered items; added items from pg. 6-33.	
	6-35	Relocated items to pg. 6-39; renumbered items; added new items 239 and 241.	
	6-36	Relocated items to pgs. 6-40 and 6-41; renumbered items; added new items 247 thru 253.	
	6-37	Relocated items to pgs. 6-41 and 6-42; renumbered items; added new items 255 and 265.	
	6-38	Relocated items to pgs. 6-43 and 6-44; renumbered items; added items from pg. 6-34.	
	6-39	Relocated items to pg. 6-45; renumbered items; added items from pg. 6-35.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 (PR800905) (cont)	6-40	Relocated items to pg. 6-46 and 6-47; renumbered items; added items 283 thru 287 from pg. 6-36.	
	6-41	Relocated items to pgs. 6-47 and 6-48; renumbered items; added items from pgs. 6-36 and 6-37.	
	6-42	Relocated items to pgs. 6-48 and 6-49; renumbered items; added items from pg. 6-37.	
	6-43	Relocated items to pg. 6-50; renumbered items; added items from pg. 6-38; added new items 303 and 305.	
	6-44	Relocated items to pgs. 6-50 and 6-51; renumbered items; added items from pg. 6-38; added new items 311, 313 and 317.	
	6-45	Relocated items to pgs. 6-53 and 6-54; renumbered items; added items from pg. 6-39.	
	6-46	Relocated items to pg. 6-54 and 6-55; renumbered items; added items from pg. 6-40.	
	6-47	Relocated items to pg. 6-56; renumbered item; added items from pgs. 6-40 and 6-41.	
	6-48	Relocated form to pg. 6-57; renumbered items; added items from pgs. 6-41 and 6-42.	
	6-49	Added pg.; relocated and renumbered items from pgs. 6-42 and 6-43.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 (PR800905) (cont)	6-50	Added pg.; relocated and renumbered items from pg. 6-43 and 6-44; added new item 352.	
	6-51	Added pg.; relocated and renumbered items from pg. 6-44.	
	6-52	Added pg.	
	6-53	Added pg.; relocated items from pg. 6-45.	
	6-54	Added pg.; relocated items from pgs. 6-45 and 6-46.	
	6-55	Added pg.; relocated item from pg. 6-46; added new items 411 and 413.	
	6-56	Added pg.; relocated and renumbered items from pg. 6-47; added new item 415.	
	6-57	Added pg.; relocated form from pg. 6-48.	
	7-8	Revised info.	
	7-12	Revised para. 7.15.	
	7-18	Revised para. 7.19.	
	7-19	Revised note.	
	7-23	Revised para. 7.25; relocated info. to pg. 7-24.	
	7-24	Relocated info. from pg. 7-23.	
	7-27	Revised para. 7.31.	
	8-i	Revised Table of Contents.	
	8-11	Relocated para. 8.21 to pg. 8-12.	
	8-12	Added para. 8.21 from pg. 8-11; revised para. 8.21 (b) and 8.21 (c).	
	8-12a	Added pg.; added new info.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 (PR800905) (cont)	8-12b	Added pg.; added new info.; added para. 8.21 (d) from pg. 8-13.	
	8-13	Relocated para. 8.21 (d) to pg. 8-12b.	
	9-i	Revised Table of Contents.	
	9-7	Revised Supplement 2.	
	9-29 thru 9-32	Added pgs. (added Supplement 6 KNS 80 Navigation System).	
	9-33 thru 9-36	Added pgs. (added Supplement 7 ANS 351 Area Navigation Computer).	
	9-37 thru 9-40	Added pgs. (added Supplement 8 Century 21 Autopilot Installation).	
	9-41 thru 9-50	Added pgs. (added Supplement 9 Century 41 Autopilot Installation).	Ward Evans Ward Evans Sept. 5, 1980
	9-51 thru 9-52	Added pgs. (added Supplement 10 Piper Control Wheel Clock Installation).	
Rev. 2 (PR810318)	3-i	Changed titles, pg. no.	
	3-5	Revised, re-titled Alternator Failure to Electrical Failures; added Electrical Overload.	
	3-6	Continued Electrical Overload; moved info. to pg. 3-7.	
	3-7	Relocated info. from pg. 3-6; moved info. to pg. 3-8.	
	3-8	Relocated info. from pg. 3-7.	
	3-15	Revised, retitled para. 3.23.	
	3-16	Added para. 3.24; moved para. 3.25 to pg. 3-17.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 2 (PR810318) (cont)	3-17	Relocated para. 3.25 from pg. 3-16; moved para. 3.31 and 3.33 to pg. 3-18.	
	3-18	Relocated para. 3.31 and 3.33 from pg. 3-17.	
	6-22	Relocated revised items 97 and 99 from pg. 6-23.	
	6-23	Moved items 97 and 99 to pg. 6-22; revised item 101.	
	6-33	Added item 216; moved item 223 to pg. 6-34.	
	6-34	Relocated item 223 from pg. 6-33.	
	6-42	Added item 292.	
	6-55	Revised items 409, 411 and 413.	
	6-56	Revised item 415; moved item 429 to pg. 6-57.	
	6-57	Relocated item 429 from pg. 6-56.	
	7-16	Revised fig. 7-15.	Ward Evans
	7-17	Revised para. 7.17.	Ward Evans
	9-41	Revised Sec. 2 c.	March 18, 1981
Rev. 3 (PR810714)	ii	Revised Warning.	
	1-5	Revised para. 1.13.	
	2-4	Added info. to para. 2.9 (c).	
	4-5	Revised para. 4.5.	
	4-8	Revised para. 4.5.	
	4-10	Revised para. 4.5.	
	4-14	Moved info. to pg. 4-14a.	
	4-14a	New pg.; relocated info. from pg. 4-14; added note; relocated para. 4.11 from pg. 4-15.	
	4-14b	New pg.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 (PR810714) (cont)	4-15	Moved para. 4.11 to pg. 4-14a.	
	4-18	Moved para. 4.21 to pg. 4-19.	
	4-19	Relocated para. 4.21 from pg. 4-18; moved para. 4.23 to pg. 4-19b.	
	4-19a	New pg.; added note to para. 4.21.	
	4-19b	New pg.; relocated para. 4.23 from pg. 4-19 and 4-20.	
	4-20	Moved para. 4.23 info. to pg. 4-19b.	
	4-22	Added note to para. 4.29; moved info. to pg. 4-23.	
	4-23	Relocated info. from pg. 4-22; moved para. 4.33 to pg. 4-24.	
	4-24	Relocated para. 4.33 from pg. 4-23.	
	6-6	Revised Figure 6-5.	
	6-15	Added info. to item 15.	
	6-26	Added info. to item 153.	
	6-30	Added new item 196.	
	6-35	Revised item 241.	
	6-40	Added new items 286 and 287; renumbered previous item 287 to 288.	
	6-42	Added new item 294.	
	6-44	Revised item 313; moved item 319 to pg. 6-45.	
	6-45	Relocated item 319 from pg. 6-44.	
	6-57	Added new item 430; removed info.	Ward Evans Ward Evans July 14, 1981
	7-15	Revised para. 7.17.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 4 (PR811130)	5-28	Revised fig. 5-33.	
	6-i	Revised Table of Contents.	
	6-13	Revised para. 6.11.	
	6-29	Revised typo.	
	6-43	Revised item 299, moved items 307 and 309 to pg. 6-43b.	
	6-43a	New page.	
	6-43b	New page, relocated items 307 and 309 from pg. 6-43; relocated item 311 from pg. 6-44.	
	6-44	Moved item 311 to pg. 6-43b.	
	6-50	Renumbered item; added new item 354; moved item 357 to pg. 6-51.	
	6-51	Relocated item 357 from pg. 6-50.	
	7-2	Revised para. 7.5.	
	7-12	Moved info. to pg. 7-14.	
	7-14	Relocated info. from pg. 7-12.	
	7-23	Revised para. 7.25; moved info. to pg. 7-24.	
	7-24	Relocated info. from pg. 7-23.	
	9-i	Corrected title in Table of Contents.	Ward Evans Ward Evans Nov. 30, 1981
	9-34	Revised illustration.	
Rev. 5 (PR870131)	2-9, 2-11	Revised para. 2.25.	
	3-2, 3-3, 3-4, 3-7	Revised para. 3.3.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 (PR870131) (contd)	3-9, 3-10	Revised para. 3.9.	
	3-11, 3-12, 3-13	Revised para. 3.13.	
	3-17	Revised para. 3.27.	
	4-5	Revised para. 4.5.	
	4-9		
	4-14	Revised para. 4.9.	
	4-19	Revised para. 4.21.	
	4-19b	Revised para 4.23.	
	4-20	Revised para. 4.25.	
	4-25, 4-26	Revised para. 4.39.	
	4-26	Revised para. 4.41.	
	5-3, 5-4, 5-5, 5-6, 5-7	Revised example para. 5.5.	
	5-26	Revised fig. 5-29.	
	7-4	Revised fig. 7-1	
	7-6	Revised para. 7.11 and fig. 7-3. Relocated info. from page 7-7 to 7-6.	
	7-7	Revised para. 7.11. Relocated info to page 7.6	
	7-8	Revised para. 7.11.	
	7-9	Revised fig. 7-5.	
	7-10	Revised fig. 7-7.	
	7-11	Revised fig. 7-9.	
	7-27	Revised para. 7.33.	
	8-2	Revised para. 8.3.	D.H. Trompler
	8-3, 8-4	Revised para. 8.5.	
	9-7	Revised Supp.2.	5/7/87 Date

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SECTION I

GENERAL

SECTION 1

GENERAL

1.1 INTRODUCTION

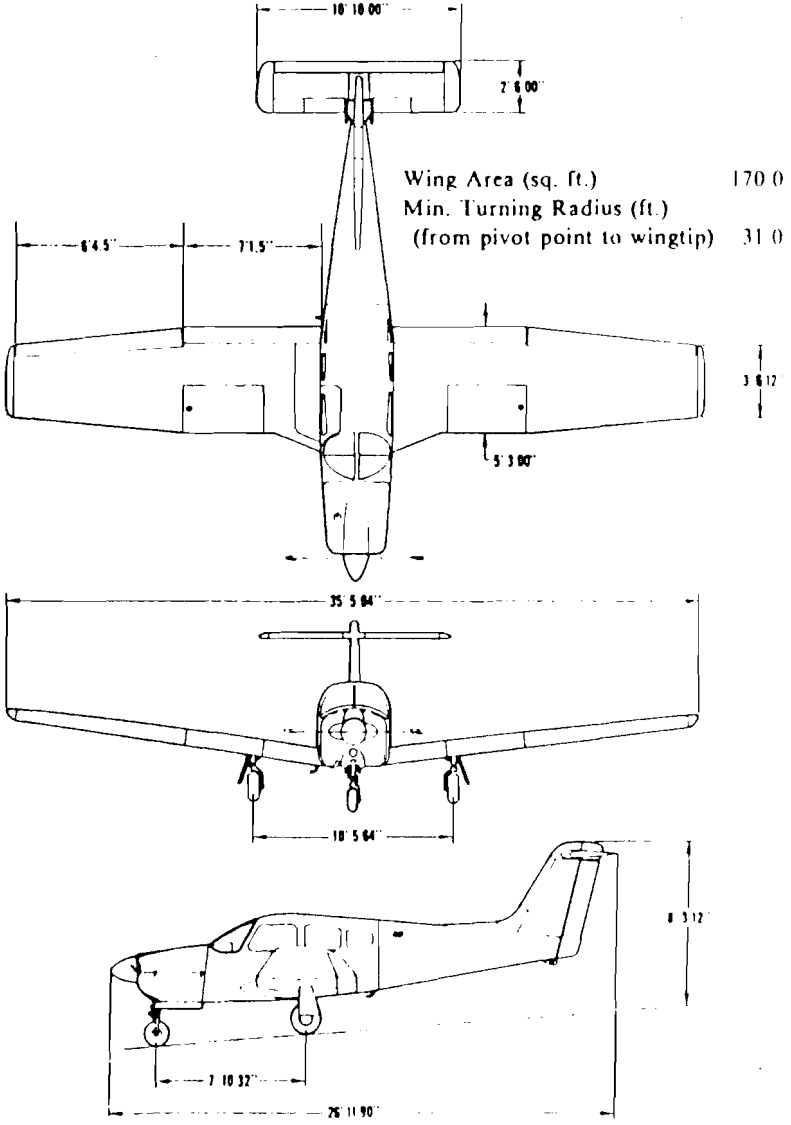
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by CAR 3 and FAR Part 21 Subpart J. It also contains supplemental data supplied by the airplane manufacturer.

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

Assurance that the airplane is an airworthy condition is the responsibility of the owner. The pilot in command is responsible for determining that the airplane is safe for flight. The pilot is also responsible for remaining within the operating limitations as outlined by instrument markings, placards, and this handbook.

Although the arrangement of this handbook is intended to increase its in-flight capabilities, it should not be used solely as an occasional operating reference. The pilot should study the entire handbook to familiarize himself with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.

The handbook has been divided into numbered (arabic) sections, each provided with a "finger-tip" tab divider for quick reference. The limitations and emergency procedures have been placed ahead of the normal procedures, performance and other sections to provide easier access to information that may be required in flight. The "Emergency Procedures" Section has been furnished with a red tab divider to present an instant reference to the section. Provisions for expansion of the handbook have been made by the deliberate omission of certain paragraph numbers, figure numbers, item numbers and pages noted as being intentionally left blank.



THREE VIEW
Figure 1-1

1.3 ENGINES

(a) Number of Engines	1
(b) Engine Manufacturer	Lycoming
(c) Engine Model Number	IO-360-C1C6
(d) Rated Horsepower	200
(e) Rated Speed (rpm)	2700
(f) Bore (in.)	5.125
(g) Stroke (in.)	4.375
(h) Displacement (cu. in.)	361
(i) Compression Ratio	8.5:1
(j) Engine Type	Four Cylinder, Direct Drive, Horizontally Opposed, Air Cooled, and Fuel Injected

1.5 PROPELLERS

McCAULEY

(a) Number of Propellers	1
(b) Propeller Manufacturer	McCauley
(c) Blade Model	90DJA-14E
(d) Number of Blades	2
(e) Hub Model	2D34C215
(f) Propeller Diameter (in.)	
(1) Maximum	76
(2) Minimum	75
(g) Propeller Type	Constant Speed, Hydraulically Actuated

1.7 FUEL

(a) Fuel Capacity (U.S. gal.) (total)	77
(b) Usable Fuel (U.S. gal.) (total)	72
(c) Fuel	
(1) Minimum Grade	100 Green or 100LL Blue Aviation Grade
(2) Alternate Fuels	Refer to latest revision of Lycoming Service Instruction 1070

1.9 OIL

(a) Oil Capacity (U.S. qts.)	8
(b) Oil Specification	Refer to latest issue of Lycoming Service Instruction 1014
(c) Oil Viscosity	Refer to Section 8 - paragraph 8.19.

1.11 MAXIMUM WEIGHTS

(a) Maximum Takeoff Weight (lbs.)	2750
(b) Maximum Landing Weight (lbs.)	2750
(c) Maximum Weights in Baggage Compartment	200

1.13 STANDARD AIRPLANE WEIGHTS

Refer to Figure 6-5 for the Standard Empty Weight and the Useful Load.

1.15 BAGGAGE SPACE

(a) Compartment Volume (cu. ft.)	24
(b) Entry Width (in.)	22
(c) Entry Height (in.)	20

1.17 SPECIFIC LOADINGS

(a) Wing Loading (lbs. per sq. ft.)	16.18
(b) Power Loading (lbs. per hp)	13.75

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

The following definitions are of symbols, abbreviations and terminology used throughout the handbook and those which may be of added operational significance to the pilot.

(a) General Airspeed Terminology and Symbols

CAS	Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KCAS	Calibrated Airspeed expressed in "Knots."
GS	Ground Speed is the speed of an airplane relative to the ground.
IAS	Indicated Airspeed is the speed of an aircraft as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.
KIAS	Indicated Airspeed expressed in "Knots."
M	Mach number is the ratio of true airspeed to the speed of sound.
TAS	True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.
V_A	Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

V_{LE}	Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
V_{LO}	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
V_{NE}/M_{NE}	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_X	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y	Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

(b) Meteorological Terminology

ISA	International Standard Atmosphere in which: The air is a dry perfect gas; The temperature at sea level is 15° Celsius (59° Fahrenheit); The pressure at sea level is 29.92 inches Hg (1013 mb); The temperature gradient from sea level to the altitude at which the temperature is -56.5° C (-69.7° F) is -0.00198° C (-0.003566° F) per foot and zero above that altitude.
OAT	Outside Air Temperature is the free air static temperature, obtained either from inflight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects.
Indicated Pressure Altitude	The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013 millibars).
Pressure Altitude	Altitude measured from standard sea-level pressure (29.92 in. Hg) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.
Station Pressure	Actual atmospheric pressure at field elevation.
Wind	The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

(c) Power Terminology

Takeoff Power	Maximum power permissible for takeoff.
Maximum Continuous Power	Maximum power permissible continuously during flight.
Maximum Climb Power	Maximum power permissible during climb.
Maximum Cruise Power	Maximum power permissible during cruise.

(d) Engine Instruments

EGT Gauge	Exhaust Gas Temperature Gauge

(e) Airplane Performance and Flight Planning Terminology

Climb Gradient	The demonstrated ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.
Demonstrated Crosswind Velocity	The 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.
Accelerate-Stop Distance	The distance required to accelerate an airplane to a specified speed and, assuming failure of an engine at the instant that speed is attained, to bring the airplane to a stop.
MEA	Minimum en route IFR altitude.
Route Segment	A part of a route. Each end of that part is identified by: (1) a geographical location; or (2) a point at which a definite radio fix can be established.

(f) Weight and Balance Terminology

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance from the reference datum.
Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.
Usable Fuel	Fuel available for flight planning.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Standard Empty Weight	Weight of a standard airplane including unusable fuel, full operating fluids and full oil.

Basic Empty Weight	Standard empty weight plus optional equipment.
Payload	Weight of occupants, cargo and baggage.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight.
Maximum Ramp Weight	Maximum weight approved for ground maneuver. (It includes weight of start, taxi and run up fuel.)
Maximum Takeoff Weight	Maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	Maximum weight approved for the landing touchdown.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.

1.21 CONVERSION FACTORS

MULTIPLY	BY	TO OBTAIN
acres	0.4047	ha
	43560	sq. ft.
	0.0015625	sq. mi.
atmospheres (atm)	76	cm Hg
	29.92	in. Hg
	1.0133	bar
	1.033	kg/cm^2
	14.70	lb./sq. in.
	2116	lb./sq. ft.
bars (bar)	0.98692	atm
	14.503768	lb./sq. in.
British Thermal Unit (BTU)	0.2519958	kg-cal
centimeters (cm)	0.3937	in.
	0.032808	ft.
centimeters of mercury at 0°C (cm Hg)	0.01316	atm
	0.3937	in. Hg
	0.1934	lb./sq. in.
	27.85	lb./sq. ft.
	135.95	kg/m^2
centimeters per second (cm/sec.)	0.032808	ft./sec.
	1.9685	ft./min.
	0.02237	mph
cubic centimeters (cm^3)	0.03381	fl. oz.
	0.06102	cu. in.
	3.531×10^{-5}	cu. ft.
	0.001	l
	2.642×10^{-4}	U.S. gal.

MULTIPLY	BY	TO OBTAIN
cubic feet (cu. ft.)	28317	cm^3
	0.028317	m^3
	1728	cu. in.
	0.037037	cu. yd.
	7.481	U.S. gal.
	28.32	l
cubic feet per minute (cu. ft./min.)	0.472	l/sec.
	0.028317	m^3/min.
cubic inches (cu. in.)	16.39	cm^3
	1.639×10^{-5}	m^3
	5.787×10^{-4}	cu. ft.
	0.5541	fl. oz.
	0.01639	l
	4.329×10^{-3}	U.S. gal.
	0.01732	U.S. qt.
cubic meters (m^3)	61024	cu. in.
	1.308	cu. yd.
	35.3147	cu. ft.
	264.2	U.S. gal.
cubic meters per minute (m^3/min.)	35.3147	cu. ft./min.
cubic yards (cu. yd.)	27	cu. ft.
	0.7646	m^3
	202	U.S. gal.
degrees (arc)	0.01745	radians
degrees per second (deg./sec.)	0.01745	radians/sec.
drams, fluid (dr. fl.)	0.125	fl. oz.
drams, avdp. (dr. avdp.)	0.0625	oz. avdp.

MULTIPLY	BY	TO OBTAIN
feet (ft.)	30.48	cm
	0.3048	m
	12	in.
	0.33333	yd.
	0.0606061	rod
	1.894×10^{-4}	mi.
	1.645×10^{-4}	NM
feet per minute (ft./min.)	0.01136	mph
	0.01829	km/hr.
	0.508	cm/sec.
	0.00508	m/sec.
feet per second (ft./sec.)	0.6818	mph
	1.097	km/hr.
	30.48	cm/sec.
	0.5921	kts.
foot-pounds (ft.-lb.)	0.138255	m-kg
	3.24×10^{-4}	kg-cal
foot-pounds per minute (ft.-lb./min.)	3.030×10^{-5}	hp
foot-pounds per second (ft.-lb./sec.)	1.818×10^{-5}	hp
gallons, Imperial (Imperial gal.)	277.4	cu. in.
	1.201	U.S. gal.
	4.546	l
gallons, U.S. dry (U.S. gal. dry)	268.8	cu. in
	1.556×10^{-1}	cu. ft.
	1.164	U.S. gal.
	4.405	l

MULTIPLY	BY	TO OBTAIN
gallons, U.S. liquid (U.S. gal.)	231	cu. in.
	0.1337	cu. ft.
	4.951×10^{-3}	cu. yd.
	3785.4	cm^3
	3.785×10^{-3}	m^3
	3.785	l
	0.83268	Imperial gal.
	128	fl. oz.
gallons per acre (gal./acre)	9.353	l/ha
grams (g)	0.001	kg
	0.3527	oz. avdp.
	2.205×10^{-3}	lb.
grams per centimeter (g/cm)	0.1	kg/m
	6.721×10^{-2}	lb./ft.
	5.601×10^{-3}	lb./in.
grams per cubic centimeter (g/cm^3)	1000	kg/m^3
	0.03613	lb./cu. in.
	62.43	lb./cu. ft.
hectares (ha)	2.471	acres
	107639	sq. ft.
	10000	m^2
horsepower (hp)	33000	ft.lb./min.
	550	ft.-lb./sec.
	76.04	m-kg/sec.
	1.014	metric hp
horsepower, metric	75	m-kg/sec.
	0.9863	hp
inches (in.)	25.40	mm
	2.540	cm
	0.0254	m
	0.08333	ft.
	0.027777	yd.

MULTIPLY	BY	TO OBTAIN
inches of mercury at 0° C (in. Hg)	0.033421	atm
	0.4912	lb./sq. in.
	70.73	lb./sq. ft.
	345.3	kg/m^2
	2.540	cm Hg
	25.40	mm Hg
inch-pounds (in.-lb.)	0.011521	m-kg
kilograms (kg)	2.204622	lb.
	35.27	oz. avdp.
	1000	g
kilogram-calories (kg-cal)	3.9683	BTU
	3087	ft.-lb.
	426.9	m-kg
kilograms per cubic meter (kg/m^3)	0.06243	lb./cu. ft.
	0.001	g/cm^3
kilograms per hectare (kg/ha)	0.892	lb./acre
kilograms per square centimeter (kg/cm^2)	0.9678	atm
	28.96	in. Hg
	14.22	lb./sq. in.
	2048	lb./sq. ft.
kilograms per square meter (kg/m^2)	2.896×10^{-3}	in. Hg
	1.422×10^{-3}	lb./sq. in.
	0.2048	lb./sq. ft
kilometers (km)	1×10^{-5}	cm
	3280.8	ft.
	0.6214	mi.
	0.53996	NM

MULTIPLY	BY	TO OBTAIN
kilometers per hour (km/hr.)	0.9113	ft./sec.
	58.68	ft./min.
	0.53996	kt
	0.6214	mph
	0.27778	m/sec.
	16.67	m/min.
knots (kt)	1	nautical mph
	1.689	ft./sec.
	1.1516	statute mph
	1.852	km/hr.
	51.48	m/sec.
liters (l)	1000	cm^3
	61.02	cu. in.
	0.03531	cu. ft.
	33.814	fl. oz.
	0.264172	U.S. gal.
	0.2200	Imperial gal.
	1.05669	qt.
liters per hectare (l/ha)	13.69	ft. oz./acre
	0.107	gal./acre
liters per second (l/sec.)	2.12	cu. ft./min.
meters (m)	39.37	in.
	3.280840	ft.
	1.0936	yd.
	0.198838	rod
	6.214×10^{-4}	mi.
	5.3996×10^{-4}	NM
meter-kilogram (m-kg)	7.23301	ft.-lb.
	86.798	in.-lb.
meters per minute (m/min.)	0.06	km/hr.

MULTIPLY	BY	TO OBTAIN
meters per second (m/sec.)	3.280840	ft./sec.
	196.8504	ft./min.
	2.237	mph
	3.6	km/hr.
microns	3.937×10^{-5}	in.
miles, statute (mi.)	5280	ft.
	1.6093	km
	1609.3	m
	0.8684	NM
miles per hour (mph)	44.7041	cm/sec.
	4.470×10^{-1}	m/sec.
	1.467	ft./sec.
	88	ft./min.
	1.6093	km/hr.
	0.8684	kt
miles per hour square (m/hr.sq.)	2.151	ft./sec. sq.
millibars	2.953×10^{-2}	in. Hg
millimeters (mm)	0.03937	in.
millimeters of mercury at 0°C (mm Hg)	0.03937	in. Hg
nautical miles (NM)	6080	ft.
	1.1516	statute mi.
	1852	m
	1.852	km
ounces, avdp. (oz. avdp.)	28.35	g
	16	dr. avdp.

MULTIPLY	BY	TO OBTAIN
ounces, fluid (fl. oz.)	8	dr. fl.
	29.57	cm^3
	1.805	cu. in.
	0.0296	l
	0.0078	U.S. gal.
ounces, fluid per acre (fl. oz./acre)	0.073	l/ha
pounds (lb.)	0.453592	kg
	453.6	g
	3.108×10^{-2}	slug
pounds per acre (lb./acre)	1.121	kg/ha
pounds per cubic foot (lb./cu. ft.)	16.02	kg/m^3
pounds per cubic inch (lb./cu. in.)	1728	lb./cu. ft.
	27.68	g/cm^3
pounds per square foot (lb./sq. ft.)	0.1414	in. Hg
	4.88243	kg/m^2
	4.725×10^{-4}	atm
pounds per square inch (psi or lb./sq. in.)	5.1715	cm Hg
	2.036	in. Hg
	0.06804	atm
	0.0689476	bar
	703.1	kg/m^2
quart, U.S. (qt.)	0.94635	l
	57.749	cu. in.
radians	57.30	deg. (arc)
	0.1592	rev.

MULTIPLY	BY	TO OBTAIN
radians per second (radians/sec.)	57.30	deg./sec.
	0.1592	rev./sec.
	9.549	rpm
revolutions (rev.)	6.283	radians
revolutions per minute (rpm or rev./min.)	0.1047	radians/sec.
revolutions per second (rev./sec.)	6.283	radians/sec.
rod	16.5	ft.
	5.5	yd.
	5.029	m
slug	32.174	lb.
square centimeters (cm^2)	0.1550	sq. in.
	0.001076	sq. ft.
square feet (sq. ft.)	929	cm^2
	0.092903	m^2
	144	sq. in.
	0.1111	sq. yd.
	2.296×10^{-5}	acres
square inches (sq. in.)	6.4516	cm^2
	6.944×10^{-3}	sq. ft.
square kilometers (km^2)	0.3861	sq. mi.
square meters (m^2)	10.76391	sq. ft.
	1.196	sq. yd.
	0.0001	ha

MULTIPLY	BY	TO OBTAIN
square miles (sq. mi.)	2.590	km^2
	640	acres
square rods (sq. rods)	30.25	sq. yd.
square yards (sq. yd.)	0.8361	m^2
	9	sq. ft.
	0.0330579	sq. rods
yards (yd.)	0.9144	m
	3	ft.
	36	in.
	0.181818	rod

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SECTION 2

LIMITATIONS

SECTION 2

LIMITATIONS

2.1 GENERAL

This section provides the "FAA Approved" operating limitations, instrument markings, color coding and basic placards necessary for the operation of the airplane and its systems.

Limitations associated with those optional systems and equipment which require handbook supplements can be found in Section 9 (Supplements).

2.3 AIRSPEED LIMITATIONS

SPEED	KIAS	KCAS
Never Exceed Speed (V_{NE}) - Do not exceed this speed in any operation.	190	186
Maximum Structural Cruising Speed (V_{NO}) - Do not exceed this speed except in smooth air and then only with caution.	149	148
Design Maneuvering Speed (VA) - Do not make full or abrupt control movements above this speed.		
At 2750 lbs. G.W.	121	121
At 1863 lbs. G.W.	96	97

CAUTION

Maneuvering speed decreases at lighter weight as the effects of aerodynamic forces become more pronounced. Linear interpolation may be used for intermediate gross weights. Maneuvering speed should not be exceeded while operating in rough air.

SPEED	KIAS	KCAS
Maximum Flaps Extended Speed (V_{FE}) - Do not exceed this speed with the flaps extended.	108	104
Maximum Landing Gear Extension Speed - Do not exceed this speed when extending the landing gear.	130	130
Maximum Landing Gear Retraction Speed- Do not exceed this speed when retracting the landing gear.	109	109
Maximum Landing Gear Extended Speed (V_{LE}) - Do not exceed this speed with the landing gear extended.	130	130

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS
Red Radial Line (Never Exceed)	190 KTS
Yellow Arc (Caution Range - Smooth Air Only)	149 KTS to 190 KTS
Green Arc (Normal Operating Range)	58 KTS to 149 KTS
White Arc (Flap Down)	53 KTS to 108 KTS

2.7 POWER PLANT LIMITATIONS

(a) Number of Engines	1
(b) Engine Manufacturer	Lycoming
(c) Engine Model No.	IO-360-C1C6
(d) Engine Operating Limits	
(1) Takeoff Power - 5 Min. Limit (BHP)	200
(2) Takeoff Engine Speed - 5 Min. Limit (RPM)	2700
(3) Maximum Oil Temperature	245°F
(4) Maximum Continuous Power (BHP)	196
(5) Maximum Continuous Engine Speed (RPM)	2650
(e) Oil Pressure	
Minimum (red line)	25 PSI
Maximum (red line)	100 PSI
(f) Fuel Pressure	
Minimum (red line)	14 PSI
Maximum (red line)	45 PSI
(g) Fuel (minimum octane)	100 or 100LL Aviation Grade
(h) Number of Propellers	1
(i) Propeller Manufacturer	McCauley
(j) Propeller Hub and Blade Model	
(1) McCauley	2D34C215/90DJA-14E
(k) Propeller Diameter	
(1) McCauley	
Minimum	75
Maximum	76
(l) Blade Angle Limits	
(1) McCauley	
Low Pitch Stop	12.5 + 0.2°
High Pitch Stop	27.5 + 1°
(m) RPM Restrictions	Avoid Continuous Operation Between 1400 and 1750 RPM Below 15 Inches Map

2.9 POWER PLANT INSTRUMENT MARKINGS

(a)	Tachometer	
	Green Arc (Normal Operating Range)	500 to 2650 RPM
	Yellow Arc (Caution Range - 5 Min. Max.)	2650 to 2700
	Red Line (Take Off Power)	2700 RPM
(b)	Oil Temperature	
	Green Arc (Normal Operating Range)	75° to 245 °F
	Red Line (Maximum)	245°F
(c)	Oil Pressure	
	Green Arc (Normal Operating Range)	60 PSI to 90 PSI
	Yellow Arc (Caution Range) (Idle)	25 PSI to 60 PSI
	Yellow Arc (Ground Warm Up)	90 PSI to 100 PSI
	Red Line (Minimum)	25 PSI
	Red Line (Maximum)	100 PSI
(d)	Fuel Pressure	
	Green Arc (Normal Operating Range)	14 PSI to 45 PSI
	Red Line (Minimum)	14 PSI
	Red Line (Maximum)	45 PSI

2.11 WEIGHT LIMITS

(a)	Maximum Weight	2750 LBS
(b)	Maximum Baggage	200 LBS

NOTE

Refer to Section 5 (Performance) for maximum weight as limited by performance.

2.13 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
2750	90.0	93.0
2400	85.5	93.0

NOTES

Straight line variation between points given.

The datum used is 78.4 inches ahead of the wing leading edge at the intersection of the straight and tapered section.

It is the responsibility of the airplane owner and the pilot to insure that the airplane is properly loaded. See Section 6 (Weight and Balance) for proper loading instructions.

2.15 MANEUVER LIMITS

No acrobatic maneuvers including spins approved.

2.17 FLIGHT LOAD FACTORS

(a) Positive Load Factor (Maximum)	3.8 G
(b) Negative Load Factor (Maximum)	No inverted maneuvers approved

2.19 TYPES OF OPERATIONS

The airplane is approved for the following operations when equipped in accordance with FAR 91 or FAR 135.

(a) Day V.F.R.
(b) Night V.F.R.
(c) Day I.F.R.
(d) Night I.F.R.
(e) Non Icing

2.21 FUEL LIMITATIONS

(a) Total Capacity	77 U.S. GAL.
(b) Unusable Fuel The unusable fuel for this airplane has been determined as 2.5 gallons in each wing tank in critical flight attitudes.	5 U.S. GAL.
(c) Usable Fuel The usable fuel in this airplane has been determined as 36.0 gallons in each wing tank.	72 U.S. GAL.
(d) Fuel remaining when the quantity indicators read zero cannot be used safely in flight.	

2.23 NOISE LEVEL

The noise level of this aircraft is 75.1 d B(A).

No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

The above statement notwithstanding the noise level stated above has been verified by and approved by the Federal Aviation Administration in noise level test flights conducted in accordance with FAR 36, Noise Standards - Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all FAR 36 noise standards applicable to this type.

2.25 PLACARDS

In full view of the pilot:

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

THIS AIRCRAFT APPROVED FOR NIGHT I.F.R. NON-ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE WITH FAR 91 OR FAR 135.

In full view of the pilot:

TAKEOFF CHECK LIST

Fuel on Proper Tank
Electric Fuel Pump - On
Engine Gauges - Checked
Alternate Air - Closed
Seat Backs Erect
Mixture - Set
Propeller - Set
Fasten Belts/Harness
Flaps - Set
Trim Tab - Set
Controls - Free
Doors - Latched
Air Conditioner - Off

LANDING CHECK LIST

Fuel on Proper Tank
Seat Backs Erect
Fasten Belts/Harness
Electric Fuel Pump - On
Mixture - Rich
Propeller - Set
Gear Down
Flaps - Set (White Arc)
Air Conditioner - Off

The "Air Conditioner Off" item in the above Takeoff and Landing Check Lists is mandatory for air conditioned aircraft only.

In full view of the pilot:

NO ACROBATIC MANEUVERS,
INCLUDING SPINS, APPROVED

Near emergency gear lever:

EMERGENCY DOWN

Near emergency gear lever (aircraft equipped with backup gear extender):

OVERRIDE ENGAGED AUTO-EXT-OFF
LOCK PIN ON SIDE
TO ENGAGE OVERRIDE:
PULL LEVER FULL UP, PUSH LOCK PIN
TO RELEASE OVERRIDE:
PULL LEVER FULL UP & RELEASE

Near gear selector switch:

GEAR UP	109 KIAS MAX.
DOWN	130 KIAS MAX.

Adjacent to upper door latch:

ENGAGE LATCH BEFORE FLIGHT

In full view of the pilot:

WARNING

TURN OFF STROBE LIGHTS WHEN IN CLOSE PROXIMITY TO GROUND OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE.

In full view of the pilot, in the area of the air conditioner controls when the air conditioner is installed:

WARNING

AIR CONDITIONER MUST BE OFF TO INSURE NORMAL TAKEOFF CLIMB PERFORMANCE.

On inside of baggage compartment door:

BAGGAGE MAXIMUM 200 LBS. SEE WEIGHT AND BALANCE DATA FOR BAGGAGE LOADING BETWEEN 150 LBS. AND 200 LBS.

Adjacent to fuel tank filler caps:

FUEL - 100 OR 100LL AVIATION GRADE
OR
FUEL - 100/130 AVIATION GRADE - MIN. USABLE CAPACITY 36 GAL.

USABLE CAPACITY TO BOTTOM OF FILLER NECK INDICATOR 25 GAL.

In full view of the pilot:

FUEL REMAINING WHEN QUANTITY INDICATOR READS ZERO CANNOT BE USED SAFELY IN FLIGHT.

On tachometer face:

AFTER 5 MIN. REDUCE POWER TO 2650 RPM.

On the aft baggage closeout:

MAXIMUM BAGGAGE 200 LBS. NO HEAVY OBJECTS ON HAT SHELF.

In full view of the pilot:

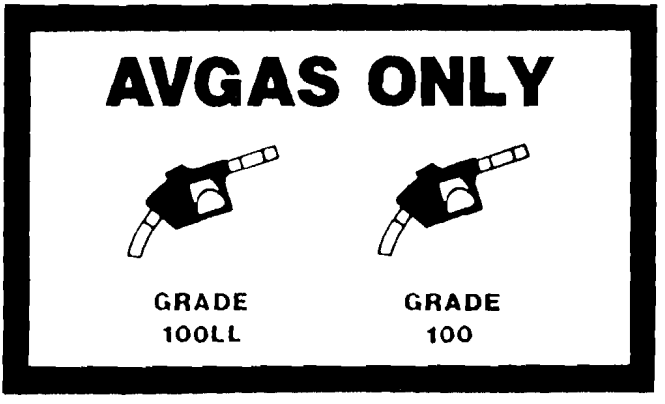
"V_A + 121 KIAS at 2750 (See P.O.H.)"
"DEMO. X-WIND 17 KTS"
V_{LO} 130 DN, 109 UP
V_{LE} 130 MAX.
130 MAX.

In full view of pilot:

"OIL COOLER WINTERIZATION PLATE TO BE REMOVED WHEN AMBIENT TEMPERATURE EXCEEDS 50°F."

On the instrument panel in full view of the pilot:

AVOID CONTINUOUS OPERATION BETWEEN 1400 AND 1750 RPM BELOW 15" MAP.



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SECTION 3

EMERGENCY PROCEDURES

SECTION 3

EMERGENCY PROCEDURES

3.1 GENERAL

The recommended procedures for coping with various types of emergencies and critical situations are provided by this section. All of the required (FAA regulations) emergency procedures and those necessary for the operation of the airplane as determined by the operating and design features of the airplane are presented.

Emergency procedures associated with those optional systems and equipment which require handbook supplements are provided by Section 9 (Supplements).

The first portion of this section consists of an abbreviated emergency check list which supplies an action sequence for critical situations with little emphasis on the operation of systems.

The remainder of the section is devoted to amplified emergency procedures containing additional information to provide the pilot with a more complete understanding of the procedures.

These procedures are suggested as the best course of action for coping with the particular condition described, but are not a substitute for sound judgment and common sense. Since emergencies rarely happen in modern aircraft, their occurrence is usually unexpected and the best corrective action may not always be obvious. Pilots should familiarize themselves with the procedures given in this section and be prepared to take appropriate action should an emergency arise.

Most basic emergency procedures, such as power off landings, are a normal part of pilot training. Although these emergencies are discussed here, this information is not intended to replace such training, but only to provide a source of reference and review, and to provide information on procedures which are not the same for all aircraft. It is suggested that the pilot review standard emergency procedures periodically to remain proficient in them.

3.3 EMERGENCY PROCEDURES CHECK LIST

ENGINE FIRE DURING START

Starter ..... crank engine
Mixture ..... idle cut-off
Throttle ..... open
Electric fuel pump ..... OFF
Fuel selector ..... OFF
Abandon if fire continues.

ENGINE POWER LOSS DURING TAKEOFF

If sufficient runway remains for a normal landing, leave gear down and land straight ahead.

If area ahead is rough, or if it is necessary to clear obstructions:
Gear selector switch ..... UP
Emergency gear lever (aircraft equipped with backup gear extender) ..... latched in OVERRIDE ENGAGED position

If sufficient altitude has been gained to attempt a restart:
Maintain safe airspeed.
Fuel selector ..... switch to tank containing fuel
Electric fuel pump ..... check ON
Mixture ..... check RICH
Alternate air ..... OPEN
Emergency gear lever ..... as required
If power is not regained, proceed with power off landing.

ENGINE POWER LOSS IN FLIGHT

Fuel selector ..... switch to tank containing fuel
Electric fuel pump ..... ON
Mixture ..... RICH
Alternate air ..... OPEN
Engine gauges ..... check for indication of cause of power loss

If no fuel pressure is indicated, check tank selector position to be sure it is on a tank containing fuel.

When power is restored:
Alternate air ..... CLOSED
Electric fuel pump ..... OFF

If power is not restored prepare for power off landing.
Trim for 79 KIAS.

POWER OFF LANDING

On aircraft equipped with the backup gear extender lock emergency gear lever in OVERRIDE ENGAGED position before airspeed drops to 105 KIAS to prevent the landing gear from free falling.

Trim for 79 KIAS.
Locate suitable field.
Establish spiral pattern.
1000 ft. above field at downwind position for normal landing approach.
When field can easily be reached slow to 72 KIAS for shortest landing.

GEAR DOWN EMERGENCY LANDING

Touchdowns should normally be made at lowest possible airspeed with full flaps.

When committed to landing:
Landing gear selector ..... Down
Throttle ..... close
Mixture ..... idle cut-off
Ignition ..... OFF
Master switch ..... OFF
Fuel selector ..... OFF
Seat belt and harness ..... tight

GEAR UP EMERGENCY LANDING

In the event a gear up landing is required, proceed as follows:
Flaps ..... as desired
Throttle ..... close
Mixture ..... idle cut-off
Ignition switches ..... OFF
Master switch ..... OFF
Fuel selector ..... OFF
Seat belt and harness ..... tight
Contact surface at minimum possible airspeed.

FIRE IN FLIGHT

Source of fire ..... check

Electrical fire (smoke in cabin):
Master switch ..... OFF
Vents ..... open
Cabin heat ..... OFF
Land as soon as practicable.

Engine fire:
Fuel selector ..... OFF
Throttle ..... CLOSED
Mixture ..... idle cut-off
Electric fuel pump ..... check OFF
Heater and defroster ..... OFF
Proceed with power off landing procedure.

LOSS OF OIL PRESSURE

Land as soon as possible and investigate cause.
Prepare for power off landing.

LOSS OF FUEL PRESSURE

Electric fuel pump ..... ON
Fuel selector ..... check on tank

HIGH OIL TEMPERATURE

Land at nearest airport and investigate the problem.
Prepare for power off landing.

ELECTRICAL FAILURES

ALT annunciator light illuminated
Ammeter ..... check to verify inop. alt.

If ammeter shows zero:
ALT switch ..... OFF

Reduce electrical loads to minimum.
ALT circuit breaker ..... check and reset as required
ALT switch ..... ON

If power not restored:
ALT switch ..... OFF

If alternator output cannot be restored, reduce electrical loads and land as soon as practical. The battery is the only remaining source of electrical power.

ELECTRICAL OVERLOAD (alternator over 20 amps above known electrical load)

FOR AIRPLANES WITH INTERLOCKED BAT AND ALT SWITCH OPERATION.

Electrical load ..... reduce

If alternator loads are not reduced:
ALT switch ..... OFF

Land as soon as practical. Battery is the only remaining source of power. Anticipate complete electrical failure.

FOR AIRPLANES WITH SEPARATE BAT AND ALT SWITCH OPERATION

ALT switch ..... ON
BAT switch ..... OFF

If alternator loads are reduced:
Electrical load ..... reduce to minimum

Land as soon as practical.

NOTE

Due to increased system voltage and radio frequency noise, operation with ALT switch ON and BAT switch OFF should be made only when required by an electrical system failure.

If alternator loads are not reduced:
ALT switch ..... OFF
BAT switch ..... as required

Land as soon as possible. Anticipate complete electrical failure.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative.

PROPELLER OVERSPEED

Throttle ..... retard
Oil pressure ..... check
Prop control ..... full DECREASE rpm, then set if any control available
Airspeed ..... reduce
Throttle ..... as required to remain below 2650 rpm

EMERGENCY LANDING GEAR EXTENSION

Prior to emergency extension procedure:
Master switch ..... check ON
Circuit breakers ..... check
Panel lights ..... OFF (in daytime)
Gear indicator bulbs ..... check

If landing gear does not check down and locked:
Airspeed ..... reduce below 87 KIAS
Landing gear selector switch ..... gear DOWN position
If gear has failed to lock down on aircraft equipped with the backup gear extender, raise emergency gear lever to OVERRIDE ENGAGED position.
If gear has still failed to lock down, move emergency lever to "Emergency Down" position.
If gear has still failed to lock down, yaw the airplane abruptly from side to side with the rudder.

If the nose gear will not lock down using the above procedure, slow the aircraft to the lowest safe speed attainable using the lowest power setting required for safe operation and accomplish the following:
Emergency gear lever (aircraft equipped with backup gear extender) ..... OVERRIDE ENGAGED
Landing gear selector switch ..... gear DOWN position
If landing gear does not check down, recycle gear through up position, and then select gear DOWN.

SPIN RECOVERY

Rudder ..... full opposite to direction of rotation

Control wheel ..... full forward while neutralizing ailerons

Throttle ..... idle
Rudder ..... neutral (when rotation stops)
Control wheel ..... as required to smoothly regain level flight attitude

OPEN DOOR

If both upper and side latches are open, the door will trail slightly open and airspeeds will be reduced slightly.

To close the door in flight:
Slow airplane to 87 KIAS
Cabin vents ..... close
Storm window ..... open

If upper latch is open ..... latch
If side latch is open ..... pull on armrest while moving latch handle to latched position
If both latches are open ..... latch side latch then top latch

3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

The following paragraphs are presented to supply additional information for the purpose of providing the pilot with a more complete understanding of the recommended course of action and probable cause of an emergency situation.

3.7 ENGINE FIRE DURING START

Engine fires during start are usually the result of overpriming. The first attempt to extinguish the fire is to try to start the engine and draw the excess fuel back into the induction system.

If a fire is present before the engine has started, move the mixture control to idle cut-off, open the throttle and crank the engine. This is an attempt to draw the fire back into the engine.

If the engine has started, continue operating to try to pull the fire into the engine.

In either case (above), if fire continues more than a few seconds, the fire should be extinguished by the best available external means.

The fuel selector valve should be OFF and the mixture at idle cut-off if an external fire extinguishing method is to be used.

3.9 ENGINE POWER LOSS DURING TAKEOFF

The proper action to be taken if loss of power occurs during takeoff will depend on the circumstances of the particular situation.

If sufficient runway remains to complete a normal landing, leave the landing gear down and land straight ahead.

If the area ahead is rough, or if it is necessary to clear obstructions, move the gear selector switch to the UP position. On aircraft equipped with the backup gear extender, lock and latch the emergency gear lever in the OVERRIDE ENGAGED position.

If sufficient altitude has been gained to attempt a restart, maintain a safe airspeed and switch the fuel selector to another tank containing fuel. Place the electric fuel pump to ON. Check that the mixture is RICH. The alternate air should be OPEN.

On aircraft equipped with the backup gear extender, the landing gear will extend automatically when engine power fails at speeds below approximately 95 KIAS. The glide distance with the landing gear extended is roughly halved. If the situation dictates, the landing gear can be retained in the retracted position by locking the emergency gear lever in the OVERRIDE ENGAGED position.

If engine failure was caused by fuel exhaustion, power will not be regained after switching fuel tanks until the empty fuel lines are filled. This may require up to ten seconds.

If power is not regained, proceed with the Power Off Landing procedure (refer to the emergency check list and Paragraph 3.13).

3.11 ENGINE POWER LOSS IN FLIGHT

Complete engine power loss is usually caused by fuel flow interruption and power will be restored shortly after fuel flow is restored. If power loss occurs at a low altitude, the first step is to prepare for an emergency landing (refer to paragraph 3.13). An airspeed of at least 79 KIAS should be maintained.

If altitude permits, switch the fuel selector to another tank containing fuel and turn the electric fuel pump to ON. Move the mixture control to RICH and the alternate air to OPEN. Check the engine gauges for an indication of the cause of the power loss. If no fuel pressure is indicated, check the tank selector position to be sure it is on a tank containing fuel.

When power is restored move the alternate air to the CLOSED

When power is restored move the alternate air to the CLOSED position and turn OFF the electric fuel pump.

If the preceding steps do not restore power, prepare for an emergency landing.

If time permits, turn the ignition switch to L then to R then back to BOTH. Move the throttle and mixture control levers to different settings. This may restore power if the problem is too rich or too lean a mixture or if there is a partial fuel system restriction. Try the other fuel tank. Water in the fuel could take some time to be used up, and allowing the engine to windmill may restore power. If power loss is due to water, fuel pressure indications will be normal.

If engine failure was caused by fuel exhaustion power will not be restored after switching fuel tanks until the empty fuel lines are filled. This may require up to ten seconds.

If power is not regained, proceed with the Power Off Landing procedure (refer to emergency check list and Paragraph 3.13).

3.13 POWER OFF LANDING

If loss of power occurs at altitude, lock emergency gear lever in OVERRIDE ENGAGED position before airspeed drops to 105 KIAS to prevent the landing gear from inadvertently free falling on aircraft equipped with the backup gear extender. Trim the aircraft for best gliding angle (79 KIAS, Air Cond. off) and look for a suitable field. If measures taken to restore power are not effective, and if time permits, check your charts for airports in the immediate vicinity; it may be possible to land at one if you have sufficient altitude. At best gliding angle, with the engine windmilling, and the propeller control in full DECREASE rpm, the aircraft will travel approximately 1.5 miles for each thousand feet of altitude in a no wind condition. If possible, notify the FAA by radio of your difficulty and intentions. If another pilot or passenger is aboard, let him help.

When you have located a suitable field, establish a spiral pattern around this field. Try to be at 1000 feet above the field at the downwind position, to make a normal landing approach. When the field can easily be reached, slow to 72 KIAS with flaps down for the shortest landing. Excess altitude may be lost by widening your pattern, using flaps or slipping, or a combination of these.

Whether to attempt a landing with gear up or down depends on many factors. If the field chosen is obviously smooth and firm, and long enough to bring the plane to a stop, the gear should be down. If there are stumps or rocks or other large obstacles in the field, the gear in the down position will better protect the occupants of the aircraft. If, however, the field is suspected to be excessively soft or short, or when landing in water of any depth, a wheels-up landing will normally be safer and do less damage to the airplane.

On aircraft equipped with the backup gear extender, the landing gear will free fall at airspeeds below approximately 95 KIAS, and will take six to eight seconds to be down and locked. If a gear up landing is desired, it will be necessary to lock the override lever in the OVERRIDE ENGAGED position before the airspeed drops to 105 KIAS to prevent the landing gear from inadvertantly free falling.

Touchdown should normally be made at the lowest possible airspeed.

(a) Gear Down Emergency Landing

When committed to a gear down emergency landing, close the throttle control and shut OFF the master and ignition switches. Flaps may be used as desired. Turn the fuel selector valve to OFF and move the mixture to idle cut-off. The seat belts and shoulder harness (if installed) should be tightened. Touchdown should be normally made at the lowest possible airspeed.

Always remember that the automatic gear mechanism will extend the gear below approximately 95 KIAS with power off. Be prepared to lock the emergency gear lever in the OVERRIDE ENGAGED position before the airspeed drops to 105 KIAS to prevent the landing gear from inadvertantly free falling, unless gear extension is desired.

NOTE

If the master switch is OFF, the gear cannot be retracted.

(b) Gear Up Emergency Landing

On aircraft equipped with the backup gear extender, lock the emergency gear lever in OVERRIDE ENGAGED position before the airspeed drops to 105 KIAS to prevent the landing gear from inadvertantly free falling. Wing flaps should be extended as desired.

When committed to a gear up landing, CLOSE the throttle and shut OFF the master and ignition switches. Turn OFF the fuel selector valve.

Touchdowns should normally be made at the lowest possible airspeed with full flaps.

3.15 FIRE IN FLIGHT

The presence of fire is noted through smoke, smell and heat in the cabin. It is essential that the source of the fire be promptly identified through instrument readings, character of the smoke, or other indications since the action to be taken differs somewhat in each case.

Check for the source of the fire first.

If an electrical fire is indicated (smoke in the cabin), the master switch should be turned OFF. The cabin vents should be opened and the cabin heat turned OFF. A landing should be made as soon as possible.

If an engine fire is present, switch the fuel selector to OFF and close the throttle. The mixture should be at idle cut-off. Turn the electric fuel pump OFF. In all cases, the heater and defroster should be OFF. If radio communication is not required select master switch OFF. If the terrain permits, a landing should be made immediately.

NOTE

The possibility of an engine fire in flight is extremely remote. The procedure given is general and pilot judgment should be the determining factor for action in such an emergency.

3.17 LOSS OF OIL PRESSURE

Loss of oil pressure may be either partial or complete. A partial loss of oil pressure usually indicates a malfunction in the oil pressure regulating system, and a landing should be made as soon as possible to investigate the cause and prevent engine damage.

A complete loss of oil pressure indication may signify oil exhaustion or may be the result of a faulty gauge. In either case, proceed toward the nearest airport, and be prepared for a forced landing. If the problem is not a pressure gauge malfunction, the engine may stop suddenly. Maintain altitude until such time as a dead stick landing can be accomplished. Don't change power settings unnecessarily, as this may hasten complete power loss.

Depending on the circumstances, it may be advisable to make an off airport landing while power is still available, particularly if other indications of actual oil pressure loss, such as sudden increases in temperatures, or oil smoke, are apparent, and an airport is not close.

If engine stoppage occurs, proceed with Power Off Landing.

3.19 LOSS OF FUEL PRESSURE

The most probable cause of loss of fuel pressure is either fuel depletion in the fuel tank selected, or failure of the engine driven fuel pump. If loss of fuel pressure occurs, check that the fuel selector is on a tank containing fuel and turn ON the electric fuel pump.

If the problem is not an empty tank, land as soon as practical and have the engine driven fuel pump and fuel system checked.

3.21 HIGH OIL TEMPERATURE

An abnormally high oil temperature indication may be caused by a low oil level, an obstruction in the oil cooler, damaged or improper baffle seals, a defective gauge, or other causes. Land as soon as practical at an appropriate airport and have the cause investigated.

A steady, rapid rise in oil temperature is a sign of trouble. Land at the nearest airport and let a mechanic investigate the problem. Watch the oil pressure gauge for an accompanying loss of pressure.

3.23 ELECTRICAL FAILURES

Loss of alternator output is detected through zero reading on the ammeter. Before executing the following procedure, insure that the reading is zero and not merely low by actuating an electrically powered device, such as the landing light. If no increase in the ammeter reading is noted, alternator failure can be assumed.

The electrical load should be reduced as much as possible. Check the alternator circuit breakers for a popped circuit.

The next step is to attempt to reset the overvoltage relay. This is accomplished by moving the ALT switch to OFF for one second and then to ON. If the trouble was caused by a momentary overvoltage condition (16.5 volts and up) this procedure should return the ammeter to a normal reading.

If the ammeter continues to indicate "0" (zero) output, or if the alternator will not remain reset, turn off the ALT switch, maintain minimum electrical load and land as soon as practical. All electrical load is being supplied by the battery.

3.24 ELECTRICAL OVERLOAD (alternator over 20 amps above known electrical load)

If abnormally high alternator output is observed (more than 20 amps above known electrical load for the operating conditions) it may be caused by a low battery, a battery fault or other abnormal electrical load. If the cause is a low battery, the indication should begin to decrease toward normal within 5 minutes. If the overload condition persists attempt to reduce the load by turning off non-essential equipment. For airplanes with interlocked BAT and ALT switch operation, when the electrical load cannot be reduced turn the ALT switch OFF and land as soon as practical. The battery is the only remaining source of electrical power. Also anticipate complete electrical failure.

For airplanes with separate BAT and ALT switch operations, turn the BAT switch OFF and the ammeter should decrease. Turn the BAT switch ON and continue to monitor the ammeter. If the alternator output does not decrease within 5 minutes, turn the BAT switch OFF and land as soon as practical. All electrical loads are being supplied by the alternator.

NOTE

Due to higher voltage and radio frequency noise, operation with the ALT switch ON and the BAT switch OFF should be made only when required by an electrical failure.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative.

3.25 PROPELLER OVERSPEED

Propeller overspeed is caused by a malfunction in the propeller governor or low oil pressure which allows the propeller blades to rotate to full low pitch.

If propeller overspeed should occur, retard the throttle and check the oil pressure. The propeller control should be moved to full "DECREASE rpm" and then set if any control is available. Airspeed should be reduced and throttle used to maintain 2650 RPM.

3.27 EMERGENCY LANDING GEAR EXTENSION

Prior to initiating the emergency extension procedure check to insure that the master switch is ON and that the circuit breakers have not opened. If it is daytime the panel lights should be turned OFF. Check the landing gear indicators for faulty bulbs.

NOTE

Refer to paragraph 4.39 for differences when emergency extension procedure is performed for training purposes.

If the landing gear does not check down and locked, reduce the airspeed below 87 KIAS. Move the landing gear selector switch to the DOWN position. If the gear has failed to lock down on aircraft equipped with the backup gear extender, raise the emergency gear lever to the OVERRIDE ENGAGED position.

If the gear has still failed to lock down, move the emergency gear lever to the EMERGENCY DOWN position.

If the gear has still failed to lock down, yaw the airplane abruptly from side to side with the rudder.

If the nose gear will not lock down using the above procedure, slow the airplane to the lowest safe speed attainable using the lowest power setting required for safe operation and raise the emergency gear lever to the OVERRIDE ENGAGED position on aircraft equipped with the backup gear extender. Move the landing gear selector switch to the gear DOWN position. If the landing gear does not check down, recycle the gear through the UP position and then select the DOWN position.

3.29 SPIN RECOVERY

Intentional spins are prohibited in this airplane. If a spin is inadvertently entered, immediately apply full rudder opposite to the direction of rotation. Move the control wheel full forward while neutralizing the ailerons. Move the throttle to IDLE. When the rotation stops, neutralize the rudder and ease back on the control wheel as required to smoothly regain a level flight attitude.

3.31 OPEN DOOR

The cabin door is double latched, so the chances of its springing open in flight at both the top and bottom are remote. However, should you forget the upper latch, or not fully engage the side latch, the door may spring partially open. This will usually happen at takeoff or soon afterward. A partially open door will not affect normal flight characteristics, and a normal landing can be made with the door open.

If both upper and side latches are open, the door will trail slightly open, and airspeed will be reduced slightly.

To close the door in flight, slow the airplane to 87 KIAS, close the cabin vents and open the storm window. If the top latch is open, latch it. If the side latch is open, pull on the arm rest while moving the latch handle to the latched position. If both latches are open, close the side latch then the top latch.

3.33 ENGINE ROUGHNESS

Engine roughness may be caused by dirt in the injector nozzles, induction system icing, or ignition problems.

First adjust the mixture for maximum smoothness. The engine will run rough if the mixture is too rich or too lean.

Move the alternate air to OPEN and then turn "ON" the electric fuel pump.

Switch the fuel selector to another tank to see if fuel contamination is the problem.

Check the engine gauges for abnormal readings. If any gauge readings are abnormal proceed accordingly.

The magneto switch should then be moved to "L" then "R," then back to "BOTH." If operation is satisfactory on either magneto, proceed on that magneto at reduced power with full RICH mixture to a landing at the first available airport.

If roughness persists, prepare for a precautionary landing at pilot's discretion.

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SECTION 4

NORMAL PROCEDURES

SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

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

Normal procedures associated with those optional systems and equipment which require handbook supplements are provided by Section 9 (Supplements).

These procedures are provided to present a source of reference and review and to supply information on procedures which are not the same for all aircraft. Pilots should familiarize themselves with the procedures given in this section in order to become proficient in the normal operations of the airplane.

The first portion of this section consists of a short form check list which supplies an action sequence for normal operations with little emphasis on the operation of the systems.

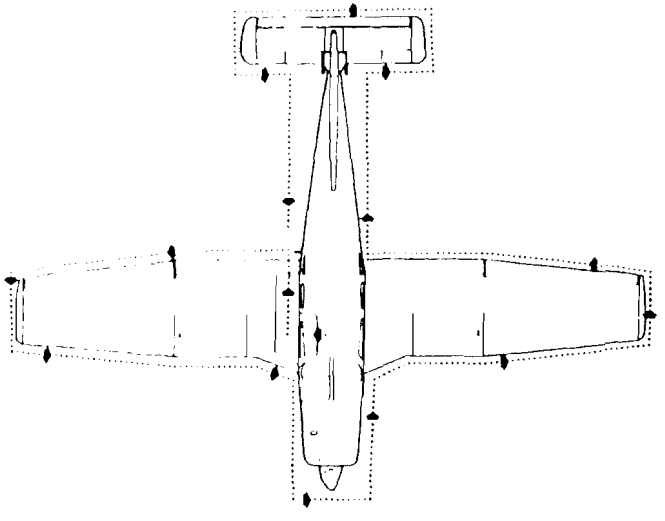
The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthy explanations. The short form check list should be used for this purpose.

4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are those which are significant to the safe operation of the airplane. These figures are for standard airplanes flown at gross weight under standard conditions at sea level.

Performance for a specific airplane may vary from published figures depending upon the equipment installed, the condition of the engine, airplane and equipment, atmospheric conditions and piloting technique.

(a) Best Rate of Climb Speed	
gear up, flaps up	87 KIAS
gear down, flaps up	76 KIAS
(b) Best Angle of Climb Speed	
gear up, flaps up	77 KIAS
gear down, flaps up	70 KIAS
(c) Turbulent Air Operating Speed (See Subsection 2.3)	121 KIAS
(d) Maximum Flap Speed	108 KIAS
(e) Landing Final Approach Speed (Full 40°)	74 KIAS
(f) Maximum Demonstrated Crosswind Velocity	17 KTS



WALK-AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECK LIST

PREFLIGHT CHECK

COCKPIT

Control wheel ..... release restraints
Avionics ..... OFF
Parking brake ..... set
All switches ..... OFF
Mixture ..... idle cut-off
Master switch ..... ON
Fuel gauges ..... check quantity
Annunciator panel ..... check
Master switch ..... OFF
Primary flight controls ..... proper operation
Flaps ..... proper operation
Trim ..... neutral
Pitot and static systems ..... drain
Windows ..... check clean

Required papers ..... check on board
Tow bar and baggage ..... stow properly - secure
Baggage door ..... close and secure

RIGHT WING

Surface condition ..... clear of ice, frost, snow
Flap and hinges ..... check
Aileron and hinges ..... check
Wing tip and lights ..... check
Fuel tank ..... check supply visually - secure cap
Fuel tank vent ..... clear
Fuel tank sump ..... drain
Tie down and chock ..... remove
Main gear strut ..... proper inflation (2.5 + .25 in.)
Tire ..... check
Brake block and disc ..... check
Fresh air inlet ..... clear

NOSE SECTION

General condition ..... check
Cowling ..... secure
Windshield ..... clean
Propeller and spinner ..... check
Air inlets ..... clear
Alternator belt ..... check tension
Chock ..... remove
Nose gear strut ..... proper inflation (2.75 + .25 in.)
Nose wheel tire ..... check
Engine baffle seals ..... check
Oil ..... check quantity
Dipstick ..... properly seated
Fuel strainer ..... drain

LEFT WING

Surface condition ..... clear of ice, frost, snow
Fresh air inlet ..... clear

Chock ..... remove
Main gear strut ..... proper inflation (2.5 ± .25 in.)
Tire ..... check
Brake block and disc ..... check
Fuel tank ..... check supply visually - secure cap
Fuel tank vent ..... clear
Fuel tank sump ..... drain
Tie down ..... remove
Pitot/static head ..... remove cover - holes clear
Wing tip and lights ..... check
Aileron and hinges ..... check
Flap and hinges ..... check

FUSELAGE

Antennas ..... check
Empennage ..... clear of ice, frost, snow
Fresh air inlet ..... clear
Stabilator and trim tab ..... check
Tie down ..... remove
Master switch ..... ON
Cockpit lighting ..... check
Nav and strobe lights ..... check
Stall warning ..... check
Pitot heat ..... check
All switches ..... OFF
Passengers ..... board
Cabin door ..... close and secure
Seat belts and harness ..... fasten/adjust check inertia reel

BEFORE STARTING ENGINE

Brakes ..... set
Propeller ..... full INCREASE rpm
Fuel selector ..... desired tank
Alternate air ..... OFF
Radios ..... OFF

STARTING ENGINE WHEN COLD

Throttle ..... 1/2" open
Master switch ..... ON
Electric fuel pump ..... ON
Mixture ..... prime - then idle cut-off
Starter ..... engage
Mixture ..... full RICH
Throttle ..... adjust
Oil pressure ..... check

STARTING ENGINE WHEN HOT

Throttle ..... 1/2" open
Master switch ..... ON
Electric fuel pump ..... ON
Mixture ..... idle cut-off
Starter ..... engage
Mixture ..... advance
Throttle ..... adjust
Oil pressure ..... check

STARTING ENGINE WHEN FLOODED

Throttle ..... open full
Master switch ..... ON
Electric fuel pump ..... OFF
Mixture ..... idle cut-off
Starter ..... engage
Mixture ..... advance
Throttle ..... retard
Oil pressure ..... check

STARTING WITH EXTERNAL POWER SOURCE

Master switch ..... OFF
All electrical equipment ..... OFF
Terminals ..... connect
External power plug ..... insert in fuselage
Proceed with normal start
Throttle ..... lowest possible RPM
External power plug ..... disconnect from fuselage
Master switch ..... ON - check ammeter
Oil pressure ..... check

WARM-UP

Throttle ..... 1400 to 1500 RPM

TAXIING

Chocks ..... removed
Taxi area ..... clear
Throttle ..... apply slowly
Prop ..... high RPM
Brakes ..... check
Steering ..... check

GROUND CHECK

Propeller ..... full INCREASE
Throttle ..... 2000 RPM
Magnetos ..... max. drop 175 RPM
- max. diff. 50 RPM
Vacuum ..... 4.8" Hg. to 5.1" Hg.
Oil temperature ..... check
Oil pressure ..... check

Air conditioner ..... check
Annunciator panel ..... press-to-test
Propeller ..... exercise - then full INCREASE
Alternate air ..... check
Engine is warm for takeoff when throttle can be opened without engine faltering.
Electric fuel pump ..... OFF
Fuel pressure ..... check
Throttle ..... retard

BEFORE TAKEOFF

Master switch ..... ON
Flight instruments ..... check
Fuel selector ..... proper tank
Electric fuel pump ..... ON
Engine gauges ..... check
Alternate air ..... CLOSED
Seat backs ..... erect
Mixture ..... set
Prop ..... set
Belts/harness ..... fastened/adjusted
Empty seats ..... seat belts snugly fastened
Flaps ..... set
Trim tab ..... set
Controls ..... free
Doors ..... latched
Air conditioner ..... OFF

TAKEOFF

NORMAL

Flaps ..... set
Tab ..... set
Accelerate to 65 to 75 KIAS.
Control wheel ..... back pressure to rotate to climb attitude

SHORT FIELD, OBSTACLE CLEARANCE

Flaps ..... 25° (second notch)
Accelerate to 50 to 60 KIAS depending on aircraft weight.
Control wheel ..... back pressure to rotate to climb attitude
After breaking ground, accelerate to 55 to 65 KIAS depending on aircraft weight.
Gear (override engaged on aircraft equipped with backup gear extender) ..... UP
Accelerate to best flaps up angle of climb speed - 77 KIAS, slowly retract the flaps and climb past the obstacle.
Accelerate to best flaps up rate of climb speed - 87 KIAS.

SOFT FIELD

Flaps ..... 25° (second notch)
Accelerate to 50 to 60 KIAS depending on aircraft weight.
Control wheel ..... back pressure to rotate to climb attitude
After breaking ground, accelerate to 55 to 65 KIAS depending on aircraft weight.
Gear (override engaged on aircraft equipped with backup gear extender) ..... UP
Accelerate to best flaps up rate of climb speed 87 KIAS.
Flaps ..... retract slowly

CLIMB

Best rate (2750 lb.)(gear up)
(flaps up) ..... 87 KIAS
Best rate (2750 lb.)(gear down)
(flaps up) ..... 76 KIAS
Best angle (2750 lb.)(gear up)
(flaps up) ..... 77 KIAS
Best angle (2750 lb.)(gear down)
(flaps up) ..... 70 KIAS
En route ..... 104 KIAS
Electric fuel pump ..... OFF at desired altitude

CRUISING

Reference, performance charts, Avco-Lycoming Operator's Manual and power setting table.

Normal max power 75%
Power ..... set per power table
Mixture ..... adjust

APPROACH AND LANDING

Fuel selector ..... proper tank
Seat backs ..... erect
Belts/harness ..... fasten/adjust
Electric fuel pump ..... ON
Mixture ..... set
Propeller ..... set
Gear ..... down - 130 KIAS max
Flaps ..... set - 108 KIAS max
Air conditioner ..... OFF
Trim to 75 KIAS

STOPPING ENGINE

Flaps ..... retract
Electric fuel pump ..... OFF
Air conditioner ..... OFF
Radios ..... OFF
Propeller ..... full INCREASE
Throttle ..... full aft
Mixture ..... idle cut-off
Magnetos ..... OFF
Master switch ..... OFF

PARKING

Parking brake ..... set
Control wheel ..... secured with belts
Flaps ..... full up
Wheel chocks ..... in place
Tie downs ..... secure

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4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

The following paragraphs are provided to supply detailed information and explanations of the normal procedures necessary for operation of the airplane.

4.9 PREFLIGHT CHECK

The airplane should be given a thorough preflight and walk-around check. The preflight should include a check of the airplane's operational status, computation of weight and C.G. limits, takeoff and landing distances, and in-flight performance. A weather briefing should be obtained for the intended flight path, and any other factors relating to a safe flight should be checked before takeoff.

CAUTION

> The flap position should be noted before boarding the airplane. The flaps must be placed in the UP position before they will lock and support weight on the step.

COCKPIT

Upon entering the cockpit, release the seat belts securing the control wheel, turn OFF all avionics equipment and set the parking brake. Insure that all electrical switches and the magneto switch are OFF and the mixture is in idle cut-off. Turn ON the master switch, check the fuel quantity gauges for adequate supply and check that the annunciator panel illuminates. Turn OFF the master switch. Check the primary flight controls and flaps for proper operation and set the trim to neutral. Open the pitot and static drains to remove any moisture that has accumulated in the lines. Check the windows for cleanliness and that the required papers are on board. Properly stow the tow bar and baggage and secure. Close and secure the baggage door.

RIGHT WING

Begin the walk-around at the trailing edge of the right wing by checking that the wing surface and control surfaces are clear of ice, frost, snow or other extraneous substances. Check the flap, aileron and hinges for damage and operational interference. Static wicks should be firmly attached and in good condition. Check the wing tip and lights for damage.

Open the fuel cap and visually check the fuel color and the quantity should match the indication that was on the fuel quantity gauge, replace cap securely. The fuel tank vent should be clear of obstructions.

Drain the fuel tank through the quick drain located at the lower inboard rear corner of the tank, making sure that enough fuel has been drained to insure that all water and sediment is removed. The fuel system should be drained daily prior to the first flight and after each refueling.

CAUTION

When draining any amount of fuel, care should be taken to insure that no fire hazard exists before starting engine.

Remove the tie down and chock.

Next, a complete check of the landing gear. Check the gear strut for proper inflation, there should be 2.5 ± .25 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake block and disc.

Check that the fresh air inlet is clear of foreign matter.

NOSE SECTION

Check the general condition of the nose section, look for oil or fluid leakage and that the cowling is secure. Check the windshield and clean if necessary. The propeller and spinner should be checked for detrimental nicks, cracks, or other defects. The air inlets should be clear of obstructions and check the alternator belt for proper tension. The landing light should be clean and intact.

Remove the chock and check the nose gear strut for proper inflation, there should be 2.75 ± .25 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Check the engine baffle seals. Check the oil level, make sure that the dipstick has been properly seated.

Open the fuel strainer located on the left side of the firewall long enough to remove any accumulation of water and sediment.

LEFT WING

The wing surface should be clear of ice, frost, snow, or other extraneous substances. Check that the fresh air inlet is clear of foreign matter and remove the chock. Check the main gear strut for proper inflation, there should be 2.5 ± .25 inches of strut exposure under a normal static load. Check the tire and the brake block and disc.

Open the fuel cap and visually check the fuel color. The quantity should match the indication on the fuel quantity gauge. Replace cap securely. The fuel tank vent should be clear of obstructions. Drain enough fuel to insure that all water and sediment has been removed.

Remove tie down and remove the cover from the pitot/static head on the underside of the wing. Make sure the holes are open and clear of obstructions. Check the wing tip and lights for damage. Check the aileron, flap, and hinges for damage and operational interference and that the static wicks are firmly attached and in good condition.

FUSELAGE

Check the condition and security of the antennas. The empennage should be clear of ice, frost, snow, or other extraneous substances, and the fresh air inlet at the top of the fin should be clear of foreign matter. Check the stabilator and trim tab for damage and operational interference. The trim tab should move in the same direction as stabilator. Remove the tie down.

Upon returning to the cockpit, an operational check of the interior lights, exterior lights, stall warning system, and pitot heat should now be made. Turn the master switch and the appropriate switches ON. Check the panel lighting and the overhead flood light. Visually confirm that exterior lights are operational. Lift the stall detector on the leading edge of the left wing and determine that the warning horn is activated. With the pitot heat switch ON the pitot head will be hot to the touch. After these checks are complete the master switch and all electrical switches should be turned OFF.

Board the passengers and close and secure the cabin door. Fasten the seat belts and shoulder harness. Fasten seat belts on empty seats.

NOTE

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls including fuel selector, flaps, trim, etc. while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

4.11 BEFORE STARTING ENGINE

Before starting the engine the brakes should be set ON and the propeller lever moved to the full INCREASE rpm position. The fuel selector should then be moved to the desired tank. Check to make sure that all the radios are OFF.

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4.13 STARTING ENGINE

(a) Starting Engine When Cold

Open the throttle lever approximately 1/2 inch. Turn ON the master switch and the electric fuel pump. Move the mixture control to full RICH until an indication is noted on the fuel flow meter. The engine is now primed.

Move the mixture control to idle cut-off and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch, advance the mixture control to full RICH and move the throttle to the desired setting.

If the engine does not fire within five to ten seconds, disengage the starter and reprime.

(b) Starting Engine When Hot

Open the throttle approximately 1/2 inch. Turn ON the master switch and the electric fuel pump. Move the mixture control lever to idle cut-off and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch, advance the mixture and move the throttle to the desired setting.

(c) Starting Engine When Flooded

The throttle lever should be full OPEN. Turn ON the master switch and turn OFF the emergency fuel pump. Move the mixture control lever to idle cut-off and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch, advance the mixture and retard the throttle.

(d) Starting Engine With External Power Source

An optional feature called the Piper External Power (PEP) allows the operator to use an external battery to crank the engine without having to gain access to the airplane's battery.

Turn the master switch OFF and turn all electrical equipment OFF. Connect the RED lead of the PEP kit jumper cable to the POSITIVE (+) terminal of an external 12-volt battery and the BLACK lead to the NEGATIVE(-) terminal. Insert the plug of the jumper cable into the socket located on the fuselage. Note that when the plug is inserted, the electrical system is ON. Proceed with the normal starting technique.

After the engine has started, reduce power to the lowest possible RPM, to reduce sparking, and disconnect the jumper cable from the aircraft. Turn the master switch ON and check the alternator ammeter for an indication of output. DO NOT ATTEMPT FLIGHT IF THERE IS NO INDICATION OF ALTERNATOR OUTPUT.

NOTE

For all normal operations using the PEP jumper cables, the master switch should be OFF, but it is possible to use the ship's battery in parallel by turning the master switch ON. This will give longer cranking capabilities, but will not increase the amperage.

CAUTION

Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the master switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply.

When the engine is firing evenly, advance the throttle to 800 RPM. If oil pressure is not indicated within thirty seconds, stop the engine and deter-

mine the trouble. In cold weather it will take a few seconds longer to get an oil pressure indication. If the engine has failed to start, refer to the Lycoming Operating Handbook, Engine Troubles and Their Remedies.

Starter manufacturers recommend that cranking periods be limited to thirty seconds with a two minute rest between cranking periods. Longer cranking periods will shorten the life of the starter.

4.15 WARM-UP

Warm-up the engine at 1400 to 1500 RPM. Avoid prolonged idling at low RPM, as this practice may result in fouled spark plugs.

Takeoff may be made as soon as the ground check is completed, provided that the throttle may be opened without backfiring or skipping, and without a reduction in engine oil pressure.

Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

4.17 TAXIING

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Ascertain that the propeller back blast and taxi areas are clear.

Power should be applied slowly to start the taxi roll. Taxi a few feet forward and apply the brakes to determine their effectiveness. Taxi with the propeller set in low pitch, high RPM setting. While taxiing, make slight turns to ascertain the effectiveness of the steering.

Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.

Avoid holes and ruts when taxiing over uneven ground.

Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

4.19 GROUND CHECK

The magnetos should be checked at 2000 RPM with the propeller set at high RPM. Drop off on either magneto should not exceed 175 RPM and the difference between the magnetos should not exceed 50 RPM. Operation on one magneto should not exceed 10 seconds.

Check the vacuum gauge; the indicator should read between 4.8 and 5.1 inches Hg at 2000 RPM.

Check the annunciator panel lights with the press-to-test button. Also check the air conditioner and the alternate air.

The propeller control should be moved through its complete range to check for proper operation, and then placed in full "INCREASE" rpm for takeoff. To obtain maximum rpm, push the pedestal mounted control fully forward on the instrument panel. Do not allow a drop of more than 500 RPM during this check. In cold weather the propeller control should be cycled from high to low RPM at least three times before takeoff to make sure that warm engine oil has circulated.

The electric fuel pump should be turned "OFF" after starting or during warm-up to make sure that the engine driven pump is operating. Prior to takeoff the electric pump should be turned ON again to prevent loss of power during takeoff should the engine driven pump fail. Check both oil temperature and oil pressure. The temperature may be low for some time if the engine is being run for the first time of the day. The engine is warm enough for takeoff when the throttle can be opened without the engine faltering.

4.21 BEFORE TAKEOFF

All aspects of each particular takeoff should be considered prior to executing the takeoff procedure.

After takeoff,on aircraft equipped with the backup gear extender, if the gear selector switch is placed in the gear up position before reaching the airspeed at which the system no longer commands gear down*, the gear will not retract. For obstacle clearance on takeoff and for takeoffs from high altitude airports, the landing gear can be retracted after lift-off at the pilot's discretion by placing the gear selector switch in the UP position and then locking the emergency gear lever in the OVERRIDE ENGAGED position. If desired, the OVERRIDE ENGAGED position can be selected and locked before takeoff, and the gear will then retract as soon as the gear selector switch is placed in the UP position. Care should always be taken not to retract the gear prematurely, or the aircraft could settle back onto the runway. If the override lock is used for takeoff, it should be disengaged as soon as sufficient airspeed and terrain clearance are obtained, to return the gear system to normal operation. For normal operation, the pilot should extend and retract the gear with the gear selector switch located on the instrument panel, just as he would if the back-up gear extender system were not installed.

After all aspects of the takeoff are considered, a pretakeoff check procedure must be performed.

Turn ON the master switch and check and set all of the flight instruments as required. Check the fuel selector to make sure it is on the proper tank (fullest). Turn ON the electric fuel pump. Check the engine gauges. The alternate air should be in the CLOSED position.

*Approximately 81 KIAS at sea level to approximately 100 KIAS at 10,000 ft. with a straight line variation between.

All seat backs should be erect.

NOTE

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls including fuel selector, flaps, trim, etc. while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

The mixture and propeller control levers should be set and the seat belts and shoulder harness fastened. Fasten the seat belts snugly around the empty seats.

Exercise and set the flaps and trim tab. Insure proper flight control movement and response.

All doors should be properly secured and latched.

On air conditioned models, the air conditioner must be "OFF" to insure normal takeoff performance.

4.23 TAKEOFF

The normal takeoff technique is conventional for the Arrow IV. The tab should be set slightly aft of neutral, with the exact setting determined by the loading of the airplane. Allow the airplane to accelerate to 65 to 75 KIAS depending on the weight of the aircraft and ease back on the control wheel to rotate to climb attitude.

The procedure used for a short field takeoff with an obstacle clearance or a soft field takeoff differs slightly from the normal technique. The flaps should be lowered to 25° (second notch). Allow the aircraft to accelerate to 50 to 60 KIAS depending on the aircraft weight and rotate the aircraft to climb attitude. After breaking ground, accelerate to 55 to 65 KIAS, depending on aircraft weight and select gear up*. Continue to climb while accelerating to the flaps-up rate of climb speed: 87 KIAS if no obstacle is present, or 77 KIAS if obstacle clearance is a consideration. Slowly retract the flaps while climbing out.

*If desired, on aircraft equipped with the backup gear extender, the override engaged position can be selected and locked before takeoff, and the gear will then retract as soon as the gear selector switch is placed in the up position. In this case care should be taken not to retract the gear prematurely, or the aircraft could settle back on the runway. If the override lock is used for takeoff, it should be disengaged as soon as sufficient terrain clearance is obtained, to return the gear system to normal operation.

4.25 CLIMB

On climb-out after takeoff, it is recommended that the best angle of climb speed (77 KIAS) be maintained only if obstacle clearance is a consideration. The best rate of climb speed (87 KIAS) should be maintained with full power on the engine until adequate terrain clearance is obtained. At lighter than gross weight these speeds are reduced somewhat. An en route climb speed of 104 KIAS or higher is also recommended. This increased climb speed provides better engine cooling, less engine wear, reduced fuel consumption, lower cabin noise level, and better forward visibility.

When reaching the desired altitude, the electric fuel pump may be turned OFF.

NOTE

On aircraft equipped with the backup gear extender, during climbs at best angle of climb speed at any altitude and best rate of climb speed above approximately 9000 ft. density altitude, it may be necessary to select OVERRIDE ENGAGED to prevent the landing gear from extending automatically during the climb. This altitude decreases with reduced climb power and increases with increased climb airspeed.

4.27 CRUISING

The cruising speed of the Arrow IV is determined by many factors, including power setting, altitude, temperature, loading and equipment installed in the airplane.

The normal maximum cruising power is 75% of the rated horsepower of the engine. When selecting cruising RPM below 2400, limiting manifold pressure for continuous operation, as specified by the appropriate "Avco-Lycoming Operator's Manual", should be observed.

To obtain the desired power, set the manifold pressure and RPM according to the power setting table in this manual.

Use of the mixture control in cruising flight reduces fuel consumption significantly, especially at higher altitudes. The mixture should be leaned during cruising operation when 75% power or less is being used. If any doubt exists as to the amount of power being used, the mixture should be in the full "RICH" position for all operations.

To lean the mixture, disengage the lock and pull the mixture control until the engine becomes rough, indicating that the lean mixture limit has been reached in the leaner cylinders. Then enrich the mixture by pushing the control towards the instrument panel until engine operation becomes smooth. The fuel flow meter will give a close approximation of the fuel being consumed. The low side of the power setting, as shown on the fuel flow meter, indicates best economy for that percent of power while the high side indicates best power.

If the airplane is equipped with the optional exhaust gas temperature (EGT) gauge, a more accurate means of leaning is available to the pilot. For this procedure, refer to the "Avco-Lycoming Operator's Manual".

Following level-off for cruise, the airplane should be trimmed.

The pilot should monitor weather conditions while flying and should be alert to conditions which might lead to icing. If induction system icing is expected, place the alternate air control in the "ON" position.

During flight, keep account of time and fuel used in connection with power settings to determine how the fuel flow and fuel quantity gauging systems are operating. If the fuel flow indication is considerably higher than the fuel actually being consumed, a fuel nozzle may be clogged and require cleaning.

There are no mechanical uplocks in the landing gear system. In the event of a hydraulic system malfunction, the landing gear will free-fall to the gear down position. The true airspeed with gear down is approximately 75% of the gear retracted airspeed for any given power setting. Allowances for the reduction in airspeed and range should be made when planning extended flight between remote airfields or flight over water.

In order to keep the airplane in best lateral trim during cruise flight, the fuel should be used alternately from each tank at one hour intervals.

Always remember that the electric fuel pump should be turned "ON" before switching tanks and should be left on for a short period thereafter. To preclude making a hasty selection and to provide continuity of flow, the selector should be changed to another tank before fuel is exhausted from the tank in use. The electric fuel pump should be normally "OFF" so that any malfunction of the engine driven fuel pump is immediately apparent. If signs of fuel starvation should occur at any time during flight, fuel exhaustion should be suspected. At which time the fuel selector should be immediately positioned to a full tank, and the electric fuel pump should be switched to the "ON" position.

4.29 APPROACH AND LANDING

Check to insure the fuel selector is on the proper (fullest) tank and that the seat backs are erect. The seat belts and shoulder harness should be fastened, and the inertia reel should be checked.

NOTE

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selector, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

Turn "ON" the electric fuel pump. The mixture should be set in the full "RICH" position. Set the propeller at full "INCREASE" rpm to facilitate ample power for an emergency go-around.

The landing gear may be extended at speeds below 130 KIAS. The airplane should be trimmed to a final approach speed of about 75 KIAS with flaps extended. The flaps can be lowered at speeds up to 108 KIAS, if desired. Turn "OFF" the air conditioner.

The mixture control should be kept in full "RICH" position to insure maximum acceleration if it should be necessary to open the throttle again.

The amount of flap used during landings and the speed of the aircraft at contact with the runway should be varied according to the landing surface and conditions of wind and airplane loading. It is generally good practice to contact the ground at the minimum possible safe speed consistent with existing conditions.

Normally, the best technique for short and slow landings is to use full flap and enough power to maintain the desired airspeed and approach flight path. Mixture should be full "RICH," fuel on the fullest tank, and the electric fuel pump "ON." Reduce the speed during the flareout and contact the ground close to the stalling speed. After ground contact hold the nose wheel off as long as possible. As the airplane slows down, gently lower the nose and apply the brakes. Braking is most effective when flaps are raised and back pressure is applied to the control wheel, putting most of the aircraft weight on the main wheels. In high wind conditions, particularly in strong crosswinds, it may be desirable to approach the ground at higher than normal speeds with partial or no flaps.

4.31 STOPPING ENGINE

At the pilot's discretion, the flaps should be raised.

NOTE

The flaps must be placed in the "UP" position for the flap step to support weight. Passengers should be cautioned accordingly.

The electric fuel pump, air conditioner and radios should be turned "OFF," the propeller set in the full "INCREASE" position, and the engine stopped by disengaging the mixture control lock and pulling the mixture control back to idle cut-off. The throttle should be left full aft to avoid engine vibration while stopping. Then the magneto and master switches must be turned "OFF."

4.33 PARKING

If necessary, the airplane should be moved on the ground with the aid of the nose wheel tow bar provided with each airplane and secured behind the rear seats. The aileron and stabilator controls should be secured by looping the safety belt through the control wheel and pulling it snug. The flaps are locked when in the "UP" position and should be left retracted.

Tie downs can be secured to rings provided under each wing and to the tail skid. The rudder is held in position by its connections to the nose wheel steering and normally does not have to be secured.

4.35 STALLS

The stall characteristics of the Arrow IV are conventional. An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall.

The gross weight stalling speed of the Arrow IV with power off and full flaps is 53 KIAS. With the flaps up this speed is increased 6 KTS. Loss of altitude during stalls can be as great as 400 feet, depending on configuration and power.

NOTE

The stall warning system is inoperative with the master switch "OFF".

During preflight, the stall warning system should be checked by turning the master switch "ON", lifting the detector and checking to determine if the horn is actuated. The master switch should be returned to the "OFF" position after the check is complete.

4.37 TURBULENT AIR OPERATION

In keeping with good operating practice used in all aircraft, when turbulent air is encountered or expected, it is recommended that the airspeed be reduced to maneuvering speed to reduce the structural loads caused by gusts and to allow for inadvertent speed build-ups, which may occur as a result of the turbulence or of distractions caused by conditons.

4.39 LANDING GEAR

Some aircraft are equipped with an airspeed - power sensing system (back-up gear extender) which extends the landing gear under low airspeed - power conditions* even though the pilot may not have selected gear down. This system will also prevent retraction of the landing gear by normal means when the airspeed - power values are below a predetermined minimum. To override this system or to hold the emergency gear lever in the OVERRIDE ENGAGED position without maintaining manual pressure on the emergency gear lever, pull the lever full up and push the lock pin in. To release the override, pull lever up and then release. For normal operation, the pilot should extend and retract the gear with the gear selector switch located on the instrument panel, just as he would if the back-up gear extender system were not installed.

The pilot should become familiar with the function and significance of the landing gear position indicators and warning lights.

The red gear warning light on the instrument panel and the horn operate simultaneously in flight when the throttle is reduced to where the manifold pressure is approximately 14 inches of mercury or below, and the gear selector switch is not in the DOWN position. On aircraft equipped with the backup gear extender this warning will also occur during flight when the back-up gear extender system has lowered the landing gear and the gear selector switch is not in the DOWN position and the manifold pressure is reduced below approximately 14 inches of mercury.

The red gear warning light on the instrument panel and the horn will also operate simultaneously on the ground when the master switch is ON and the gear selector switch is in the UP position and the throttle is in the retarded position.

The three green lights on the instrument panel operate individually as each associated gear is locked in the extended position.

*Approximately 95 KIAS at any altitude, power off.

WARNING

Panel lights' dimmer switch must be off to obtain gear and overboost lights full intensity during daytime flying. When aircraft is operated at night and panel lights' dimmer switch is turned on, gear lights and overboost light will automatically dim.

On aircraft equipped with the backup gear extender the yellow Auto Ext. OFF light immediately below the gear selector switch flashes whenever the emergency gear lever is in the OVERRIDE ENGAGED position.

When the Emergency Landing Gear Extension Procedure (Paragraph 3.27) is performed for training purposes, the following changes must be made to the procedure to prevent the hydraulic pump from activating during the procedure. On aircraft equipped with the backup gear extender the landing gear selector must be left in the UP position until all gear position indicators are green. On aircraft which do not have the backup gear extender a pull type LANDING GEAR PUMP circuit breaker is installed and must be pulled prior to executing the emergency extension procedure to allow normal gear system operation.

4.41 WEIGHT AND BALANCE

It is the responsibility of the owner and pilot to determine that the airplane remains within the allowable weight vs. center of gravity envelope while in flight.

For weight and balance data, refer to Section 6 (Weight and Balance).

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SECTION 5

PERFORMANCE

SECTION 5

PERFORMANCE

5.1 GENERAL

All of the required (FAA regulations) and complementary performance information applicable to the Arrow IV is provided by this section.

Performance information associated with those optional systems and equipment which require handbook supplements is provided by Section 9 (Supplements).

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

The performance information presented in this section is based on measured Flight Test Data corrected to I.C.A.O. standard day conditions and analytically expanded for the various parameters of weight, altitude, temperature, etc.

The performance charts are unfactored and do not make any allowance for varying degrees of pilot proficiency or mechanical deterioration of the aircraft. This performance, however, can be duplicated by following the stated procedures in a properly maintained airplane.

Effects of conditions not considered on the charts must be evaluated by the pilot, such as the effect of soft or grass runway surface on takeoff and landing performance, or the effect of winds aloft on cruise and range performance. Endurance can be grossly affected by improper leaning procedures, and inflight fuel flow and quantity checks are recommended.

REMEMBER! To get chart performance, follow the chart procedures.

The information provided by paragraph 5.5 (Flight Planning Example) outlines a detailed flight plan using the performance charts in this section. Each chart includes its own example to show how it is used.

WARNING

Performance information derived by extrapolation beyond the limits shown on the charts should not be used for flight planning or operational purposes.

5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

The first step in planning a flight is to calculate the airplane weight and center of gravity by using the information provided in Section 6 (Weight and Balance) of this handbook.

The basic empty weight for the airplane as delivered from the factory has been entered in Figure 6-5. If any alterations to the airplane have been made effecting weight and balance, reference to the aircraft log book and Weight and Balance Record (Figure 6-7) should be made to determine the current basic empty weight of the airplane.

Use the Weight and Balance Loading Form (Figure 6-11 and the C.G. Range and Weight graph (Figure 6-15) to determine the total weight of the airplane and the center of gravity position.

Use the information provided to find the following weights for the flight planning example.

NOTE

The landing weight cannot be determined until the weight of the fuel to be used has been established (refer to item (g)(1)).

(1)	Basic Empty Weight	1890 lbs.
(2)	Occupants (2 x 170 lbs.)	340 lbs.
(3)	Baggage and Cargo	70 lbs.
(4)	Fuel (6 lb./gal. x 50)	300 lbs.
(5)	Takeoff Weight	2600 lbs.
(6)	Landing Weight (a)(5) minus (g)(1), (2600 lbs. minus 67.8 lbs.)	2532 lbs.

The takeoff weight is below the maximum of 2750 lbs., and weight and balance calculations have determined the C.G. position to be within approved limits.

(b) Takeoff and Landing

All existing conditions at the departure and destination airport must be acquired, evaluated and maintained throughout the flight.

Apply departure airport conditions and takeoff weight to the appropriate Takeoff Performance and Takeoff Ground Roll graph (Figures 5-7, 5-9, 5-11 and 5-13) to determine the length of runway necessary for takeoff and barrier distances.

Perform the landing distance calculations in the same manner using existing conditions at the destination airport and, when established, the landing weight.

The conditions and calculations for the example flight are listed below. The takeoff and landing distances required for the example flight are below available runway lengths.

	Departure Airport	Destination Airport
(1) Pressure Altitude	1900 ft.	1900 ft.
(2) Temperature	20°C	20°C
(3) Wind Component (Headwind)	4 KTS	2 KTS
(4) Runway Length Available	3000 ft	4600 ft
(5) Runway Required	2250 ft*	1490 ft**

NOTE

The remainder of the performance charts used in this flight planning example assume a no wind condition. The effect of winds aloft must be considered by the pilot when computing climb, cruise and descent performance.

*reference Figure 5-11
**reference Figure 5-41

(c) Climb

The next step in the flight plan is to determine the necessary climb segment components.

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables in determining the climb components from the Fuel, Time and Distance to Climb graph (Figure 5-19). After the fuel, time and distance for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to the graph (Figure 5-19). Subtract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

The remaining values are the true fuel, time and distance components for the climb segment of the flight plan corrected for field pressure altitude and temperature.

The following values were determined from the above instructions in our flight planning example.

(1) Cruise Pressure Altitude	6000 ft.
(2) Cruise oat	10°C
(3) Time to Climb (10 min minus 2 min)	8 min*
(4) Distance to Climb (14 naut miles minus 3 naut miles)	11 naut miles*
(5) Fuel to Climb (3 gal minus 1 gal)	2.0 gal*

(d) Descent

The descent data will be determined prior to the cruise data to provide the descent distance for establishing the total cruise distance.

Using the cruise pressure altitude and oat, determine the basic fuel, time and distance for descent (Figure 5-37). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, time and distance

*reference Figure 5-19

values from the graph (Figure 5-37). Subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find true fuel, time and distance values needed for the flight plan.

The values obtained by using the graphs for the descent segment of the example are shown below.

(1) Time to Descend (6 min minus 2 min)	4 min*
(2) Distance to Descend (15.7 naut miles minus 4.8 naut miles)	10.9 naut miles*
(3) Fuel to Descend (1.5 gal minus 0.5 gal)	1.0 gal*

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the Power Setting Table (Figure 5-21) when selecting the cruise power setting. The established pressure altitude and temperature values and the selected cruise power should now be utilized to determine the true airspeed from the appropriate Speed Power graph (Figure 5-23 or 5-25).

Calculate the cruise fuel flow for the cruise power setting (65% Power Best Economy for this example) from the information provided by the Best Economy Range chart (Figure 5-31).

The cruise time is found by dividing the cruise distance by the cruise speed and the cruise fuel is found by multiplying the cruise fuel flow by the cruise time.

The cruise calculations established for the cruise segment of our flight planning example are as follows:

(1) Total Distance	130 naut miles
(2) Cruise Distance (e)(1) minus (c)(4) minus (d)(2), (130 naut miles minus 11 naut miles minus 10.9 naut miles)	108.1 naut miles

*reference Figure 5-37

(3) Cruise Power (Best Economy)	65% rated power
(4) Cruise Speed	126 KTS TAS*
(5) Cruise Fuel Consumption	9.6 gph*
(6) Cruise Time	
(e)(2) divided by (e)(4), (108.1 naut miles divided by 126 KTS)	.86 hrs (52 min)
(7) Cruise Fuel	
(e)(5) multiplied by (e)(6), (9.6 gph multiplied by 0.86 hrs)	8.3 gal

(f) Total Flight Time

Determine the total flight time by adding the time to climb, the time to descend and the cruise time. The time values taken from the climb and descent graphs are in minutes and must be converted to hours before adding them to the cruise time.

The following flight time is required for the flight planning example.

(1) Total Flight Time	
(c)(3) plus (d)(1) plus (e)(6),	
(0.13 hrs plus 0.07 hrs plus 0.86 hrs)	
(8 min plus 4 min plus 52 min)	1.06 hrs
	64 min

(g) Total Fuel Required

Determine the total fuel required by adding the fuel to climb, the fuel to descend and the cruise fuel. When the total fuel (in gallons) is determined, multiply this value by 6 lb/gal to determine the total fuel weight used for the flight.

The total fuel calculations for the example flight plan are shown below.

(1) Total Fuel Required	
(c)(5) plus (d)(3) plus (e)(7),	
(2 gal plus 1.0 gal plus 8.3 gal)	11.3 gal
(11.3 gal multiplied by 6 lb/gal)	67.8 lbs

*reference Figure 5-25

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5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

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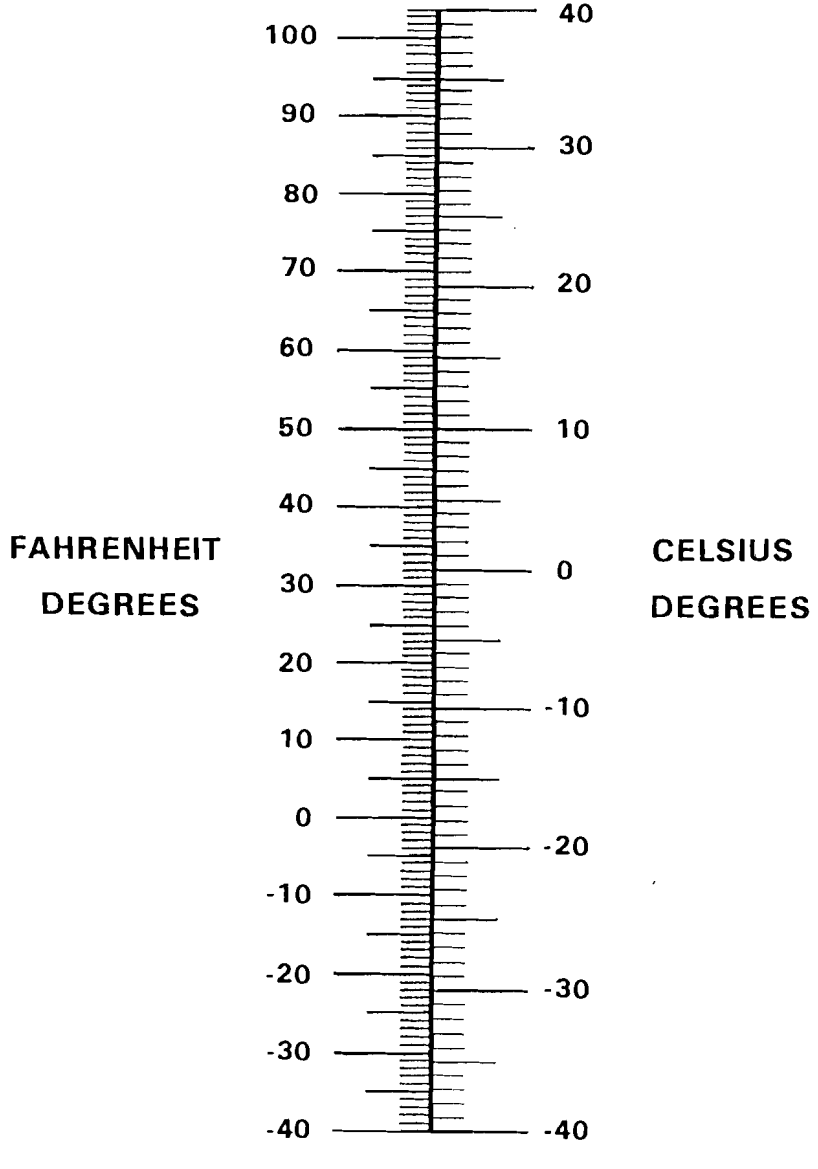
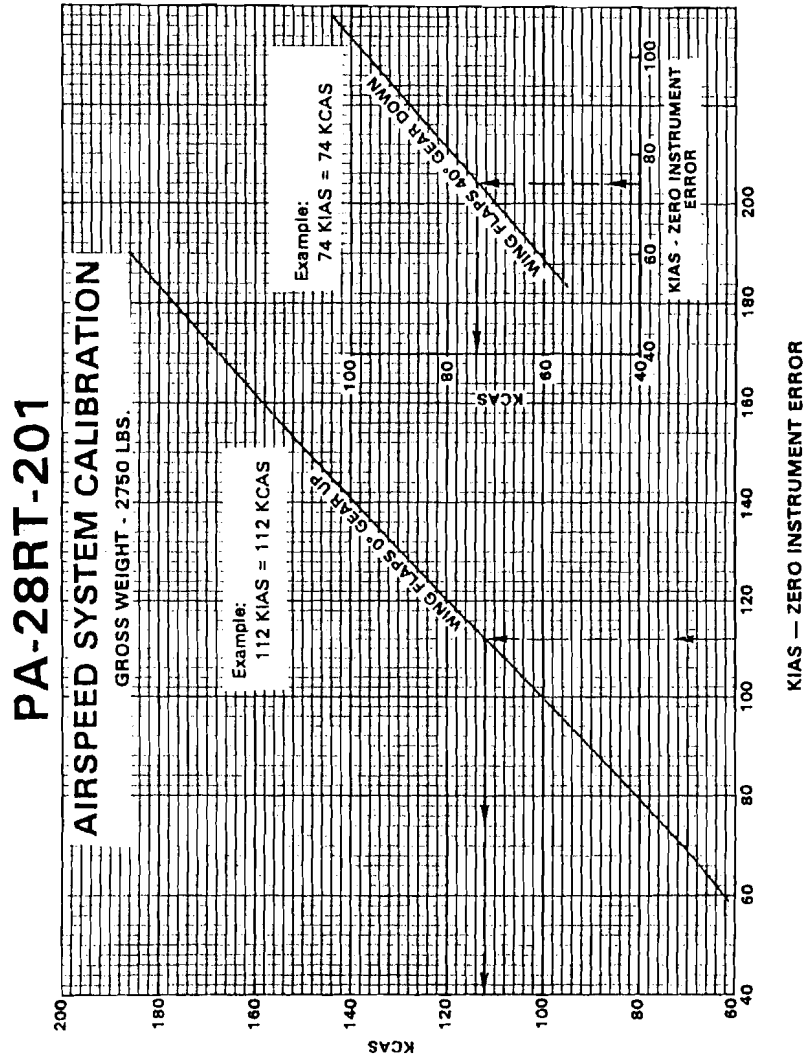
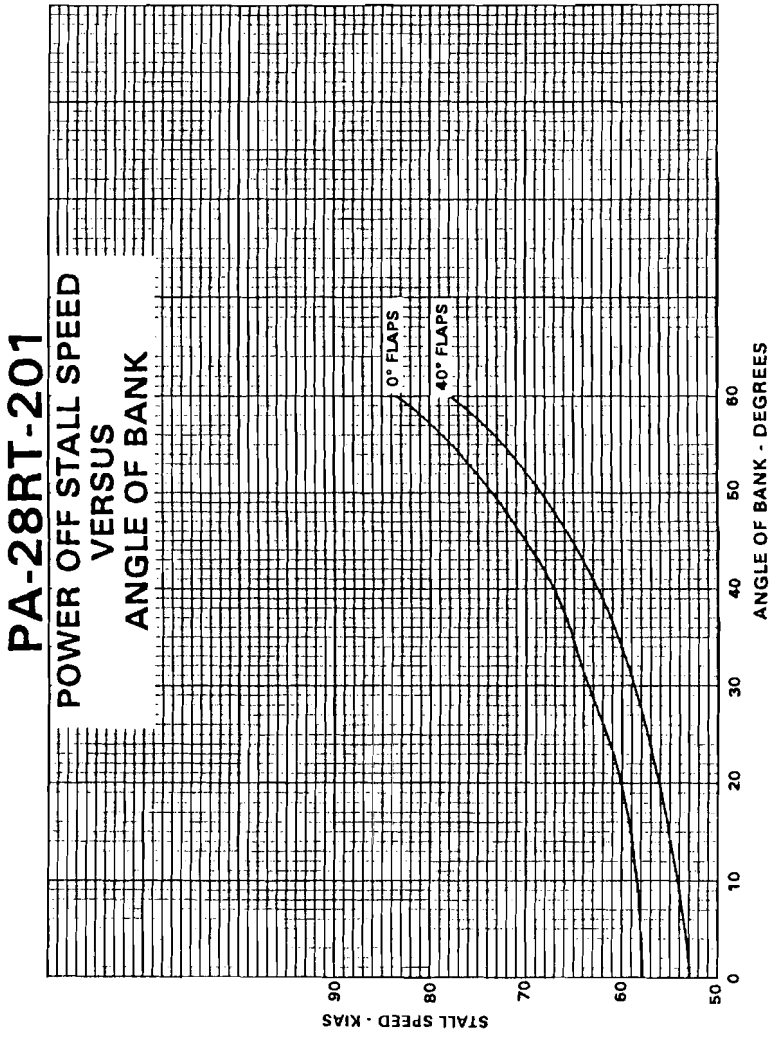


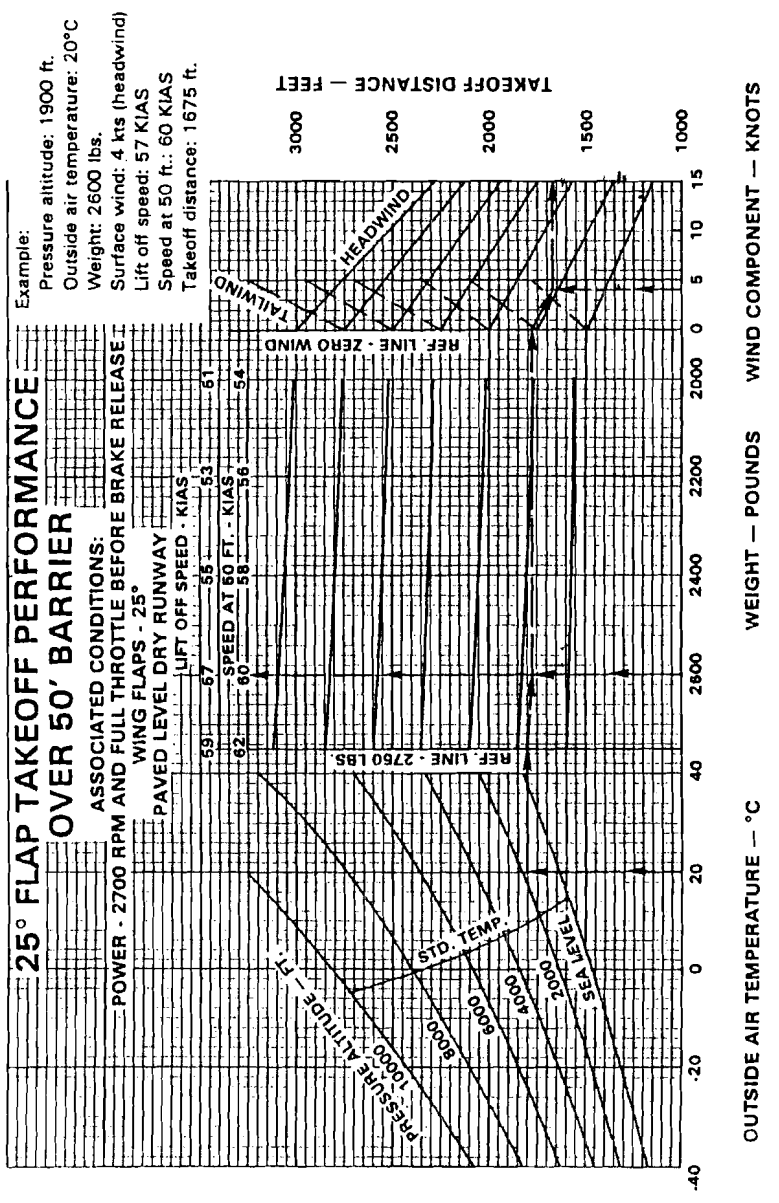
TEMPERATURE CONVERSION
Figure 5-1



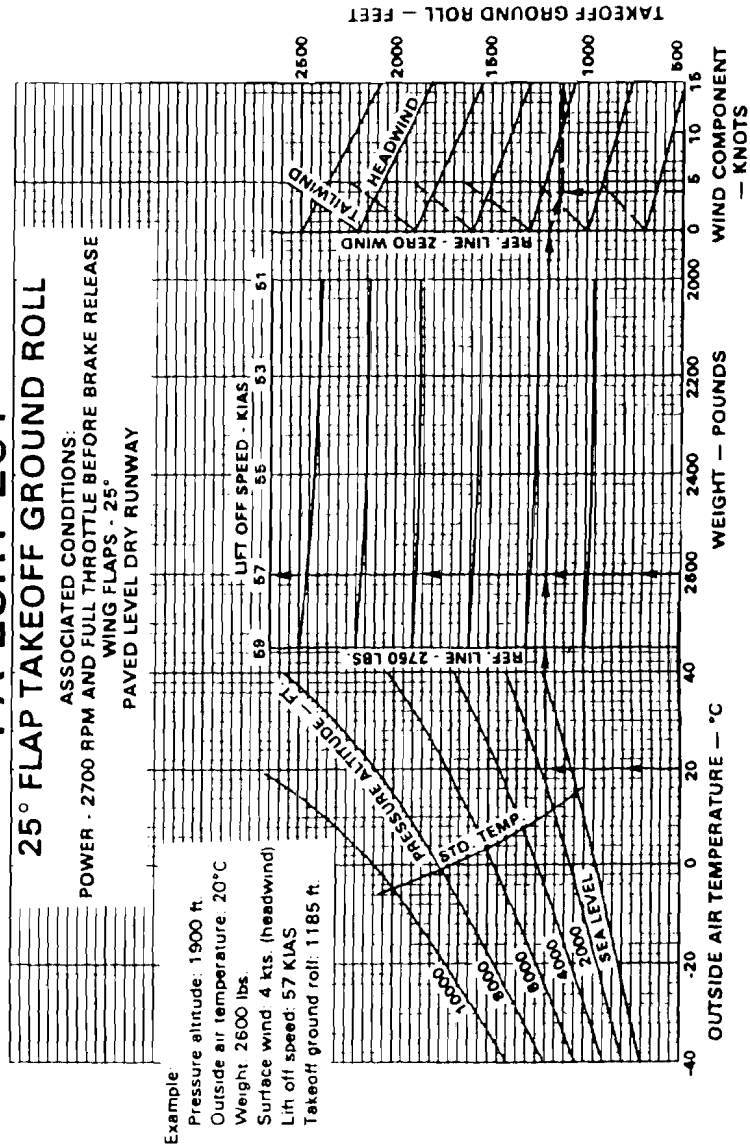
AIRSPEED SYSTEM CALIBRATION
Figure 5-3



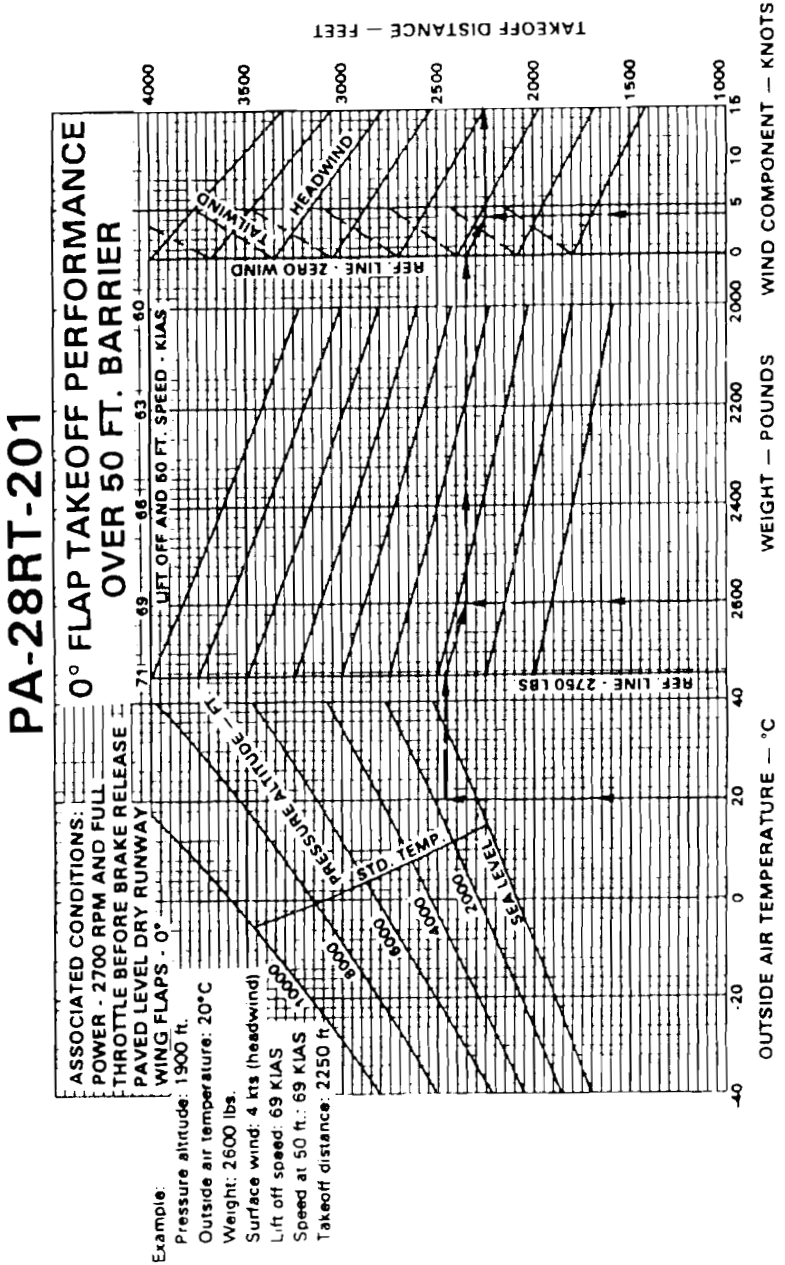
POWER OFF STALL SPEED VS. ANGLE OF BANK
Figure 5-5



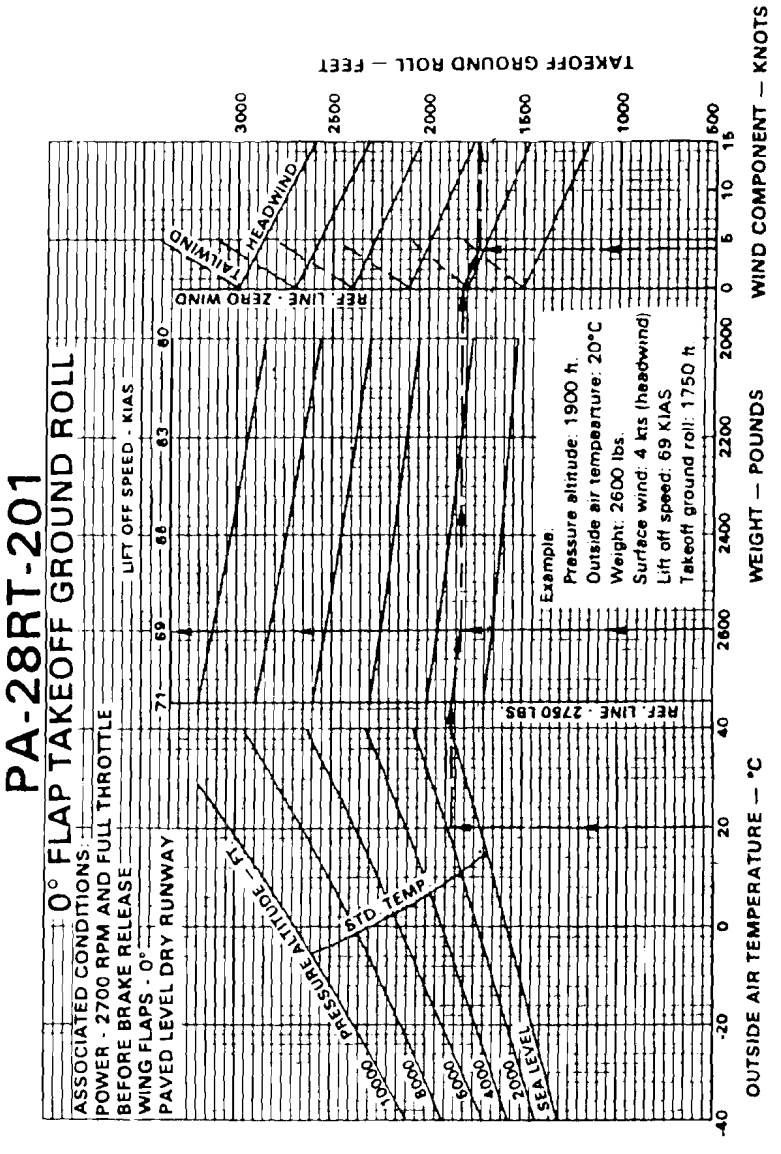
25° FLAP TAKEOFF PERFORMANCE
Figure 5-7



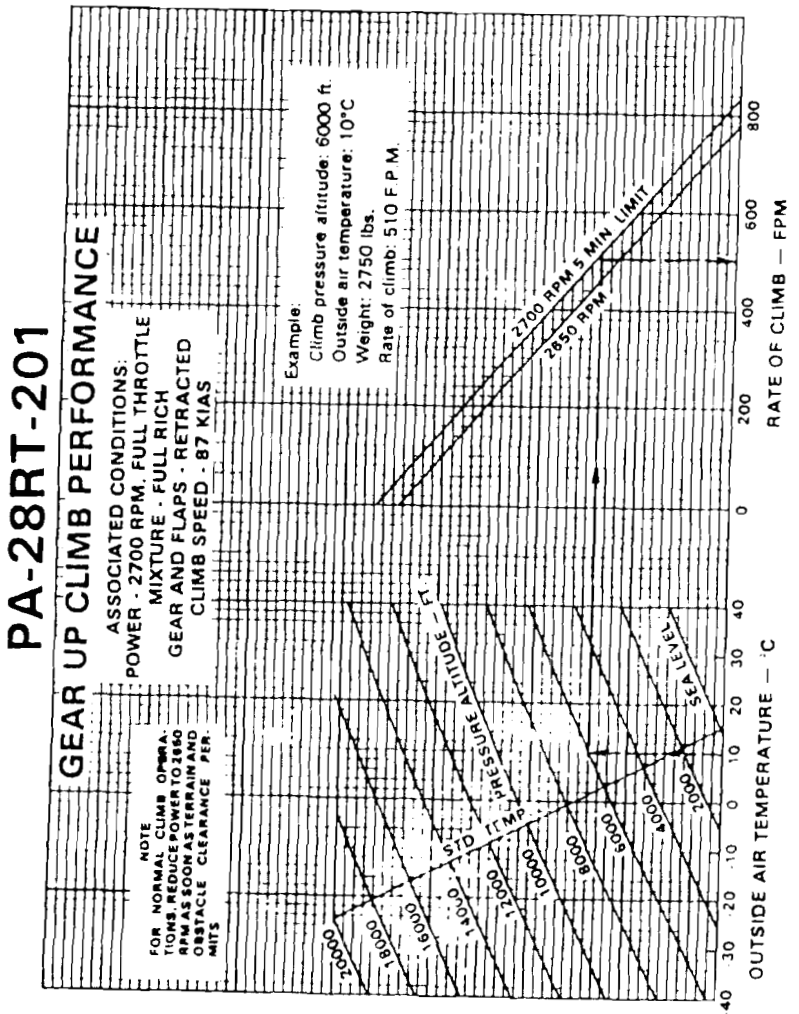
25° FLAP TAKEOFF GROUND ROLL
Figure 5-9



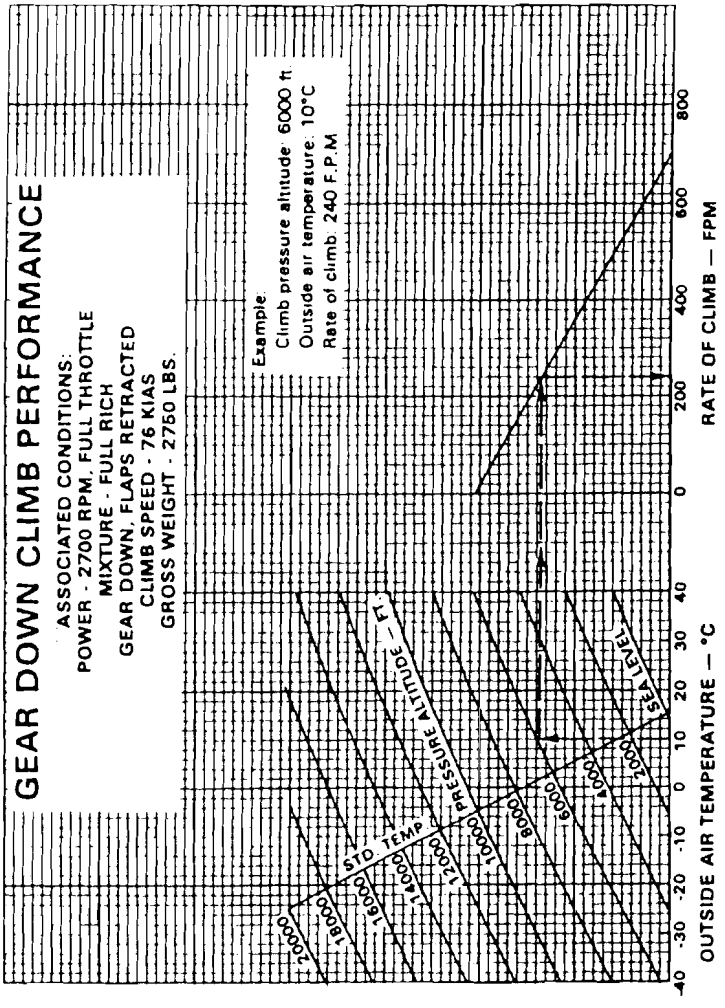
0° FLAP TAKEOFF PERFORMANCE
Figure 5-11



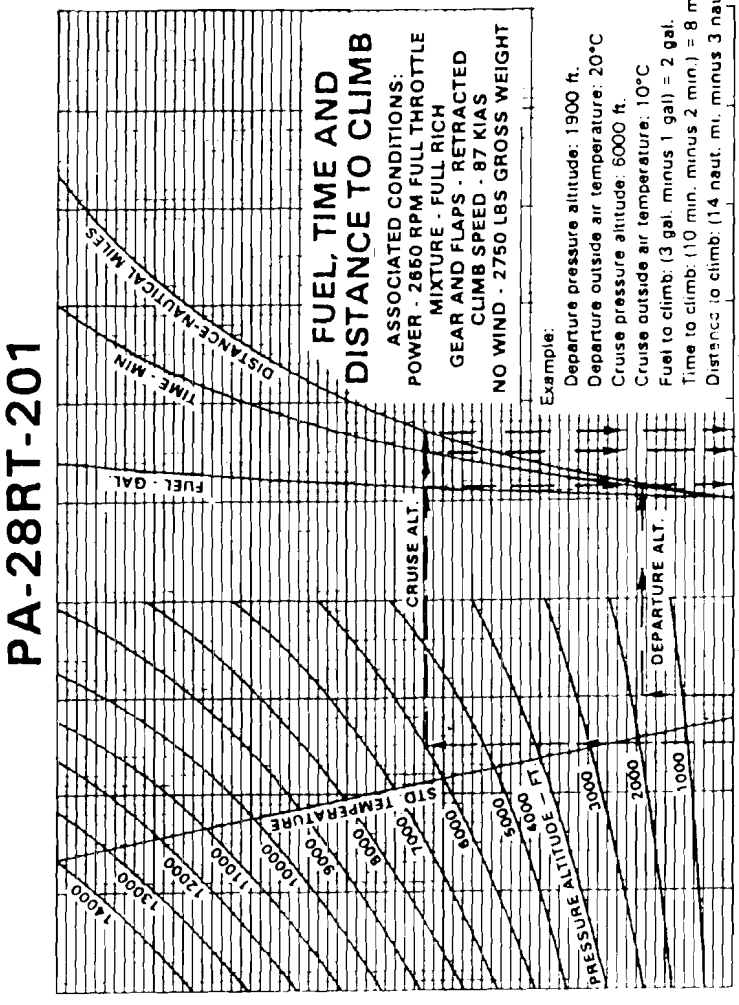
0° FLAP TAKEOFF GROUND ROLL
Figure 5-13



GEAR UP CLIMB PERFORMANCE
Figure 5-15



GEAR DOWN CLIMB PERFORMANCE
Figure 5-17



FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-19

LYCOMING MODEL IO-360-C SERIES, 200 HP ENGINE AS INSTALLED IN PA-28RT-201

Press. Alt. Feet	Std. Alt. Temp. °C	110 HP - 55% POWER RPM AND MAN. PRESS. 2200	2500	130 HP - 65% POWER RPM AND MAN. PRESS. 2200	2500	150 HP - 75% POWER RPM AND MAN. PRESS. 2500	Press Alt. Feet
S.L.	15	25.0	22.2	27.1	23.5	26.0	S.L.
1000	13	24.6	21.8	26.8	23.3	25.8	1000
2000	11	24.1	21.5	26.4	23.1	25.7	2000
3000	9	23.7	21.2	26.1	23.0	25.6	3000
4000	7	23.3	20.9	25.7	22.9	25.5	4000
5000	5	22.8	20.5	F.T.	22.8	F.T.	5000
6000	3	22.4	20.2		22.7		6000
7000	1	21.9	19.8		22.5		7000
8000	-1	21.5	19.5		F.T.		8000
9000	-3	21.0	19.2				9000
10000	-5	F.T.	18.8				10000
11000	-7	—	18.5				11000
12000	-9	—	18.2				12000
13000	-11	—	17.8				13000
14000	-13	—	17.5				14000

To maintain constant power, correct manifold pressure approximately 0.16" Hg for each 10° F variation in inlet air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard.

Full throttle manifold pressure values may not be obtainable when atmospheric conditions are non-standard.

POWER SETTING TABLE
Figure 5-21

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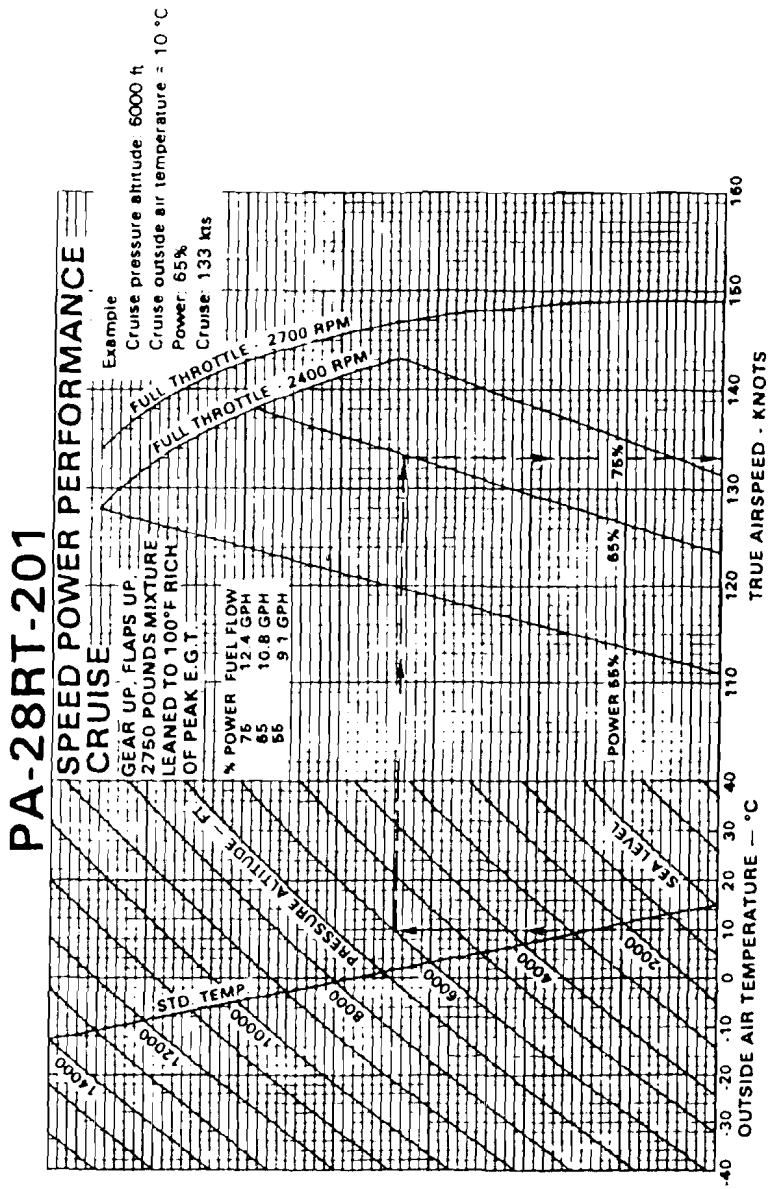
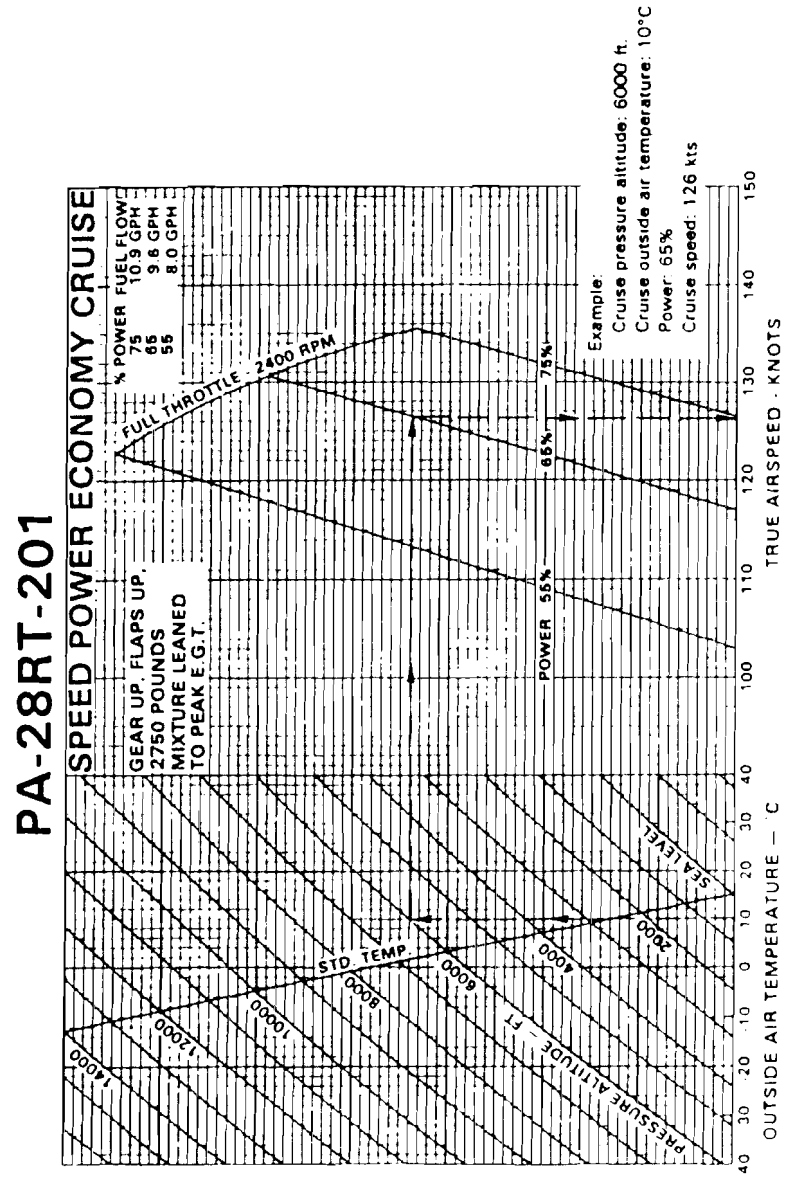
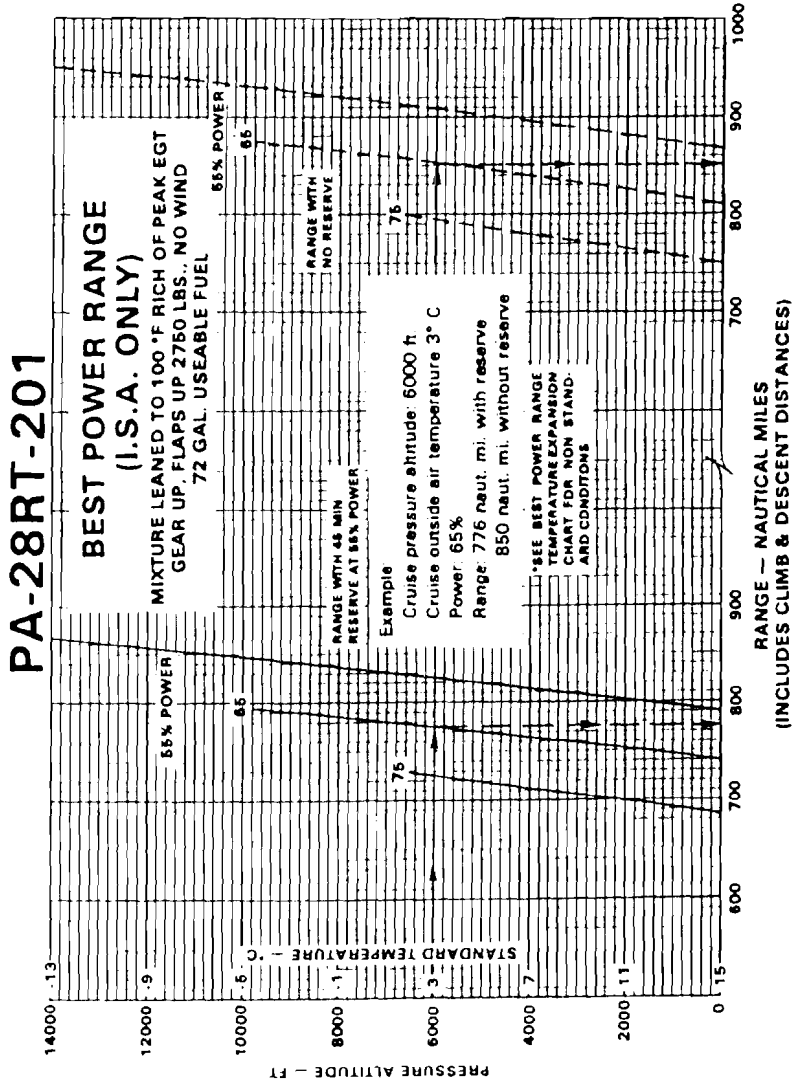


SPEED POWER - PERFORMANCE CRUISE
Figure 5-23



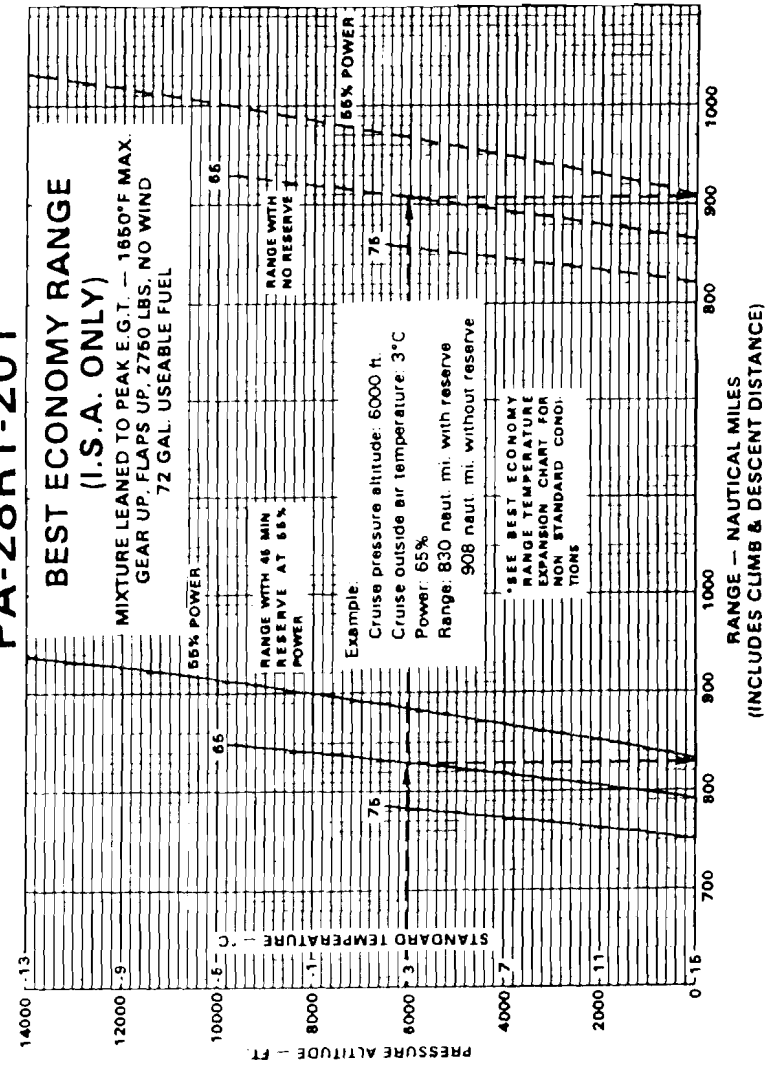
SPEED POWER - ECONOMY CRUISE
Figure 5-25



BEST POWER RANGE - ISA
Figure 5-27

Pressure Altitude Feet	Outside Air Temp. °C		45 Min. Reserve At 55% Power			No Reserve		
			% Power			% Power		
			75	65	55	75	65	55
0	ISA -30°C	-15	654	709	754	715	775	824
2000		-19	666	720	766	728	787	838
4000		-23	678	731	777	742	800	851
6000		-27	690	748	789	755	812	864
8000		-31	—	752	800	—	824	877
10,000		-35	—	762	811	—	836	889
12,000		-39	—	—	821	—	—	901
14,000		-43	—	—	833	—	—	912
0	ISA -15°C	0	671	726	772	733	793	844
2000		-4	683	737	784	747	806	858
4000		-8	695	748	796	761	818	871
6000		-12	707	759	808	774	831	884
8000		-16	—	769	819	—	843	897
10,000		-20	—	780	829	—	855	910
12,000		-24	—	—	839	—	—	921
14,000		-28	—	—	849	—	—	930
0	ISA +15°C	30	701	756	805	766	826	880
2000		26	714	767	817	780	839	894
4000		22	726	778	829	794	852	907
6000		18	739	789	841	808	864	921
8000		14	—	800	852	—	876	933
10,000		10	—	810	861	—	888	945
12,000		5	—	—	867	—		954
14,000		2	—	—	872	—		962
0	ISA +30°C	45	715	769	820	781	841	896
2000		41	728	781	833	796	854	910
4000		37	740	792	844	810	867	924
6000		33	753	803	856	824	879	937
8000		29	—	813	866	—	891	949
10,000		25	—	822	875		901	959
12,000		21			879			965
14,000		17			884			970

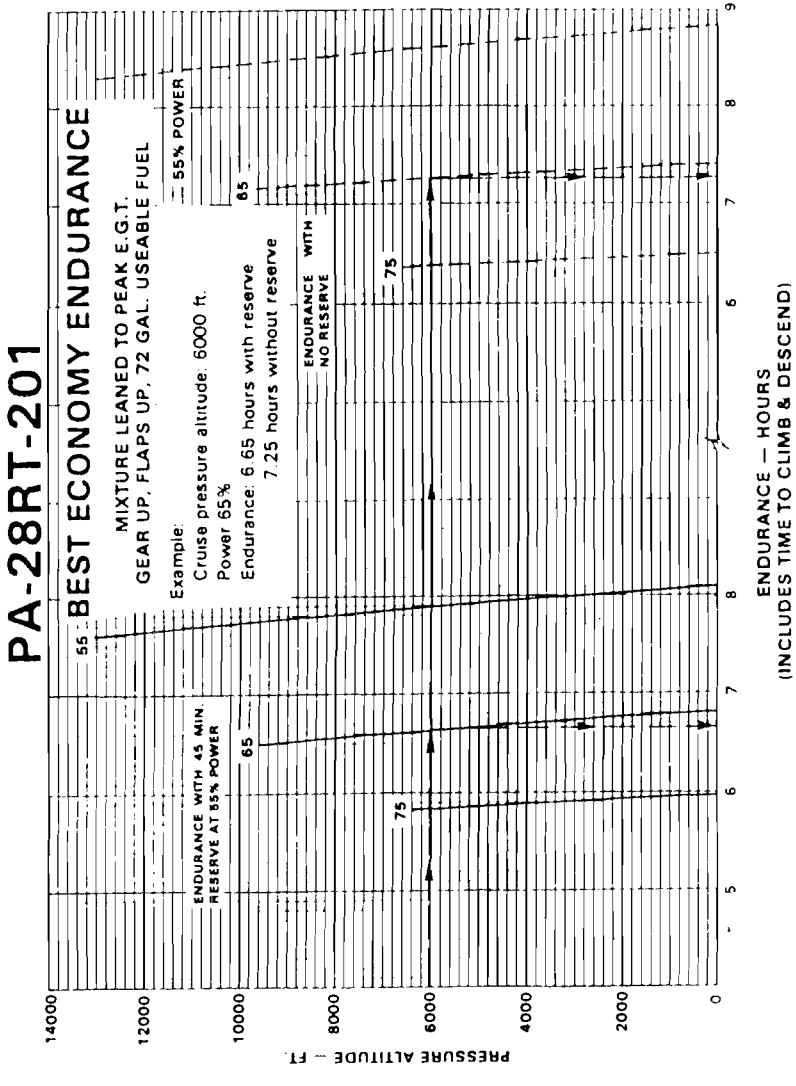
BEST POWER RANGE - NAUTICAL MILES
NON-STANDARD TEMPERATURE EXPANSION CHART
Figure 5-29



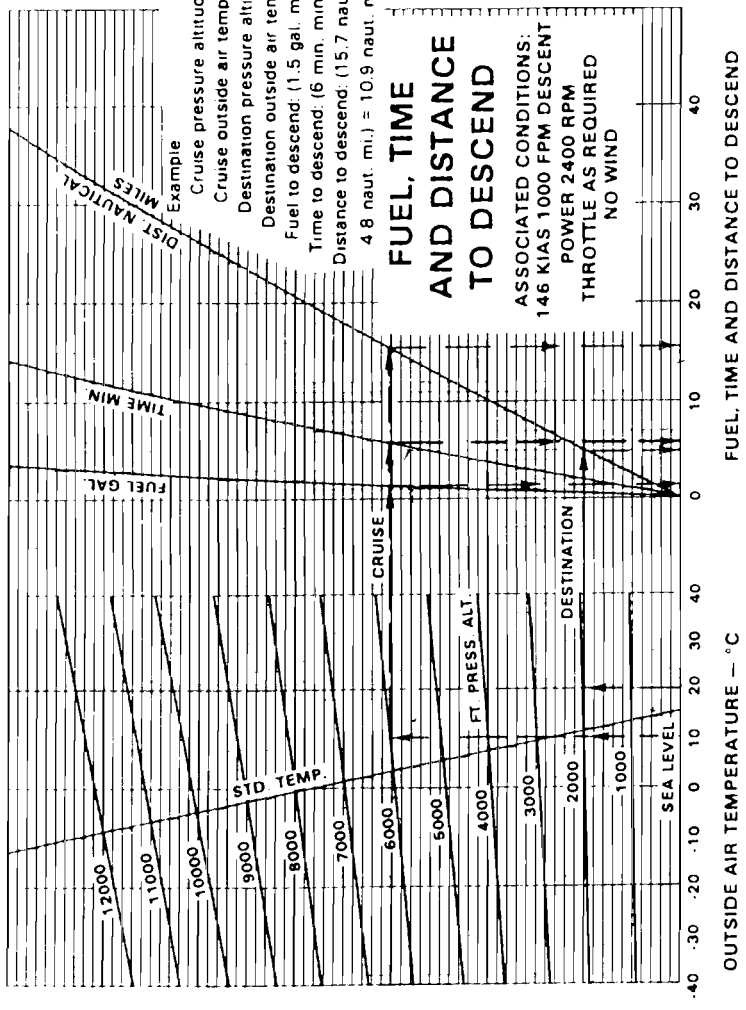
BEST ECONOMY RANGE - ISA
Figure 5-31

Pressure Altitude Feet	Outside Air Temp. °C		45 Min. Reserve At 55% Power			No Reserve		
			% Power			% Power		
			75	65	55	75	65	55
0	ISA -30°C	-15	721	755	784	787	825	857
2000		-19	730	767	801	799	839	876
4000		-23	740	779	818	810	853	896
6000		-27	750	791	835	821	866	915
8000		-31	—	802	851	—	879	953
10,000		-35	—	814	867	—	892	951
12,000		-39	—	—	881	—	—	968
14,000		-43	—	—	892	—	—	980
0	ISA -15°C	0	736	774	808	804	846	883
2000		-4	746	786	826	816	860	903
4000		-8	756	798	843	827	874	923
6000		-12	766	810	860	839	887	942
8000		-16	—	822	876	—	900	960
10,000		-20	—	833	891	—	913	978
12,000		-24	—	—	905	—	—	994
14,000		-28	—	—	918	—	—	1009
0	ISA +15°C	30	764	808	853	835	882	932
2000		26	775	820	870	847	897	952
4000		22	785	832	888	859	911	971
6000		18	795	844	904	870	924	990
8000		14	—	855	919	—	937	1007
10,000		10	—	865	932	—	949	1023
12,000		5	—	—	943	—	—	1036
14,000		2	—	—	952	—	—	1058
0	ISA +30°C	45	777	823	873	849	899	954
2000		41	788	835	891	861	913	974
4000		37	798	848	907	873	927	993
6000		33	808	859	923	884	941	1011
8000		29	—	870	937	—	953	1028
10,000		25	—	878	949	—	963	1042
12,000		21	—	—	955	—	—	1050
14,000		17	—	—	960	—	—	1057

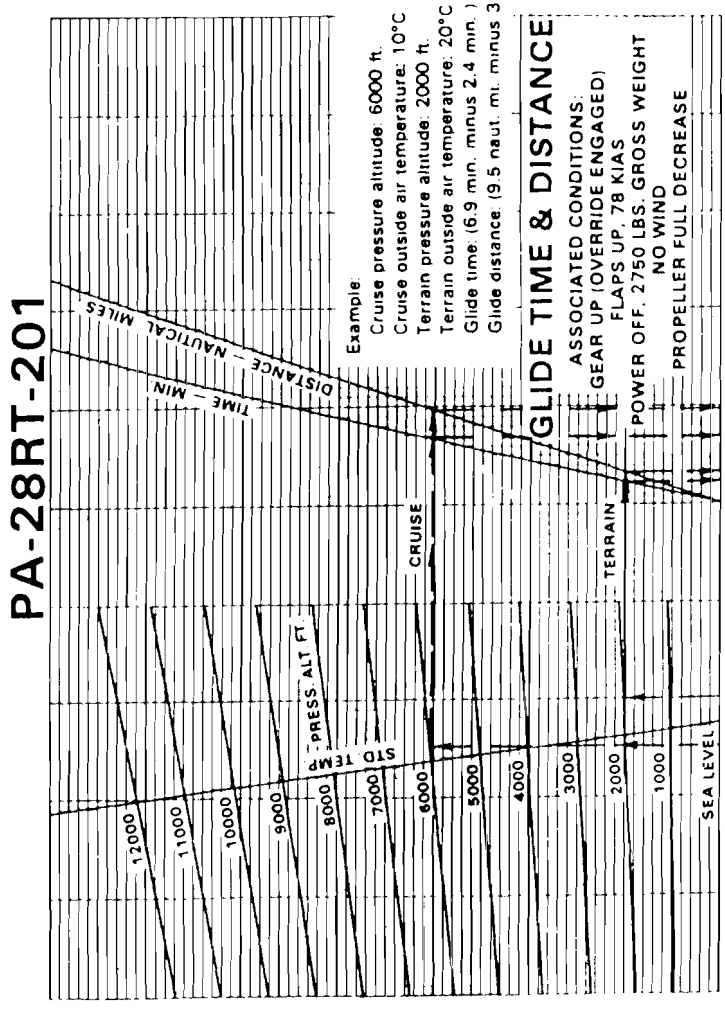
BEST ECONOMY RANGE - NAUTICAL MILES
NON-STANDARD TEMPERATURE EXPANSION CHART
Figure 5-33



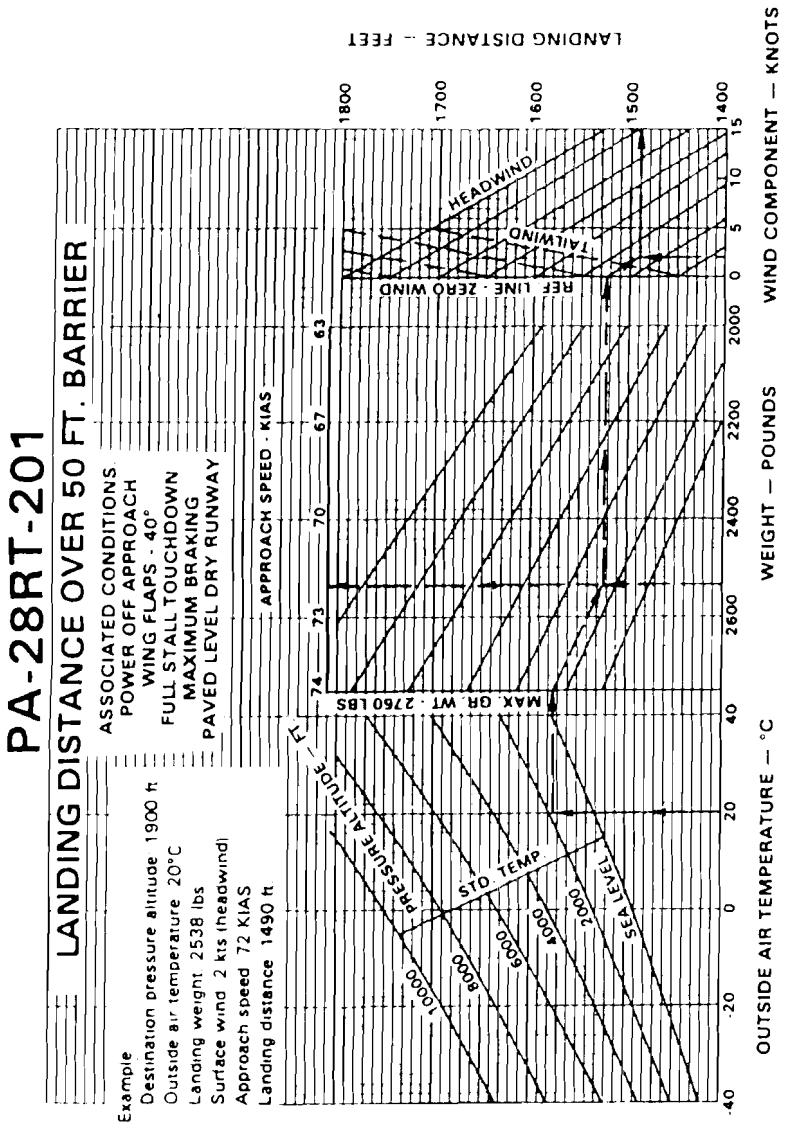
BEST ECONOMY ENDURANCE
Figure 5-35



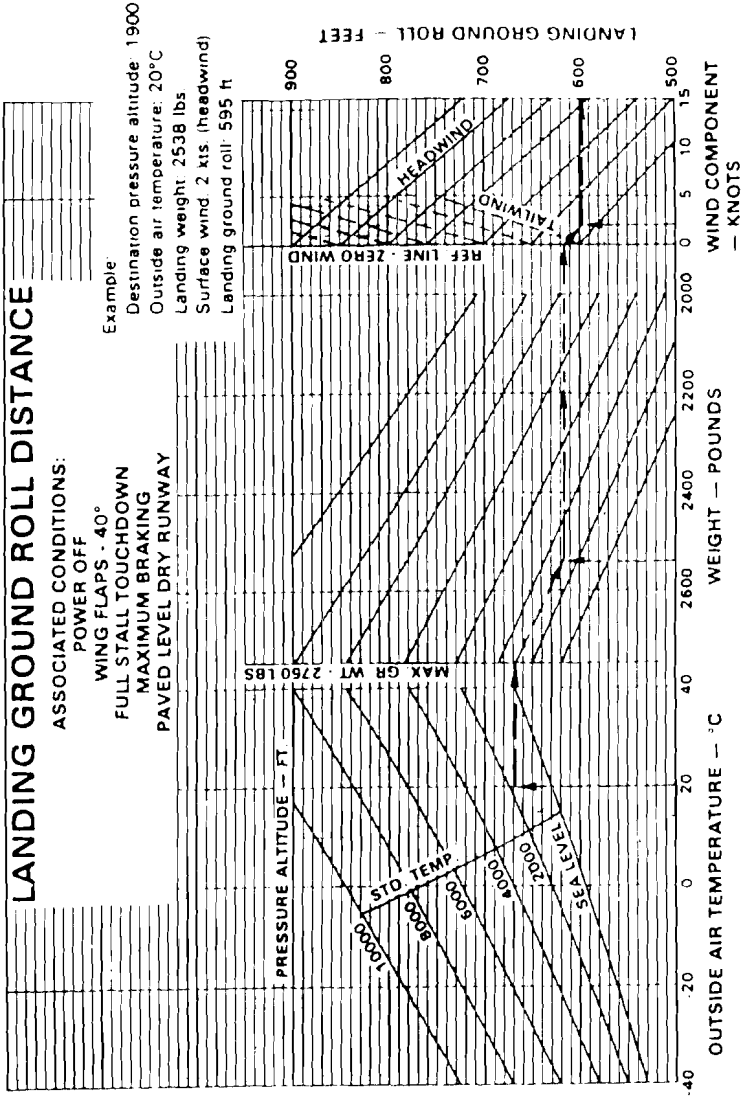
FUEL, TIME AND DISTANCE TO DESCEND
Figure 5-37



GLIDE TIME AND DISTANCE
Figure 5-39



LANDING DISTANCE OVER 50 FT.
Figure 5-41



LANDING GROUND ROLL DISTANCE
Figure 5-43

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SECTION 6

WEIGHT AND BALANCE

SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance and good flying characteristics which are designed into the airplane, it must be flown with the weight and center of gravity (C.G.) position within the approved operating range (envelope). Although the airplane offers flexibility of loading, it cannot be flown with the maximum number of adult passengers, full fuel tanks and maximum baggage. With the flexibility comes responsibility. The pilot must ensure that the airplane is loaded within the loading envelope before he makes a takeoff.

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

Center of gravity is a determining factor in flight characteristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for takeoff or landing. If the C.G. is too far aft, the airplane may rotate prematurely on takeoff or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult as the center of gravity moves aft of the approved limit.

A properly loaded airplane, however, will perform as intended. Before the airplane is delivered, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can easily determine the weight and C.G. position for the loaded airplane by computing the total weight and moment and then determining whether they are within the approved envelope.

The basic empty weight and C.G. location are recorded in the Weight and Balance Data Form (Figure 6-5) and the Weight and Balance Record (Figure 6-7). The current values should always be used. Whenever new equipment is added or any modification work is done, the mechanic responsible for the work is required to compute a new basic empty weight and C.G. position and to write these in the Aircraft Log Book and the Weight and Balance Record. The owner should make sure that it is done.

A weight and balance calculation is necessary in determining how much fuel or baggage can be boarded so as to keep within allowable limits. Check calculations prior to adding fuel to insure against improper loading.

The following pages are forms used in weighing an airplane in production and in computing basic empty weight, C.G. position, and useful load. Note that the useful load includes usable fuel, baggage, cargo and passengers. Following this is the method for computing takeoff weight and C.G.

6.3 AIRPLANE WEIGHING PROCEDURE

At the time of delivery, Piper Aircraft Corporation provides each airplane with the basic empty weight and center of gravity location. This data is supplied by Figure 6-5.

The removal or addition of equipment or airplane modifications can affect the basic empty weight and center of gravity. The following is a weighing procedure to determine this basic empty weight and center of gravity location:

(a) Preparation

(1) Be certain that all items checked in the airplane equipment list are installed in the proper location in the airplane.

(2) Remove excessive dirt, grease, moisture, foreign items such as rags and tools from the airplane before weighing.

(3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate engine on each tank until all undrainable fuel is used and engine stops. Then add the unusable fuel (5.0 gallons total, 2.5 gallons each wing).

CAUTION

Whenever the fuel system is completely drained and fuel is replenished it will be necessary to run the engines for a minimum of 3 minutes at 1000 RPM on each tank to insure no air exists in the fuel supply lines.

(4) Fill with oil to full capacity.

(5) Place pilot and copilot seats in fourth (4th) notch, aft of forward position. Put flaps in the fully retracted position and all control surfaces in the neutral position. Tow bar should be in the proper location and all entrance and baggage doors closed.

(6) Weigh the airplane inside a closed building to prevent errors in scale readings due to wind.

(b) Leveling

(1) With airplane on scales, block main gear oleo pistons in the fully extended position.

(2) Level airplane (refer to Figure 6-3) deflating nose wheel tire, to center bubble on level.

(c) Weighing - Airplane Basic Empty Weight

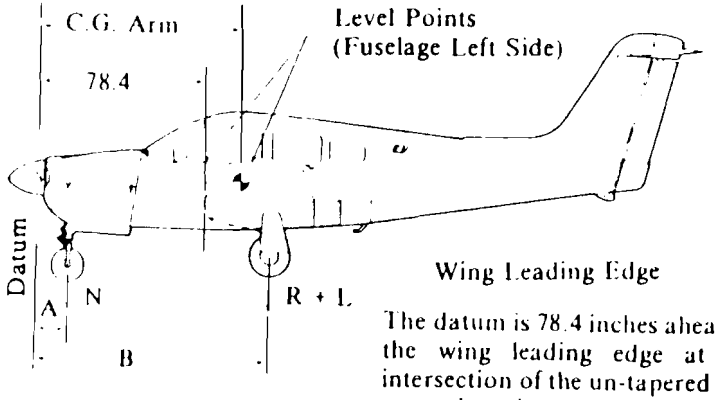
(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

Scale Position and Symbol		Scale Reading	Tare	Net Weight
Nose Wheel	(N)			
Right Main Wheel	(R)			
Left Main Wheel	(L)			
Basic Empty Weight, as Weighed (T)				

WEIGHING FORM
Figure 6-1

(d) Basic Empty Weight Center of Gravity

(1) The following geometry applies to the PA-28RT-201 airplane when it is level. Refer to Leveling paragraph 6.3 (b).



The datum is 78.4 inches ahead of the wing leading edge at the intersection of the un-tapered and tapered section.

A = 15.6
B = 109.7

LEVELING DIAGRAM
Figure 6-3

(2) The basic empty weight center of gravity (as weighed including optional equipment, full oil and unusable fuel) can be determined by the following formula:

$$\text{C.G. Arm} = \frac{N\,(A) + (R + L)\,(B)}{T} \quad \text{inches}$$

Where: $T = N + R + L$

6.5 WEIGHT AND BALANCE DATA AND RECORD

The Basic Empty Weight, Center of Gravity Location and Useful Load listed in Figure 6-5 are for the airplane as delivered from the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane as delivered from the factory has been entered in the Weight and Balance Record (Figure 6-7). This form is provided to present the current status of the airplane basic empty weight and a complete history of previous modifications. Any change to the permanently installed equipment or modification which affects weight or moment must be entered in the Weight and Balance Record.

MODEL PA-28RT-201 ARROW IV

Airplane Serial Number _____

Registration Number _____

Date _____

AIRPLANE BASIC EMPTY WEIGHT

Item		Weight (Lbs)	x	C.G. Arm (Inches Aft of Datum)	=	Moment (In-Lbs)
Standard Empty Weight*	Actual / Computed					
Optional Equipment						
Basic Empty Weight						

*The standard empty weight includes full oil capacity and 5.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

(Gross Weight) - (Basic Empty Weight) = Useful Load

(2750 lbs.) - (lbs.) = lbs.

THIS BASIC EMPTY WEIGHT, C.G. AND USEFUL LOAD ARE FOR THE AIRPLANE AS DELIVERED FROM THE FACTORY. REFER TO APPROPRIATE AIRCRAFT RECORD WHEN ALTERATIONS HAVE BEEN MADE.

WEIGHT AND BALANCE DATA FORM
Figure 6-5

PA-28RT-201		Serial Number		Registration Number			Page Number	
Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Moment /100

WEIGHT AND BALANCE RECORD
Figure 6-7

PA-28RT-201		Serial Number		Registration Number				Page Number	
				Weight Change				Running Basic Empty Weight	
Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Wt. (Lb.)	Arm (In.)	Moment/100		Wt. (Lb.)	Moment/100

WEIGHT AND BALANCE RECORD (cont)
Figure 6-7 (cont)

6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

(a) Add the weight of all items to be loaded to the basic empty weight.
(b) Use the Loading Graph (Figure 6-13) to determine the moment of all items to be carried in the airplane.
(c) Add the moment of all items to be loaded to the basic empty weight moment.
(d) Divide the total moment by the total weight to determine the C.G. location.
(e) By using the figures of item (a) and item (d) (above), locate a point on the C.G. range and weight graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger	340.0	80.5	27370
Passengers (Rear Seats)	340.0	118.1	40154
Fuel (72 Gallons Maximum Usable)		95.0	
Baggage (200 Lbs. Maximum)		142.8	
Moment due to Retraction of Landing Gear			819
Total Loaded Airplane			

The center of gravity (C.G.) of this sample loading problem is at inches aft of the datum line. Locate this point ( ) on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

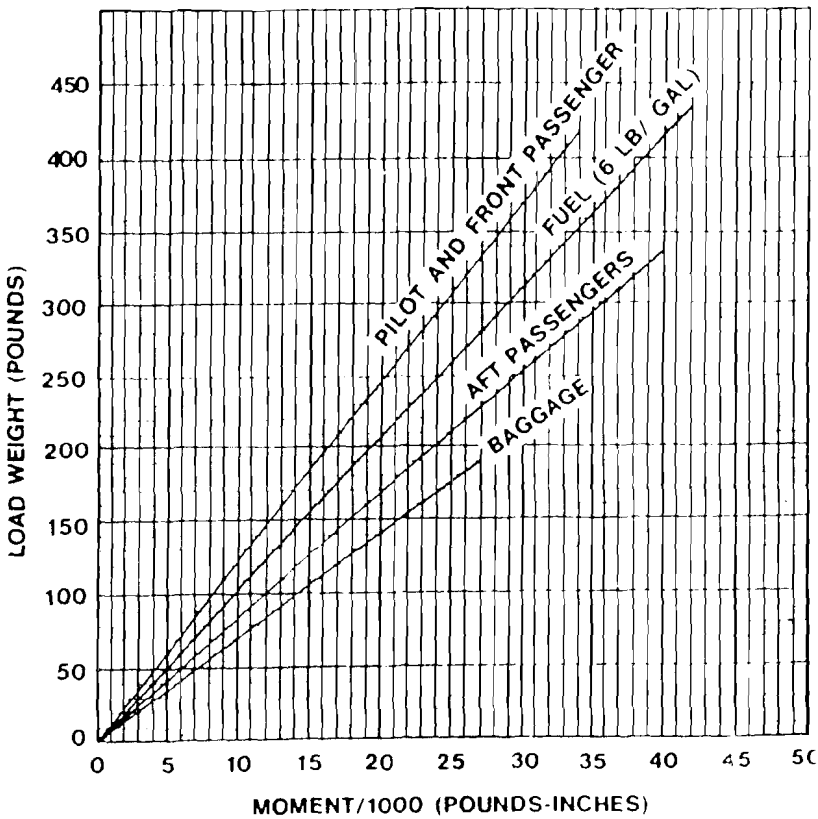
IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY.

SAMPLE LOADING PROBLEM (NORMAL CATEGORY)
Figure 6-9

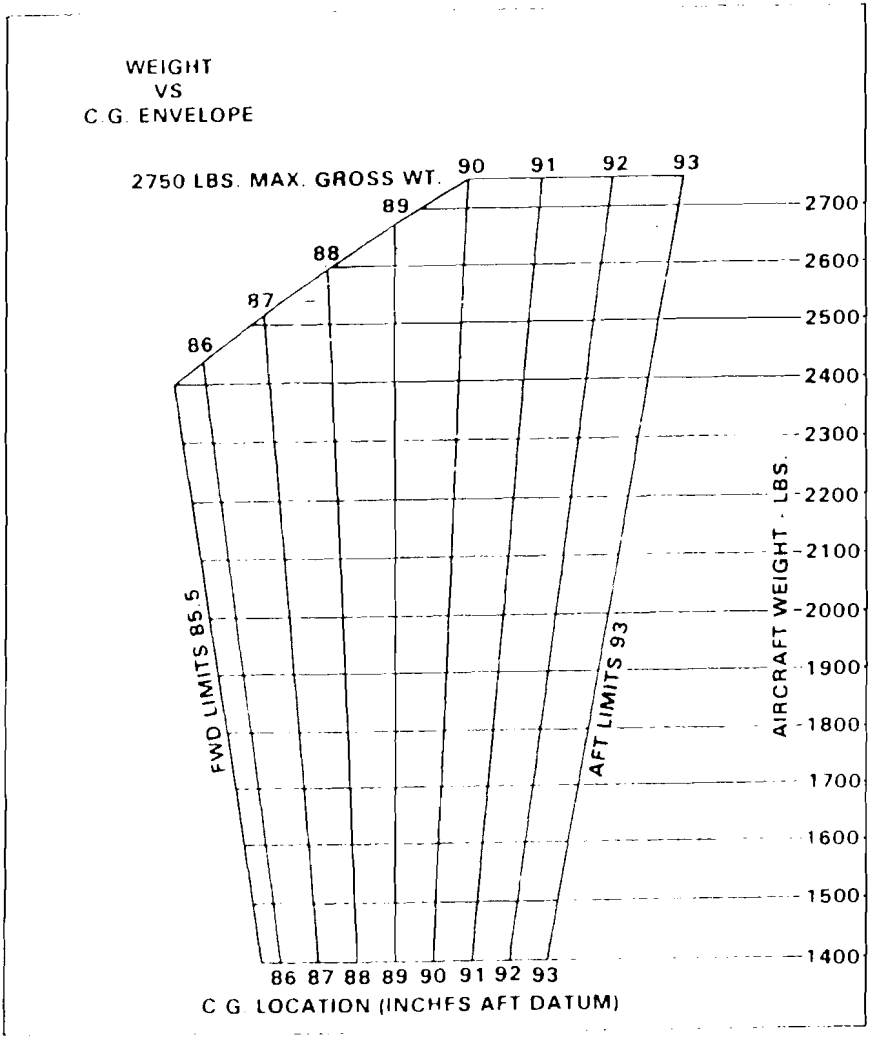
	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		80.5	
Passengers (Rear Seats)		118.1	
Fuel (72 Gallons Maximum Usable)		95.0	
Baggage (200 Lbs. Maximum)		142.8	
Moment due to Retraction of Landing Gear			819
Total Loaded Airplane			

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight and Balance Data Form (Figure 6-5). If the airplane has been altered, refer to the Weight and Balance Record for this information.

WEIGHT AND BALANCE LOADING FORM
Figure 6-11



LOADING GRAPH
Figure 6-13



C.G. RANGE AND WEIGHT
Figure 6-15

6.9 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE PLOTTER

This plotter is provided to enable the pilot quickly and conveniently to:

(a) Determine the total weight and C.G. position.

(b) Decide how to change his load if his first loading is not within the allowable envelope.

Heat can warp or ruin the plotter if it is left in the sunlight. Replacement plotters may be purchased from Piper dealers and distributors.

When the airplane is delivered, the basic weight and basic C.G. will be recorded on the computer. These should be changed any time the basic weight or C.G. location is changed.

The plotter enables the user to add weights and corresponding moments graphically. The effect of adding or disposing of useful load can easily be seen. The plotter does not cover the situation where cargo is loaded in locations other than on the seats or in the baggage compartments.

Brief instructions are given on the plotter itself. To use it, first plot a point on the grid to locate the basic weight and C.G. location. This can be put on more or less permanently because it will not change until the airplane is modified. Next, position the zero weight end of any one of the loading slots over this point. Using a pencil, draw a line along the slot to the weight which will be carried in that location. Then position the zero weight end of the next slot over the end of this line and draw another line representing the weight which will be located in this second position. When all the loads have been drawn in this manner, the final end of the segmented line locates the total load and the C.G. position of the airplane for takeoff. If this point is not within the allowable envelope it will be necessary to remove fuel, baggage, or passengers and/or to rearrange baggage and passengers to get the final point to fall within the envelope.

Fuel burn-off and gear movement do not significantly affect the center of gravity.

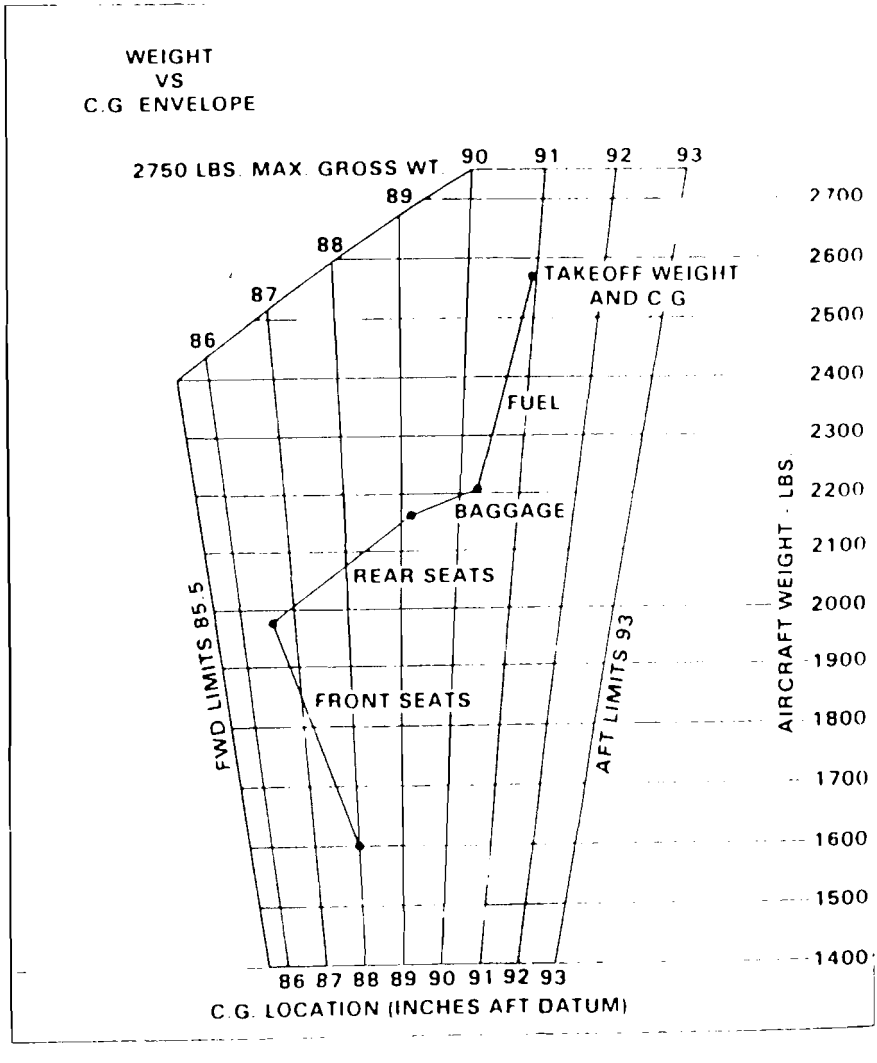
SAMPLE PROBLEM

A sample problem will demonstrate the use of the weight and balance plotter.

Assume a basic weight and C.G. location of 1600 pounds at 88.00 inches respectively. We wish to carry a pilot and 3 passengers. Two men weighing 180 and 200 pounds will occupy the front seats, and two children weighing 80 and 100 pounds will ride in the rear. Two suitcases weighing 25 pounds and 20 pounds respectively, will be carried in the rear compartment. We wish to carry 60 gallons of fuel. Will we be within the safe envelope?

(a) Place a dot on the plotter grid at 1600 pounds and 88.00 to represent the basic airplane. (See illustration.)
(b) Slide the slotted plastic into position so that the dot is under the slot for the forward seats, at zero weight.
(c) Draw a line up the slot to the 380 pound position (180 + 200) and put a dot.
(d) Continue moving the plastic and plotting points to account for weight in the rear seats (80 + 100), baggage compartment (45), and fuel tanks (360).
(e) As can be seen from the illustration, the final dot shows the total weight to be 2565 pounds with the C.G. at 90.94. This is well within the envelope.
(f) There will be room for more fuel.

As fuel is burned off, the weight and C.G. will follow down the fuel line and stay within the envelope for landing.


WEIGHT
VS
C.G. ENVELOPE
2750 LBS. MAX. GROSS WT.
90
91
92
93
89
88
87
86
TAKEOFF WEIGHT
AND C.G.
FUEL
BAGGAGE
REAR SEATS
FRONT SEATS
FWD LIMITS 85.5
AFT LIMITS 93
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
AIRCRAFT WEIGHT - LBS
86 87 88 89 90 91 92 93
C.G. LOCATION (INCHES AFT DATUM)

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SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The Arrow IV is a single engine, retractable landing gear, all metal airplane featuring the tail surfaces in a "T" configuration. It has seating for up to four occupants, a 200 pound luggage compartment, and a 200 HP engine.

7.3 AIRFRAME

With the exception of the steel engine mount, the landing gear, miscellaneous steel parts, the cowling, and the lightweight plastic extremities (tips of wings, tail fin and stabilator), the basic airframe is of aluminum alloy. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure. There is a front door on the right side. A cargo door is installed aft of the rear seat.

The wing is of a conventional design semi-tapered and employs a laminar flow NACA 652-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the aft seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. The four-position wing flaps are mechanically controlled by a handle located between the front seats. When fully retracted, the right flap locks into place to provide a step for cabin entry. Each wing contains one fuel tank.

A vertical stabilizer, an all-movable horizontal stabilator, and a rudder make up the empennage. The stabilator, which is mounted on top of the fin, incorporates an anti-servo tab which improves longitudinal stability and provides longitudinal trim. This tab moves in the same direction as the stabilator, but with increased travel.

7.5 ENGINE AND PROPELLER

The Arrow IV incorporates a Lycoming IO-360-C1C6 four-cylinder, direct drive, horizontally opposed fuel injected engine rated at 200 horsepower at 2700 RPM. It is furnished with a starter, 60 ampere 14-volt alternator, shielded ignition, vacuum pump drive, fuel pump, propeller governor and a dry automotive type induction air filter. A recommended overhaul period is based on Lycoming service experience. Since Lycoming from time to time revises the recommended overhaul period, the owner should check the latest Lycoming Service Instruction #1009 at his Piper dealer for the latest recommended overhaul period and for any additional information.

The aircraft is equipped with a constant speed, controllable pitch propeller. The propeller control is located on the power quadrant between the throttle and mixture controls. A mixture control lock is provided to prevent activation of the mixture control instead of the pitch control.

The exhaust system is a crossover type, which reduces back pressure and improves performance. It is constructed entirely of stainless steel and is equipped with dual mufflers. Cabin heat and windshield defrosting are provided by a heater shroud around the muffler.

An oil cooler is located on the forward lower right side of the fire wall, with the air inlet for the cooler located on the right side of the bottom cowling. A winterization plate is provided to restrict air during winter operation. (See Winterization in Handling and Servicing.)

7.7 INDUCTION SYSTEM

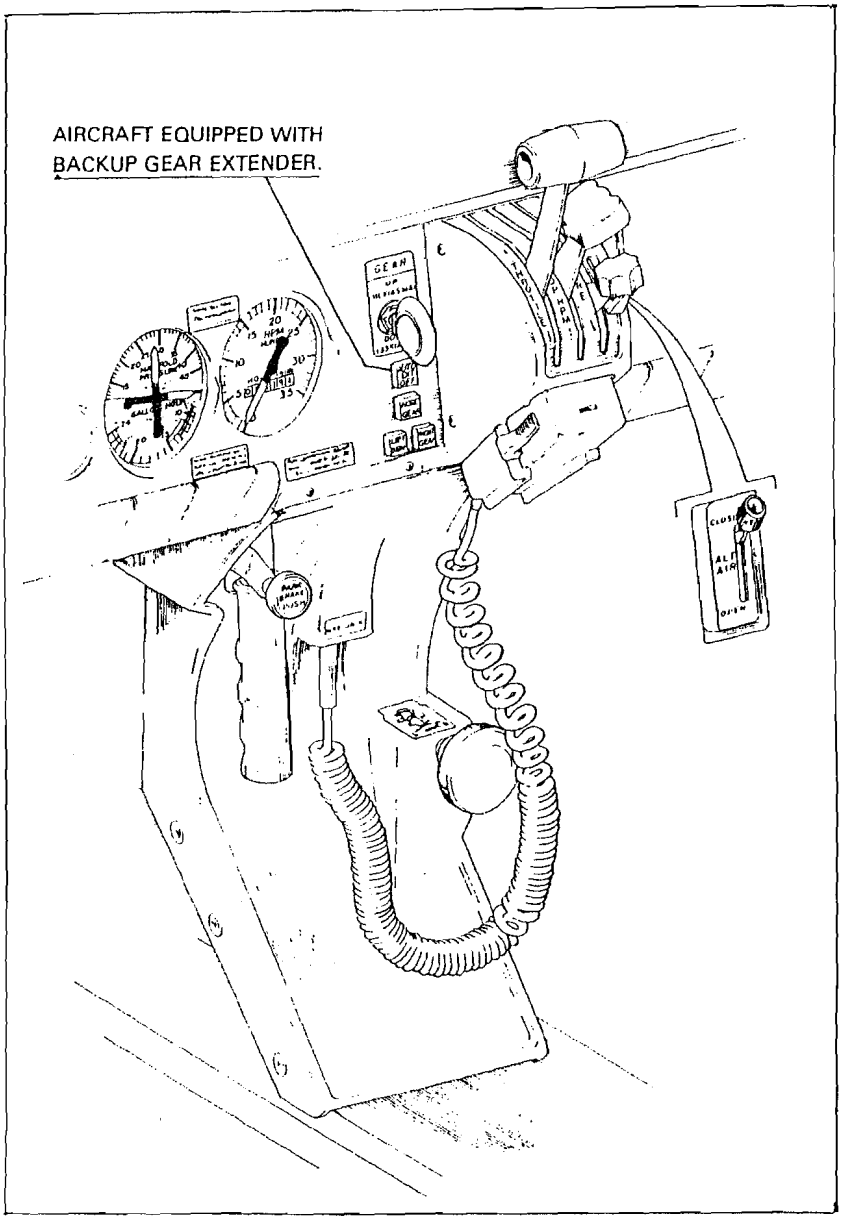
The induction system incorporates a Bendix RSA-5AD1 type fuel injector. The injector is based on the principle of differential pressure, which balances air pressure against fuel pressure. The regulated fuel pressure established by the servo valve when applied across a fuel control (jetting system) makes the fuel flow proportional to airflow. Fuel pressure regulation by the servo valve causes a minimal drop in fuel pressure throughout the metering system. Metering pressure is maintained above most vapor forming conditions while fuel inlet pressure is low enough to allow use of a diaphragm pump. The servo system feature also checks vapor lock and associated starting problems.

The servo regulation meters fuel flow proportionally with airflow and maintains the mixture as manually set for all engine speeds. The fuel flow divider receives metered fuel and distributes fuel to each cylinder fuel nozzle.

The fuel flow portion of the manifold pressure/fuel flow gauge is connected to the flow divider and monitors fuel pressure. This instrument converts fuel pressure to an indication of fuel flow in gallons per hour and percentage of rated horsepower.

The alternate air source of the induction system contains a door that functions automatically or manually. If the primary source is obstructed, the door will open automatically. It may be opened manually by moving the selector on the right side of the quadrant. The primary source should always be used for takeoff.

The pilot should read and follow the procedures recommended in the Lycoming Operator's Manual for this engine, in order to obtain maximum engine efficiency and time between engine overhauls.



CONTROL QUADRANT AND CONSOLE
Figure 7-1

7.9 ENGINE CONTROLS

Engine controls consist of a throttle control, a propeller control and a mixture control lever. These controls are located on the control quadrant on the lower center of the instrument panel (Figure 7-1) where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control cables to reduce friction and binding.

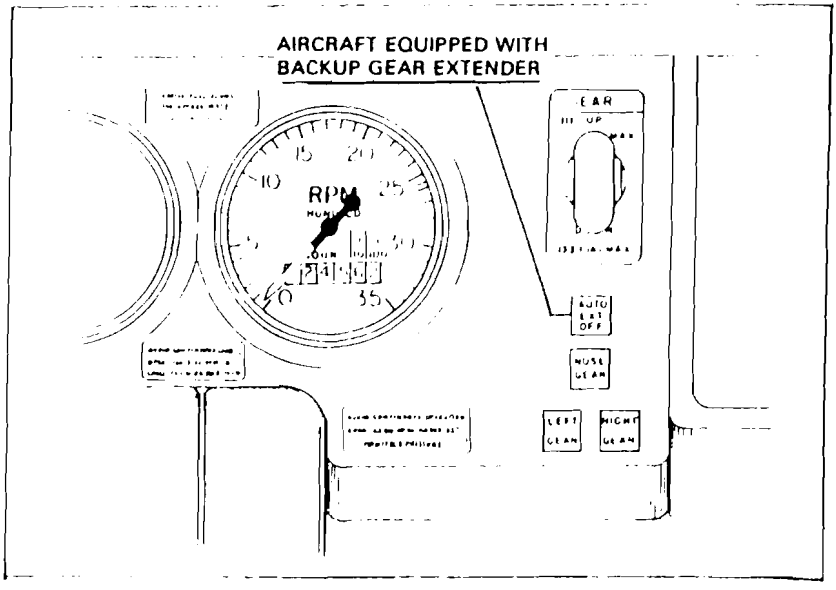
The throttle lever is used to adjust the manifold pressure. It incorporates a gear up warning horn switch which is activated during the last portion of travel of the throttle lever to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked or until the power setting is increased. This is a safety feature to warn of an inadvertent gear up landing.

The propeller control lever is used to adjust the propeller speed from high RPM to low RPM.

The mixture control lever is used to adjust the air to fuel ratio. The engine is shut down by the placing of the mixture control lever in the full lean position. In addition, the mixture control has a lock to prevent activation of the mixture control instead of the pitch control. For information on the leaning procedure, see the Avco-Lycoming Operator's Manual.

The friction adjustment lever on the right side of the control quadrant may be adjusted to increase or decrease the friction holding the throttle, propeller, and mixture controls in a selected position.

The alternate air control is located to the right of the control quadrant. When the alternate air lever is in the up, or closed, position the engine is operating on filtered air; when the lever is in the down, or open, position the engine is operating on unfiltered, heated air.



LANDING GEAR SELECTOR
Figure 7-3

7.11 LANDING GEAR

The Arrow IV is equipped with a retractable tricycle landing gear, which is hydraulically actuated by an electrically powered reversible pump. The pump is controlled by a selector switch on the instrument panel to the left of the control quadrant (Figure 7-3). The landing gear is retracted or extended in about seven seconds.

Some aircraft also incorporate a pressure sensing device in the system which lowers the gear regardless of gear selector position, depending upon airspeed and engine power (propeller slipstream). Gear extension is designed to occur, even if the selector is in the up position, at airspeeds below approximately 95 KIAS with power off. The extension speeds will vary from approximately 75 KTS to approximately 95 KIAS depending on power settings and altitude. The device also prevents the gear from retracting at airspeeds below approximately 75 KTS with full power, though the selector switch may be in the up position. This speed increases with reduced power and/or increased altitude. Manual override of the device is provided by

an emergency gear lever located between the front seats to the left of the flap handle (refer to Figure 7-9). The sensing device operation is controlled by differential air pressure across a flexible diaphragm which is mechanically linked to a hydraulic valve and an electrical switch which actuates the pump motor. A high pressure and static air source for actuating the diaphragm is provided in a mast mounted on the left side of the fuselage above the wing. Any obstruction of the holes in this mast will cause the gear to extend. An optional heated mast is available to alleviate obstruction in icing conditions. The optional heated mast is turned on whenever the PITOT HEAT is turned on.

WARNING

Avoid ejecting objects out of the pilot storm window which could possibly enter or obstruct the holes in the mast.

The emergency gear lever, when placed in the raised position, can be used to override the system, and gear position is then controlled by the selector switch regardless of airspeed/power combinations. The emergency gear lever is provided with a locking device which may be used to lock the override lever in the up position. The lock is located on the left side panel of the console below the level of the manual override lever. To lock the override lever in the up position, raise the override lever to the full up position and push the pin in. A yellow warning light located below the gear selector switch (Figure 7-3) flashes to warn the pilot that the automatic gear lowering system is disabled. The lock is spring-loaded to the off position to aid disengagement. To disengage the lock raise the override lever and release. The lever will return to its normal position and the yellow flashing light will extinguish. The lever must also be locked in the raised (up) position when gear-up stalls are practiced.

The emergency gear lever, when used for emergency extension of the gear, manually releases hydraulic pressure to permit the gear to free-fall with spring assistance on the nose gear. The lever must be held in the downward position for emergency extension.

Gear down and locked positions are indicated by three green lights located below the selector, and a red "Warning Gear Unsafe" light is located at the top of the panel. An all lights out condition indicates the gear is up. The landing gear should not be retracted above a speed of 109 KIAS and should not be extended above a speed of 130 KIAS.

The main landing gear uses 6.00 x 6 wheels. The main gear incorporate brake drums and Cleveland single disc hydraulic brake assemblies. The nose wheel carries a 5.00 x 5 four ply tire and the main gear use 6.00 x 6 six ply tires. All three tires are tube type.

A micro-switch in the throttle quadrant activates a warning horn and red "Warning Gear Unsafe" light under the following conditions:

(a) Gear up and power reduced below approximately 14 inches of manifold pressure.

(b) On aircraft equipped with the backup gear extender, if the system has extended the landing gear and the gear selector is up, with the power reduced below approximately 14 inches of manifold pressure.

(c) Gear selector switch "UP" while on the ground and throttle in retarded position

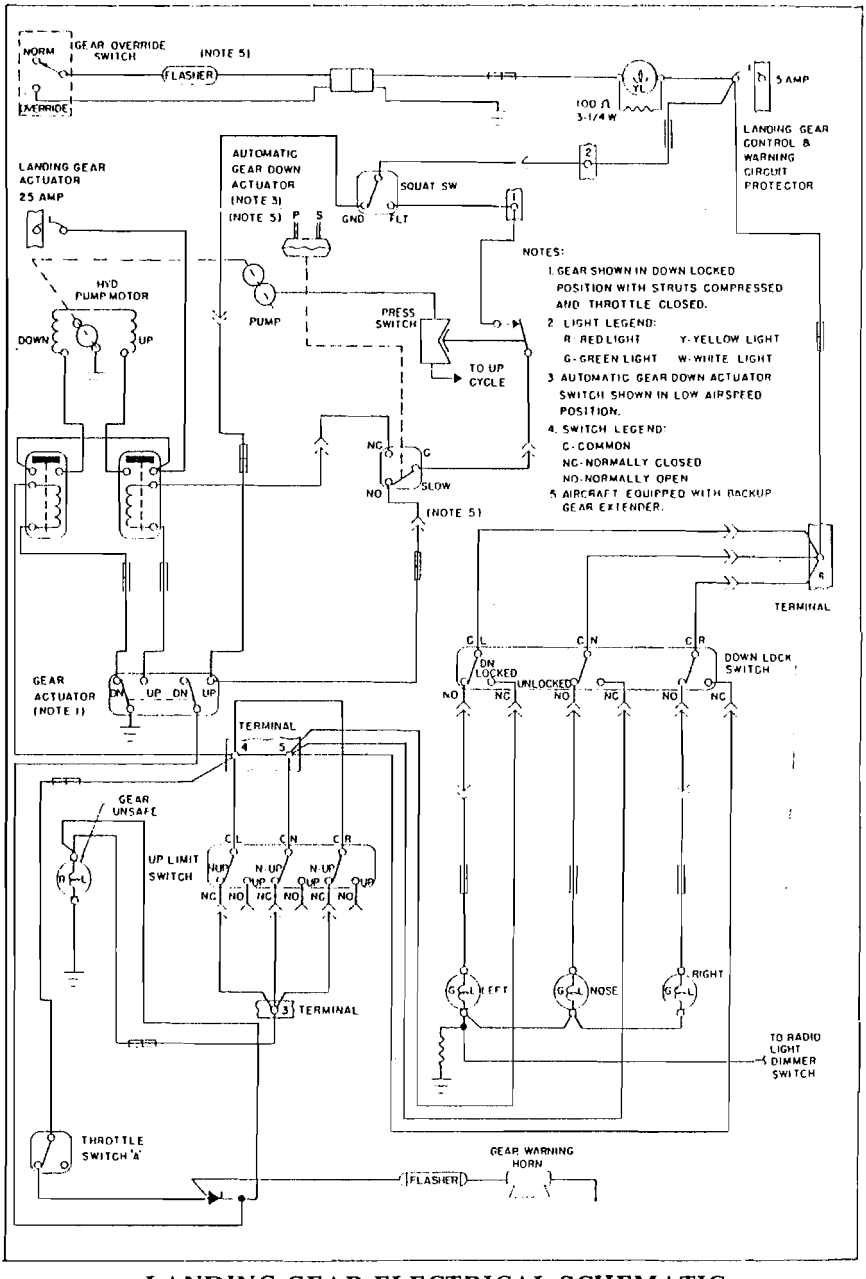
On aircraft which are NOT equipped with the backup gear extender an additional switch is installed which activates the warning horn and light whenever the flaps are extended beyond the approach position (10°) and the landing gear are not down and locked.

The gear warning horn emits a high pitch beeping sound approximately 90 times per minute in contrast to the stall warning horn which emits a continuous sound.

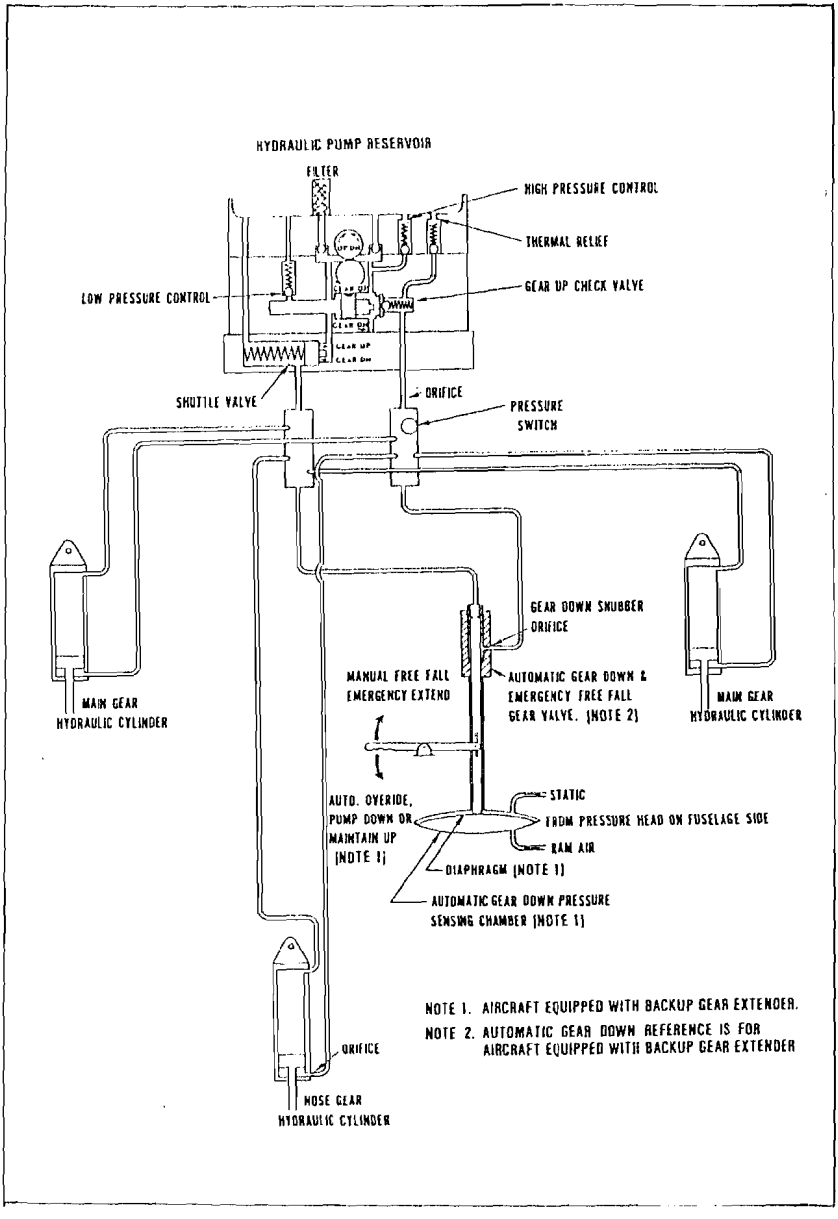
The nose gear is steerable through a 30 degree arc each side of center through the use of the rudder pedals. As the nose wheel retracts, the steering linkage disengages to reduce rudder pedal loads in flight. The nose wheel is equipped with a hydraulic shimmy dampener to reduce nose wheel shimmy. A bungee assembly is also included to reduce ground steering effort and to dampen shocks and bumps during taxiing.

The oleo struts are of the air-oil type, with normal extension being 2.75 + .25 inches for the nose gear and 2.5 + .25 inches for the main gear under normal static load (empty weight of airplane plus full fuel and oil).

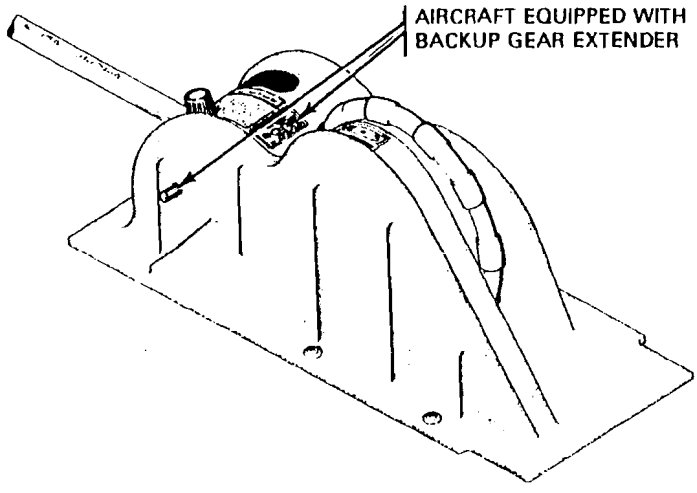
The standard brake system includes toe brakes on the left and right set of rudder pedals and a hand brake located below and near the center of the instrument panel. The toe brakes and the hand brake have individual brake cylinders, but all cylinders use a common reservoir. The parking brake is incorporated in the lever brake and is operated by pulling back on the lever and depressing the knob attached to the top of the handle. To release the parking brake, pull back on the brake lever; then allow the handle to swing forward.



LANDING GEAR ELECTRICAL SCHEMATIC
Figure 7-5



LANDING GEAR HYDRAULIC SCHEMATIC
Figure 7-7



FLIGHT CONTROL CONSOLE
Figure 7-9

7.13 FLIGHT CONTROLS

Dual flight controls are provided as standard equipment. A cable system provides actuation of the control surfaces when the flight controls are moved in their respective directions.

The horizontal surface (stabilator) is mounted atop the fin in a "T" configuration and features a trim tab/servo mounted on the trailing edge. This tab serves the dual function of providing trim control and pitch control forces. The trim function is controlled by a trim control wheel located on the control console between the two front seats (Figure 7-9). Rotating the wheel forward gives nose down trim and rotation aft gives nose up trim.

The rudder is conventional in design and incorporates a rudder trim. The trim mechanism is a spring-loaded recentering device. The trim control is located on the right side of the pedestal below the throttle quadrant. Turning the trim control clockwise gives nose right trim and counterclockwise rotation gives nose left trim.

Manually controlled flaps are provided. They are extended by a control cable and are spring-loaded to the retracted (up) position. The control is located between the two front seats on the control console. To extend the flaps pull the handle up to the desired flap setting of 10, 25 or 40 degrees. To retract, depress the button on the end of the handle and lower the control.

When extending or retracting flaps, there is a pitch change in the aircraft. This pitch change can be corrected either by stabilator trim or increased control wheel force. When the flaps are in the retracted position the right flap, provided with a over-center lock mechanism, acts as a step.

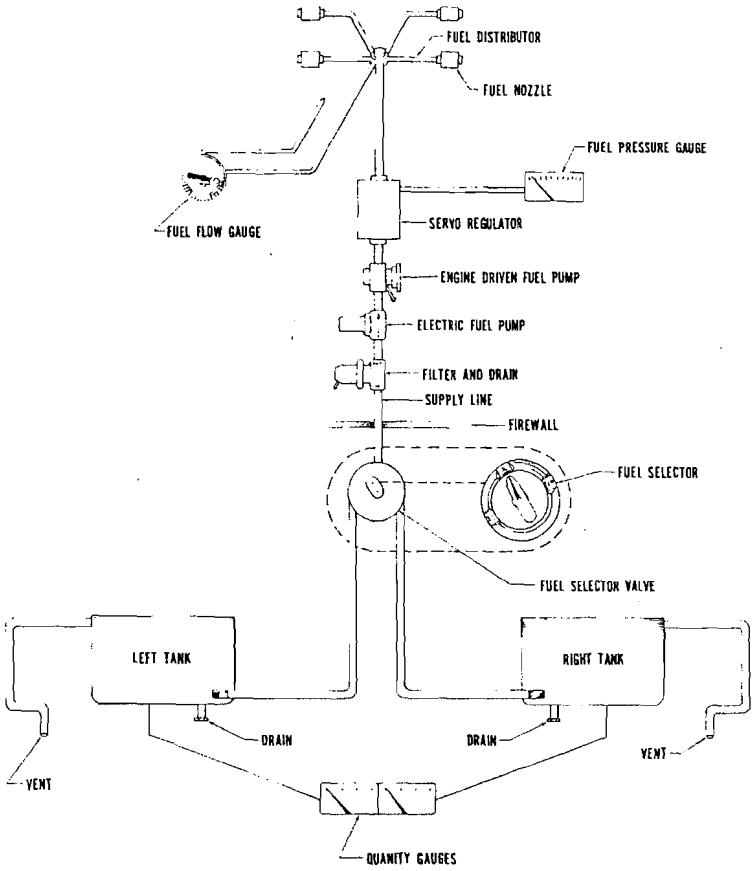
NOTE

The right flap will support a load only in the fully retracted (up) position. When loading and unloading passengers make sure the flaps are in the retracted (up) position.

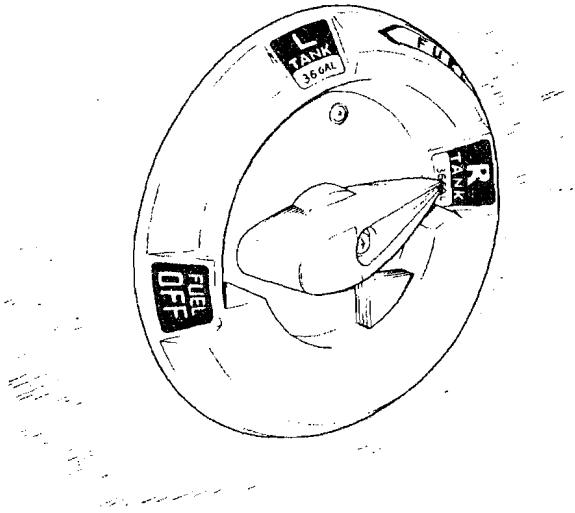
7.15 FUEL SYSTEM

The fuel system was designed with simplicity in mind. It incorporates two fuel tanks, one in each wing containing 38.5 U.S. Gallons, giving a total capacity of 77 gallons, of which 72 gallons are usable. Each tank is equipped with a filler neck indicator tab to aid in determining fuel remaining when the tanks are not full. Usable capacity to the bottom of the indicator tab is 25 gallons. The minimum fuel grade is 100 (green). The tanks are attached to the leading edge of the wing with screws and are an integral part of the wing structure. This allows removal for service. The tanks are vented individually by a vent tube which protrudes below the bottom of the wing at the rear inboard corner of each tank. The vents should be checked periodically to ascertain that the vent is not obstructed and will allow passage of air.

Each fuel tank has an individual quick drain located at the bottom inboard rear corner. The fuel strainer also incorporates a quick drain, which is located on the left lower portion of the fire wall. The quick drain protrudes thru the cowling to allow easy draining of the fuel strainer. To avoid the accumulation of water and sediment, the fuel sumps and strainer should be drained daily prior to first flight and after refueling.



FUEL SYSTEM SCHEMATIC
Figure 7-11



FUEL SELECTOR
Figure 7-13

CAUTION

When draining fuel, care should be taken to ensure that no fire hazard exists before starting the engine.

A fuel tank selector allows the pilot to control the flow of fuel of the engine, and is located on the left side wall below the instrument panel. It has three positions: OFF, LEFT TANK and RIGHT TANK. The arrow on the handle of the selector points to the tank which is supplying fuel to the engine. The valve also incorporates a safety latch which prevents inadvertently selecting the "OFF" position.

Normally fuel is supplied to the engine through an engine-driven fuel pump. An electric fuel pump serves as a back-up feature. The electric fuel pump is controlled by a rocker switch on the switch panel above the throttle quadrant. The electric fuel pump should be ON when switching fuel tanks and during takeoffs and landings.

Fuel quantity and pressure are indicated on gauges on the instrument panel. There is a separate fuel quantity gauge for each tank.

7.17 ELECTRICAL SYSTEM

All switches are grouped in a switch panel above the power quadrant. On the lower right side of the instrument panel is the circuit panel, with each breaker clearly marked to show what circuit it protects. Also, circuit provisions are made to handle the addition of communications and navigational equipment.

Standard electrical accessories include alternator, starter, electric fuel pump, stall warning indicator, ammeter, and annunciator panel.

The annunciator panel includes alternator and low oil pressure indicator lights. When the optional gyro system is installed, the annunciator panel also includes a low vacuum indicator light. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly, and that he should check and monitor the applicable system gauge to determine when or if any necessary action is required.

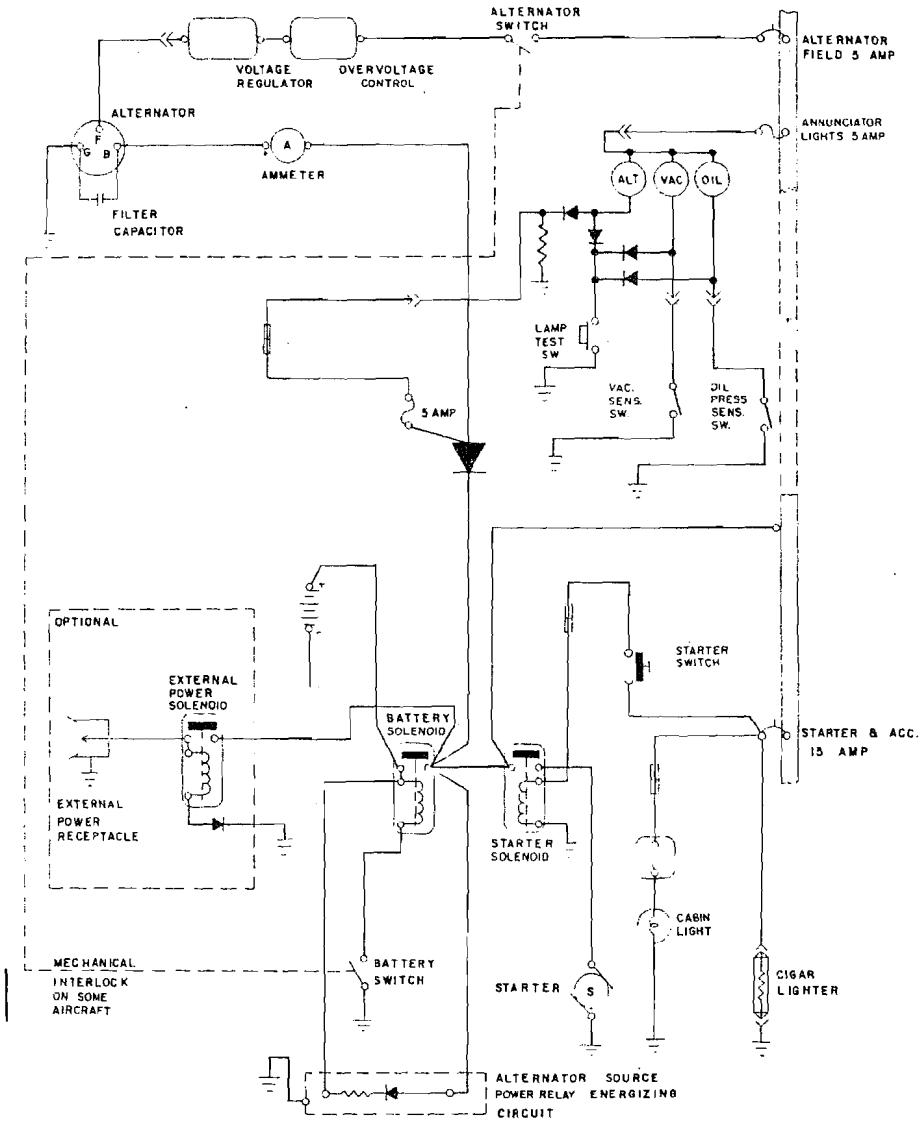
Optional electrical accessories include navigation anti-collision, landing, instrument and cabin dome lights. Navigation and radio lights are controlled by a rheostat switch on the left side of the switch panel. The instrument panel lights are controlled by a rheostat switch on the right side of the panel.

An optional light, mounted in the overhead panel, provides instrument and cockpit lighting for night flying. The light is controlled by a rheostat switch located adjacent to it. A map light window in the lens is actuated by an adjacent switch.

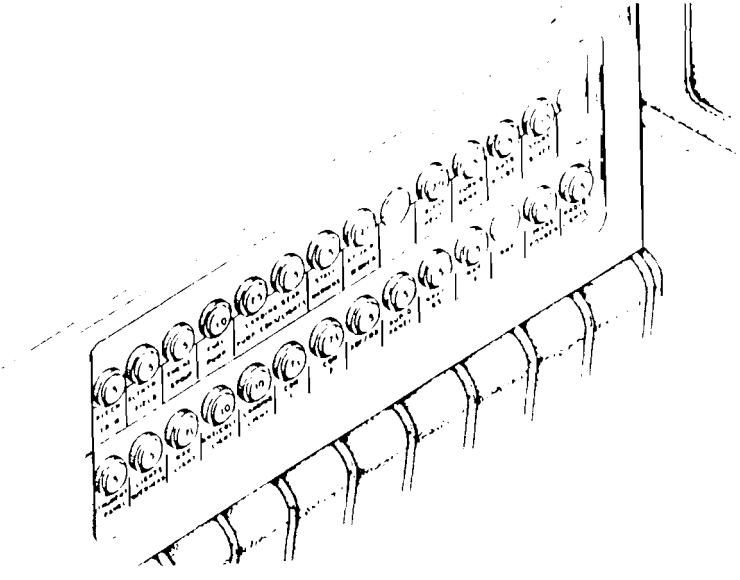
WARNING

When optional and panel lights are installed, rheostat switch must be off to obtain gear lights full intensity during daytime flying. When aircraft is operated at night and panel light rheostat switch is turned on, gear lights will automatically dim.

The anti-collision and landing lights are controlled by rocker switches on the switch panel.



ALTERNATOR AND STARTER SCHEMATIC
Figure 7-15



CIRCUIT BREAKER PANEL
Figure 7-17

WARNING

Anti-collision lights should not be operating when flying through cloud, fog or haze, since the reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

NOTE

On airplanes with interlocked BAT and ALT switches, the ALT switch is mechanically interlocked with the BAT switch. When ALT switch is turned ON, the BAT switch will also be turned ON. On airplanes with separate BAT and ALT switch operation, the switches may be positioned independently as desired.

The primary electrical power source is a 14-volt, 60-amp alternator, which is protected by a voltage regulator and an overvoltage relay. The alternator provides full electrical power output even at low engine RPM. This provides improved radio and electrical equipment operation and increases battery life by reducing battery load.

Secondary power is provided by a 12-volt, 25-ampere hour battery.

The ammeter as installed does not show battery discharge; rather it shows the electrical load placed on the system. With all the electrical equipment off, and the master switch on, the ammeter will indicate the charging rate of the battery. As each electrical unit is switched on, the ammeter will indicate the total ampere draw of all the units including the battery. For example, the average continuous load for night flying with radios on is about 30 amperes. The 30 ampere value plus 2 amperes for charging the battery will then show on the ammeter, indicating the alternator is functioning properly.

Solenoids, provided in the battery and starter circuits, are used to control high current drain functions remotely from the cabin.

7.19 VACUUM SYSTEM

The vacuum system is designed to operate the air driven gyro instruments. This includes the directional and attitude gyros when installed. The system consists of an engine vacuum pump, a vacuum regulator, a filter and the necessary plumbing.

The vacuum pump is a dry type pump which eliminates the need for an air/oil separator and its plumbing. A shear drive protects the engine from damage. If the drive shears the gyros will become inoperative.

The vacuum gauge, mounted on the right instrument panel to the right of the radios, (refer to Figure 7-21) provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period, may indicate a dirty filter, dirty screens, possibly a sticking vacuum regulator or leak in system (a low vacuum indicator light is provided in the annunciator panel). Zero pressure would indicate a sheared pump drive, defective pump, possibly a defective gauge or collapsed line. In the event of any gauge

variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system.

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 4.8 to 5.1 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Higher settings will damage the gyros and with a low setting the gyros will be unreliable. The regulator is located behind the instrument panel.

7.21 PITOT-STATIC SYSTEM

The system supplies both pitot and static pressure for the airspeed indicator, altimeter and vertical speed indicator (when installed).

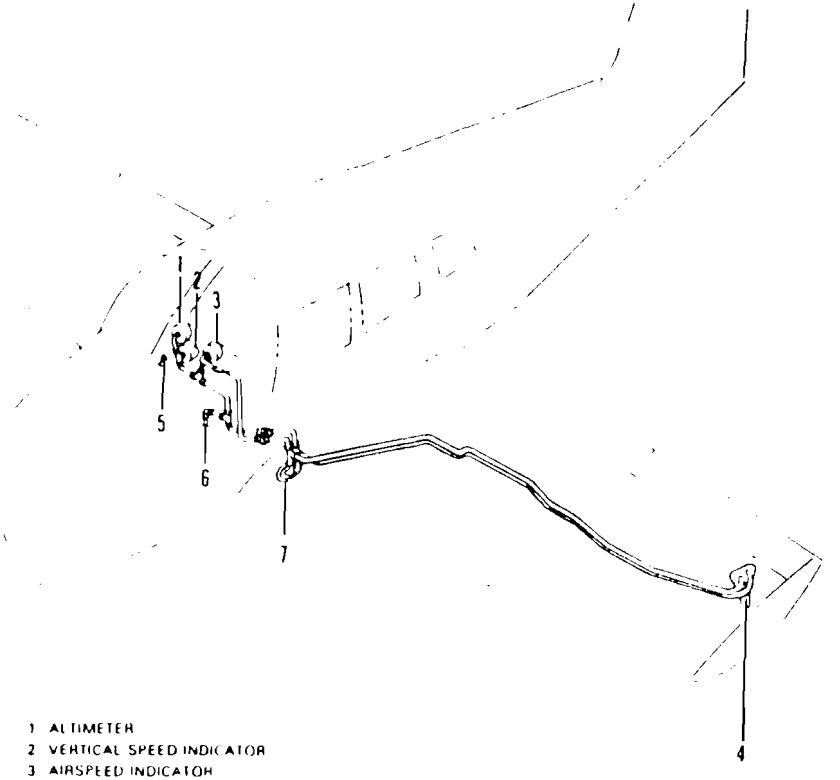
Pitot and static pressure are picked up by the pitot head on the bottom of the left wing. An optional heated pitot head, which alleviates problems with icing or heavy rain, is available. The switch for pitot heat is located on the switch panel. Push-button type pitot and static drains are located on the lower left sidewall of the cockpit.

An alternate static source is available as optional equipment. The control valve is located below the left side of the instrument panel. When the valve is set in the alternate position, the altimeter, vertical speed indicator and airspeed indicator will be using cabin air for static pressure. The storm window and cabin vents must be closed and the cabin heater and defroster must be on during alternate static source operation. The altimeter error is less than 50 feet unless otherwise placarded.

To prevent bugs and water from entering the pitot and static pressure holes when the airplane is parked, a cover should be placed over the pitot head. A partially or completely blocked pitot head will give erratic or zero readings on the instruments.

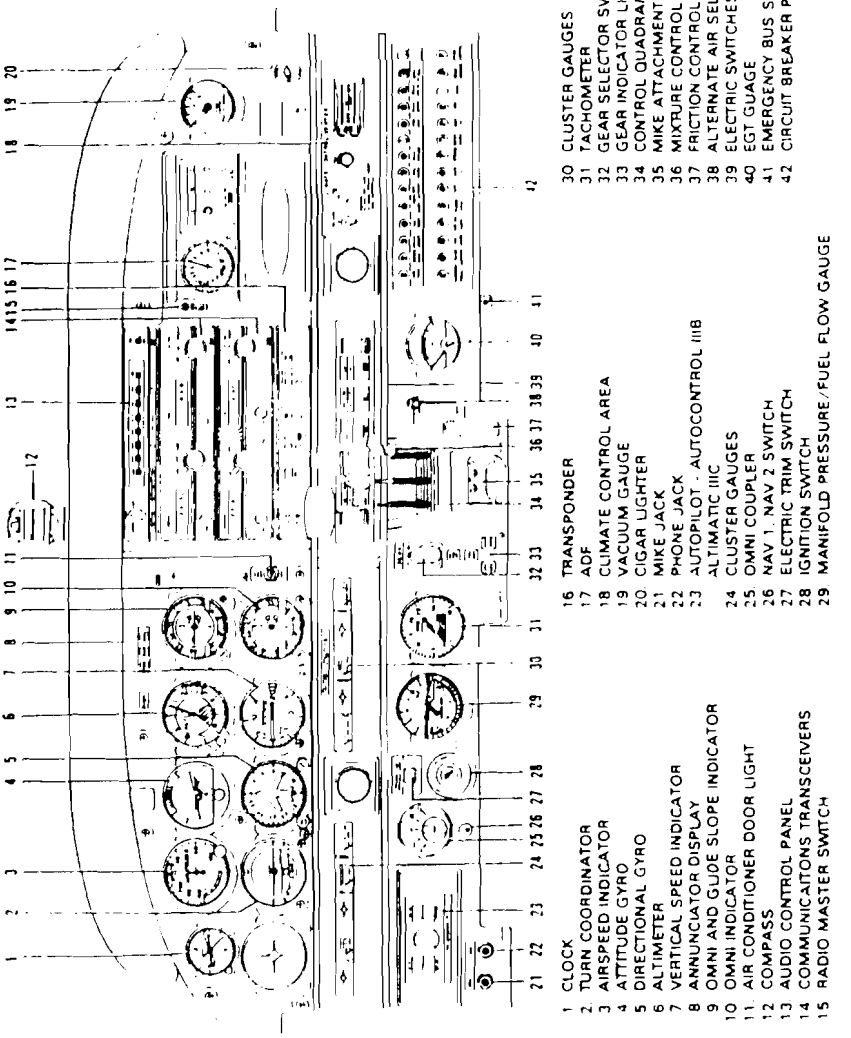
NOTE

During preflight, check to make sure any pitot cover is removed.



1 ALTIMETER
2 VERTICAL SPEED INDICATOR
3 AIRSPEED INDICATOR
4 PITOT/STATIC HEAD
5 HEATED PITOT SWITCH (OPTIONAL)
6 ALTERNATE STATIC SOURCE VALVE
7 PITOT AND STATIC DRAINS

PITOT-STATIC SYSTEM
Figure 7-19



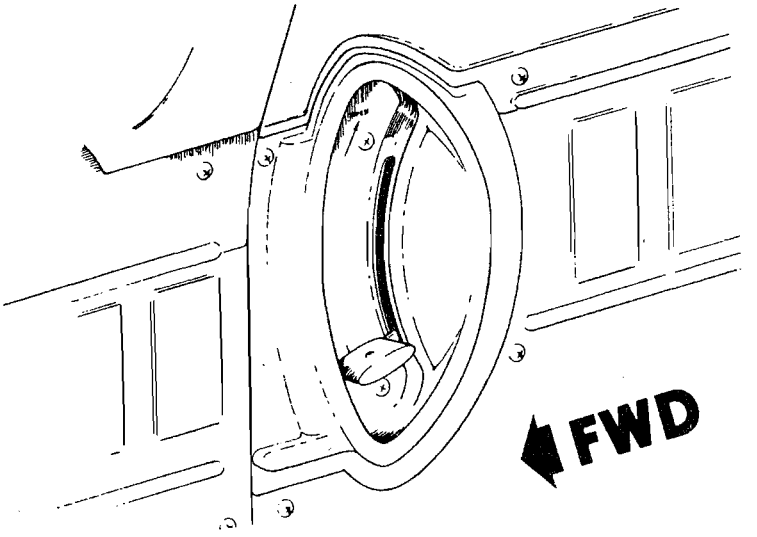
INSTRUMENT PANEL
Figure 7-21

7.23 INSTRUMENT PANEL

The instrument panel is designed to accommodate the customary advanced flight instruments and the normally required power plant instruments. The artificial horizon and directional gyro are vacuum operated and are located in the center of the left hand instrument panel. The vacuum gauge is located on the right hand instrument panel. The turn indicator, on the left side, is electrically operated.

The radios are located in the center section of the panel, and the circuit breakers are in the lower right corner of the panel. An optional radio master switch is located near the top of the instrument panel between the radio stacks. It controls the power to all radios through the aircraft master swtich. An emergency bus switch is also provided to provide auxiliary power to the avionics bus in event of a radio master switch circuit failure. The emergency bus switch is located behind the lower right shin guard left of the circuit breaker panel.

An annunciator panel is mounted in the upper instrument panel to warn the pilot of a possible malfunction in the alternator, oil pressure, or vacuum systems.



CABIN DOOR LATCH
Figure 7-23

7.25 CABIN FEATURES

All seat backs have three positions: normal, intermediate and recline. The adjustment lever is located at the base of the seat back on the outboard side of the seat. The front seats adjust fore and aft for ease of entry and occupant comfort. An armrest is located on the side panels adjacent to the front seat. The rear seats are easily removed to provide room for bulky items. Rear seat installations incorporate leg retainers with latching mechanisms which must be released before the rear seats can be removed. Releasing the retainers is accomplished by depressing the plunger behind each rear leg. Optional headrests are available.

A single strap adjustable shoulder harness located above the side window, protects each front seat occupant. Optional shoulder straps for the rear occupants are available. The shoulder strap is routed over the shoulder adjacent to the window and attached to the lap belt in the general area of the occupant's inboard hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint for the occupant. Shoulder harnesses with inertial reels are available for all four seats. A check of the

inertial reel mechanism can be made by pulling sharply on the strap and checking that the reel will lock in place under sudden stress; this locking feature prevents the strap from extending and holds the occupant in place. Under normal movement the strap will extend and retract as required. Shoulder harnesses should be routinely worn during takeoff, landing and whenever an inflight emergency situation occurs.

Additional features include pilot storm window, two sun visors, ash trays for each occupant, map pockets located on the side panels below the instrument panel, miscellaneous pockets on the rear of the front seat backs, armrests for the front occupants, cabin or baggage door locks and ignition lock.

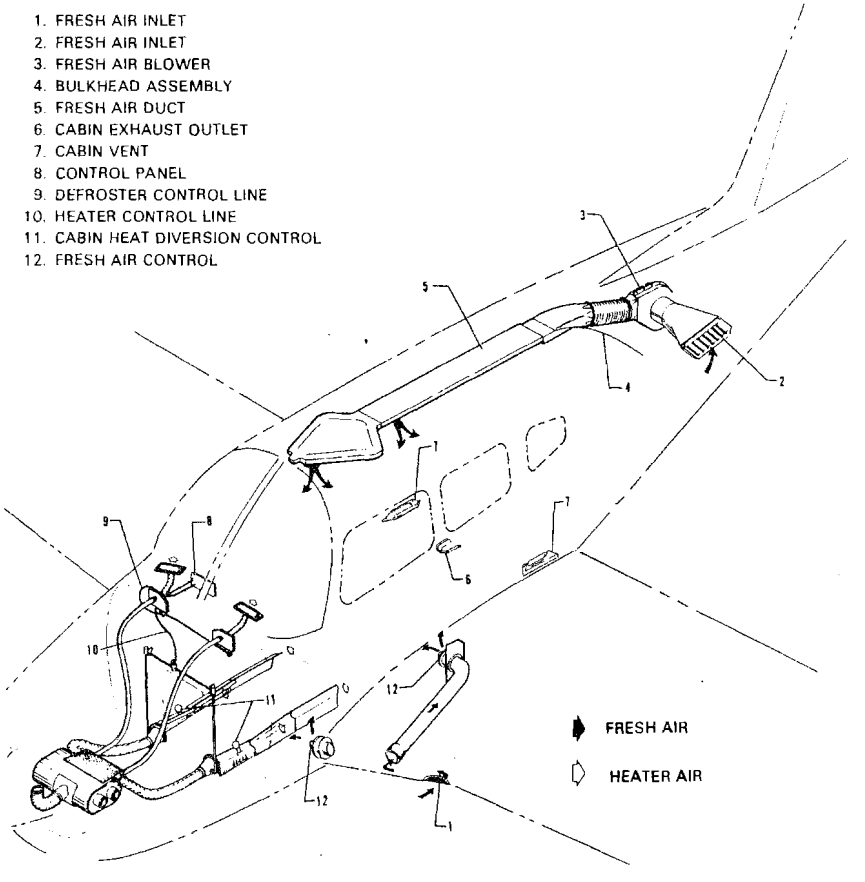
The cabin door is double latched. To close the cabin door, hold the door closed with the arm set while moving the side door latch to the "LATCHED" position. Then engage the top latch. Both latches must be secured before flight.

7.27 BAGGAGE AREA

A large baggage area, located behind the rear seats, in accessible either from the cabin or through a large outside baggage door on the right side of the aircraft. Maximum capacity is 200 lbs. Tie-down straps are provided and should be used at all times.

NOTE

It is the pilot's responsibility to be sure when the baggage is loaded that the aircraft C.G. falls within the allowable C.G. Range. (See Weight and Balance Section.)



HEATING AND VENTILATING AND DEFROSTING SYSTEM
Figure 7-25

7.29 HEATING, VENTILATING AND DEFROSTING SYSTEM

The heating system is designed to provide maximum comfort for the occupants during winter and cool weather flights. The system includes a heat shroud, heat ducts, defroster outlets, heat and defroster controls.

CAUTION

When cabin heat is operated, heat duct surface becomes hot. This could result in burns if arms or legs are placed too close to heat duct outlets or surface.

An opening in the front of the lower cowl admits air to the heater shroud and then the air is ducted to the heater shut-offs on the right and left side of the fire wall. When the shut-off's are opened the heated air then enters the heat ducts located along each side of the center console. Outlets in the heat ducts are located at each seat location. Airflow to the rear seats can be regulated by controls in the heat ducts located between the front seats. The temperature of the cabin is regulated by the heater control located on the right side of the instrument panel.

Defrosting is accomplished by heat outlets located on the right and left side of the cowl cover. Heated air is ducted directly to defroster shut-off valves at the fire wall, then to the defroster outlets. The airflow is regulated by a defroster control located below the heat control.

To aid air distribution, the cabin air is exhausted overboard by an outlet located on the bottom of the fuselage. Cabin exhaust outlets are located below and outboard of the rear seats. The above features are removed when air conditioning is installed.

Optional individual overhead fresh air outlets supply fresh air from a louvered inlet on the side of the aft fuselage. The air is then ducted to the individual outlets. For individual comfort, the amount and direction of air can be regulated to control the amount of air and direction of desired airflow. An optional blower is available which forces outside air through the overhead vents for ground use. The blower is operated by a "FAN" switch with 3 positions - "OFF," "LOW," or "HIGH."

7.31 STALL WARNING

An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild to moderate airframe buffeting and gentle pitching may also precede the stall. Stall speeds are shown on graphs in the Performance Section. The stall warning horn emits a continuous sound. The landing gear warning horn is different in that it emits a high pitch beeping sound approximately 90 times per minute. The stall warning horn is activated by a lift detector installed on the leading edge of the left wing. During preflight, the stall warning system should be checked by turning the master switch ON, lifting the detector and checking to determine if the horn is actuated.

7.33 FINISH

All exterior surfaces are primed with etching primer and finished with acrylic lacquer. To keep the finish attractive looking, economy size spray cans of touch-up paint are available from Piper Dealers. An optional polyurethane finish is available.

7.35 AIR CONDITIONING*

The air conditioning system is a recirculating air system. The major components include an evaporator, a condenser, a compressor, a blower, switches and temperature controls.

The evaporator is located behind the rear baggage compartment. This cools the air used for the air conditioning system.

The condenser is mounted on a retractable scoop located on the bottom of the fuselage and to the rear of the baggage compartment area. The scoop extends when the air conditioner is ON and retracts to a flush position when the system is OFF.

The compressor is mounted on the rear left side of the engine. It has an electric clutch which automatically engages or disengages the compressor to the belt drive system of the compressor.

Air from the baggage area is drawn through the evaporator by the blower and distributed through an overhead duct to individual outlets located adjacent to each occupant.

*Optional equipment

The switches and temperature control are located on the lower right side of the instrument panel in the climate control center panel. The temperature control regulates the temperature of the cabin. Turning the control clockwise increases cooling; counterclockwise decreases cooling.

The fan speed switch and the air conditioning ON-OFF switch are inboard of the temperature control. The fan can be operated independently of the air conditioning; however, the fan must be on for air conditioner operation. Turning either switch off will disengage the compressor clutch and retract the condenser door. Cooling air should be felt within one minute after the air conditioner is turned on.

NOTE

If the system is not operating in 5 minutes, turn the system OFF until the fault is corrected.

The fan switch allows operation of the fan with the air conditioner turned OFF to aid in cabin air circulation. "LOW" or "HIGH" can be selected to direct a flow of air through the air conditioner outlets in the overhead duct. These outlets can be adjusted or turned off individually.

The condenser door light is located to the right of the engine instrument cluster in front of the pilot. The door light illuminates when the door is open and is off when the door is closed.

A circuit breaker on the circuit breaker panel protects the air conditioning electrical system.

Whenever the throttle is in the full forward position, it actuates a micro switch which disengages the compressor and retracts the scoop. This allows maximum power and maximum rate of climb. The fan continues to operate and the air will remain cool for about one minute. When the throttle is retarded approximately 1/4 inch, the clutch will engage, the scoop will extend, and the system will again supply cool, dry air.

7.37 PIPER EXTERNAL POWER*

An optional starting installation known as Piper External Power (PEP) is accessible through a receptacle located on the right side of the fuselage just aft of the fire wall. An external battery can be connected to the socket, thus allowing the operator to crank the engine without having to gain access to the airplane's battery.

7.39 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT) meets the requirements of FAR 91.52. It operates on self-contained batteries and is located in the aft fuselage section. It is accessible through a rectangular cover on the right hand side. A number 2 Phillips screwdriver is required to remove the cover.

A battery replacement date is marked on the transmitter. To comply with FAA regulations, the battery must be replaced on or before this date. The battery must also be replaced if the transmitter has been used in an emergency situation or if the accumulated test time exceeds one hour, or if the unit has been inadvertently activated for an undetermined time period.

NOTE

If for any reason a test transmission is necessary, the test transmission should be conducted only in the first five minutes of any hour and limited to three audio sweeps. If tests must be made at any other time, the tests should be coordinated with the nearest FAA tower or flight service station.

NARCO ELT 10 OPERATION

On the ELT unit itself is a three position switch placarded "ON," "OFF" and "ARM." The ARM position sets the ELT so that it will transmit after impact and will continue to transmit until its battery is drained. The ARM position is selected when the ELT is installed in the airplane and it should remain in that position.

*Optional equipment

To use the ELT as a portable unit in an emergency, remove the cover and unlatch the unit from its mounting base. The antenna cable is disconnected by a left quarter-turn of the knurled nut and a pull. A sharp tug on the two small wires will break them loose. Deploy the self-contained antenna by pulling the plastic tab marked "PULL FULLY TO EXTEND ANTENNA." Move the switch to ON to activate the transmitter.

In the event the transmitter is activated by an impact, it can only be turned off by moving the switch on the ELT unit to OFF. Normal operation can then be restored by pressing the small clear plastic reset button located on the top of the front face of the ELT and then moving the switch to ARM.

A pilot's remote switch located on the left side panel is provided to allow the transmitter to be turned on from inside the cabin. The pilot's remote switch is placarded "ON" and "ARMED." The switch is normally in the ARMED position. Moving the switch to ON will activate the transmitter. Moving the switch back to the ARMED position will turn off the transmitter only if the impact switch has not been activated.

The ELT should be checked to make certain the unit has not been activated during the gound check. Check by selecting 121.50 MHz on an operating receiver. If there is an oscillating chirping sound, the ELT may have been activated and should be turned off immediately. This requires removal of the access cover and moving the switch to OFF, then press the reset button and return the switch to ARM. Recheck with the receiver to ascertain the transmitter is silent.

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AIRPLANE HANDLING, SERVICING AND MAINTENANCE

SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

8.1 GENERAL

This section provides general guidelines relating to the handling, servicing and maintenance of the Arrow IV.

Every owner should stay in close contact with his Piper dealer or distributor and Authorized Piper Service Center to obtain the latest information pertaining to his aircraft and to avail himself of the Piper Aircraft Service Back-up.

Piper Aircraft Corporation takes a continuing interest in having the owner get the most efficient use from his aircraft and keeping it in the best mechanical condition. Consequently, Piper Aircraft from time to time issues Service Bulletins, Service Letters and Service Spares Letters relating to the aircraft.

Service Bulletins are of special importance and should be complied with promptly. These are sent to the latest registered owners, distributors and dealers. Depending on the nature of the bulletin, material and labor allowances may apply, and will be addressed in the body of the Bulletin.

Service Letters deal with product improvements and service hints pertaining to the aircraft. They are sent to dealers, distributors and occasionally (at the factory's discretion) to latest registered owners, so they can properly service the aircraft and keep it up to date with the latest changes. Owners should give careful attention to the Service Letter information.

Service Spares Letters offer improved parts, kits and optional equipment which were not available originally and which may be of interest to the owner.

If an owner is not having his aircraft serviced by an Authorized Piper Service Center, he should periodically check with a Piper dealer or distributor to find out the latest information to keep his aircraft up to date.

Piper Aircraft Corporation has a Subscription Service for the Service Bulletins, Service Letters and Service Spares Letters. This service is offered to interested persons such as owners, pilots and mechanics at a nominal fee, and may be obtained through Piper dealers and distributors.

A service manual, parts catalog, and revisions to both, are available from your Piper dealer or distributor. Any correspondence regarding the airplane should include the airplane model and serial number to insure proper response.

8.3 AIRPLANE INSPECTION PERIODS

The Federal Aviation Administration (FAA) occasionally publishes Airworthiness Directives (ADs) that apply to specific groups of aircraft. They are mandatory changes and are to be complied with within a time limit set by the FAA. When an AD is issued, it is sent by the FAA to the latest registered owner of the affected aircraft and also to subscribers of their service. The owner should periodically check with his Piper dealer or A & P mechanic to see whether he has the latest issued AD against his aircraft.

Piper Aircraft Corporation provides for the initial and first 50-hour inspection, at no charge to the owner. The Owner Service Agreement which the owner receives upon delivery of the aircraft should be kept in the aircraft at all times. This identifies him to authorized Piper dealers and entitles the owner to receive service in accordance with the regular service agreement terms. This agreement also entitles the transient owner full warranty by any Piper dealer in the world.

One hundred hour inspections are required by law if the aircraft is used commercially. Otherwise this inspection is left to the discretion of the owner. This inspection is a complete check of the aircraft and its systems, and should be accomplished by a Piper Authorized Service Center or by a qualified aircraft and power plant mechanic who owns or works for a reputable repair shop. The inspection is listed, in detail, in the inspection report of the appropriate Service Manual.

An annual inspection is required once a year to keep the Airworthiness Certificate in effect. It is the same as a 100-hour inspection except that it must be signed by an Inspection Authorized (IA) mechanic or a General Aviation District Office (GADO) representative. This inspection is required whether the aircraft is operated commercially or for pleasure.

A Progressive Maintenance program is approved by the FAA and is available to the owner. It involves routine and detailed inspections at 50-hour intervals. The purpose of the program is to allow maximum utilization of the aircraft, to reduce maintenance inspection cost and to maintain a maximum standard of continuous airworthiness. Complete details are available from Piper dealers.

A spectographic analysis of the oil is available from several sources. This system, if used intelligently, provides a good check of the internal condition of the engine. For this system to be accurate, oil samples must be sent in at regular intervals, and induction air filters must be cleaned or changed regularly.

8.5 PREVENTIVE MAINTENANCE

The holder of a Pilot Certificate issued under FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not used in air carrier service. Although such maintenance is allowed by law, each individual should make a self-analysis as to whether he has the ability to perform the work.

All other maintenance on the airplane should be accomplished by appropriately licensed personnel.

If the above work is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

(a) The date the work was accomplished.
(b) Description of the work.
(c) Number of hours on the aircraft.
(d) The certificate number of pilot performing the work.
(e) Signature of the individual doing the work.

8.7 AIRPLANE ALTERATIONS

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.

(a) To be displayed in the aircraft at all times:
  (1) Aircraft Airworthiness Certificate Form FAA-8100-2.
  (2) Aircraft Registration Certificate Form FAA-8050-3.
  (3) Aircraft Radio Station License if transmitters are installed.

(b) To be carried in the aircraft at all times:
(1) Pilot's Operating Handbook.
(2) Weight and Balance data plus a copy of the latest Repair and Alteration Form FAA-337, if applicable.
(3) Aircraft equipment list.

Although the aircraft and engine logbooks are not required to be in the aircraft, they should be made available upon request. Logbooks should be complete and up to date. Good records will reduce maintenance cost by giving the mechanic information about what has or has not been accomplished.

8.9 GROUND HANDLING

(a) Towing

The airplane may be moved on the ground by the use of the nose wheel steering bar that is stowed in the rear baggage compartment or by power equipment that will not damage or excessively strain the nose gear steering assembly. The steering bar is engaged by inserting it into the nose wheel axle.

CAUTION

When towing with power equipment, do not turn the nose gear beyond its steering radius in either direction, as this will result in damage to the nose gear and steering mechanism.

CAUTION

Do not tow the airplane when the controls are secured.

In the event towing lines are necessary, ropes should be attached to both main gear struts as high up on the tubes as possible. Lines should be long enough to clear the nose and/or tail by not less than fifteen feet, and a qualified person should ride in the pilot's seat to maintain control by use of the brakes.

(b) Taxiing

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Engine starting and shut-down procedures as well as taxi techniques should be covered. When it is ascertained that the propeller back blast and taxi areas are clear, power should be applied to start the taxi roll, and the following checks should be performed:

(1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
(2) Taxi with the propeller set in low pitch, high RPM setting.
(3) While taxiing, make slight turns to ascertain the effectiveness of the steering.
(4) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
(5) When taxiing over uneven ground, avoid holes and ruts.
(6) Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel, or any loose material that may cause damage to the propeller blades.

(c) Parking

When parking the airplane, be sure that it is sufficiently protected from adverse weather conditions and that it presents no danger to other aircraft. When parking the airplane for any length of time or overnight, it is suggested that it be moored securely.

(1) To park the airplane, head it into the wind if possible.
(2) Set the parking brake by pulling back on the brake lever and depressing the knob on the handle. To release the parking brake, pull back on the handle until the catch disengages; then allow the handle to swing forward.

CAUTION

Care should be taken when setting brakes that are overheated or during cold weather when accumulated moisture may freeze a brake.

(3) Aileron and stabilator controls should be secured with the front seat belt and chocks used to properly block the wheels.

(d) Mooring

The airplane should be moored for immovability, security and protection. The following procedures should be used for the proper mooring of the airplane:

(1) Head the airplane into the wind if possible.
(2) Retract the flaps.
(3) Immobilize the ailerons and stabilator by looping the seat belt through the control wheel and pulling it snug.
(4) Block the wheels.
(5) Secure tie-down ropes to the wing tie-down rings and to the tail skid at approximately 45 degree angles to the ground. When using rope of non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract.

CAUTION

Use bowline knots, square knots or locked slip knots. Do not use plain slip knots.

NOTE

Additional preparations for high winds include using tie-down ropes from the landing gear forks and securing the rudder.

(6) Install a pitot head cover if available. Be sure to remove the pitot head cover before flight.
(7) Cabin and baggage doors should be locked when the airplane is unattended.

8.11 ENGINE AIR FILTER

(a) Removing Engine Air Filter

(1) Remove the upper cowl.

(2) Remove the wing nuts securing the filter box cover. Remove the filter.

(b) Cleaning Engine Air Filter

The induction air filter must be cleaned at least once every 50 hours, and more often, even daily, when operating in dusty conditions. Extra filters are inexpensive, and a spare should be kept on hand for use as a rapid replacement.

To clean the filter:

(1) Tap the filter gently to remove dirt particles, being careful not to damage the filter. DO NOT wash the filter in any liquid. DO NOT attempt to blow out dirt with compressed air.

(2) If the filter is excessively dirty or shows any damage, replace it immediately.

(3) Wipe the filter housing with a clean cloth soaked in unleaded gasoline. When the housing is clean and dry, install the filter.

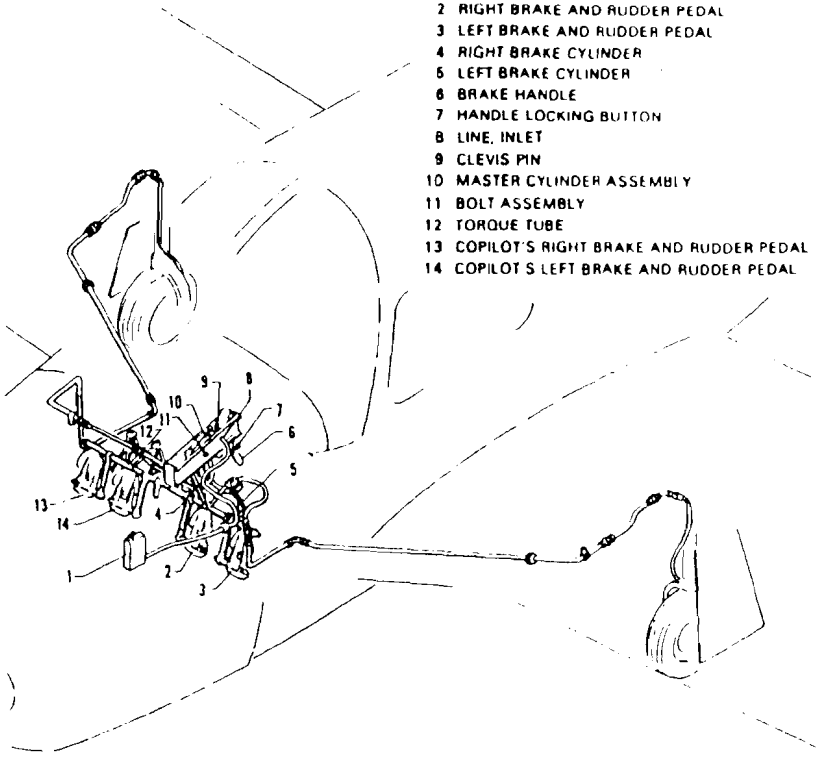
(c) Installation of Engine Air Filter

After cleaning or when replacing the filter, install the filter in the reverse order of removal.

8.13 BRAKE SERVICE

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic brake fluid. The fluid level should be checked periodically or at every 100-hour inspection and replenished when necessary. The brake reservoir is located on the left side of the fire wall in the engine compartment. If the entire system must be refilled, fill with fluid under pressure from the brake end of the system. This will eliminate air from the system.

No adjustment of the brake clearances is necessary. If after extended service brake blocks become excessively worn, they should be replaced with new segments.



BRAKE SYSTEM
Figure 8-1

8.15 LANDING GEAR SERVICE

The main landing gear uses 6.00 x 6 wheels with 6.00 x 6, six-ply rating tires and tubes. The nose wheel uses a 5.00 x 5 wheel with a 5.00 x 5 four-ply rating, type III tire and tube. (Refer to Paragraph 8.23.)

Wheels are removed by taking off the hub cap, cotter pin, axle nut, and the two bolts holding the brake segment in place. Mark tire and wheel for reinstallation; then dismount by deflating the tire, removing the three through-bolts from the wheel and separating the wheel halves.

Landing gear oleos on the Arrow IV should be serviced according to the instructions on the units. The main oleos should be extended under normal static load until 2.5 + .25 inches of oleo piston tube is exposed, and the nose gear should show 2.75 + .25 inches. To add air to the oleo struts, attach a strut pump to the valve assembly near the top of the oleo strut housing and pump the oleo to the desired position. To add oil, jack the aircraft, release the air pressure in the strut, remove the valve core and add oil through this opening with the strut extended. After the strut is full, compress it slowly and fully to allow excess air and oil to escape. With the strut still compressed reinsert the valve stem and pump up the strut as above.

In jacking the aircraft for landing gear or other service, two hydraulic jacks and a tail stand should be used. At least 250 pounds of ballast should be placed on the base of the tail stand before the airplane is jacked up. The hydraulic jacks should be placed under the jack points on the bottom of the wing and the airplane jacked up until the tail skid is at the right height to attach the tail stand. After the tail stand is attached and the ballast added, jacking may be continued until the airplane is at the height desired.

The steering arms from the rudder pedals to the nose wheel are adjusted at the rudder pedals or at the nose wheel by turning the threaded rod end bearings in or out. Adjustment is normally accomplished at the forward end of the rods and should be done in such a way that the nose wheel is in line with the fore and aft axis of the plane when the rudder pedals and rudder are centered. Alignment of the nose wheel can be checked by pushing the airplane back and forth with the rudder centered to determine that the plane follows a perfectly straight line. The turning arc of the nose wheel is 30° in either direction and is factory adjusted at stops on the bottom of the forging.

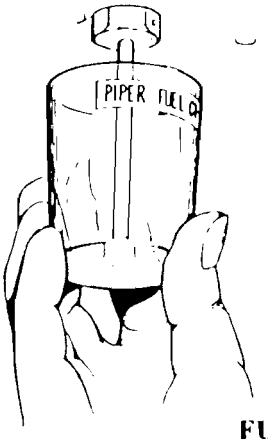
8.17 PROPELLER SERVICE

The spinner and backing plate should be cleaned and inspected for cracks frequently. Before each flight the propeller should be inspected for nicks, scratches, and corrosion. If found, they should be repaired as soon as possible by a rated mechanic, since a nick or scratch causes an area of increased stress which can lead to serious cracks or the loss of a propeller tip. The back face of the blades should be painted when necessary with flat black paint to retard glare. To prevent corrosion, the surface should be cleaned and waxed periodically.

8.19 OIL REQUIREMENTS

The oil capacity of the Lycoming IO-360 series engine is 8 quarts, and the minimum safe quantity is 2 quarts. It is recommended that the oil be changed every 50 hours and sooner under unfavorable operating conditions. The following grades are recommended for the specified temperatures:

Average Ambient Air Temperature For Starting	Single Viscosity Grade	Multi-Viscosity Grades
Above 60°F	SAE 50	SAE 40 or SAE 50
30° to 90°F	SAE 40	SAE 40
0° to 70°F	SAE 30	SAE 40 or 20W-30
Below 10°F	SAE 20	SAE 20W-30



FUEL DRAIN
Figure 8-3

8.21 FUEL SYSTEM

(a) Servicing Fuel System

At every 50-hour inspection, the fuel screen in the strainer must be cleaned. The fuel strainer is located on the forward left lower side of the fire wall. It is accessible by removing the lower cowling. After cleaning, a small amount of grease applied to the gasket will facilitate reassembly.

(b) Fuel Requirements

Aviation grade fuel with a minimum octane of 100/130 is specified for this airplane. Since the use of lower grades can cause serious engine damage in a short period of time, the engine warranty is invalidated by the use of lower octanes. Refer to latest issue of Lycoming Service Instruction 1070 for approved alternate grade fuels.

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the filler located on the forward slope of the wing. Each wing holds a maximum of 38.5 U.S. gallons. When using less than the standard 77 gallon capacity, fuel should be distributed equally between each side.

A summary of the current grades as well as the previous fuel designations is shown in the following chart:

FUEL GRADE COMPARISON CHART

Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM D910-75)			Current Military Fuel Grades (MIL-G-5572E) Amendment No. 1		
Grade	Color	Max TEL ml/U.S. gal	Grade	Color	Max TEL ml/U.S. gal	Grade	Color	Max TEL ml/U.S. gal
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/98	blue	2.0	*100LL	blue	2.0	none	none	none
100/130	green	3.0	100	green	**3.0	100/130	green	**3.0
115/145	purple	4.6	none	none	none	115/145	purple	4.6

* - Grade 100LL fuel in some overseas countries is currently colored green and designated as 100L.
**- Commercial fuel grade 100 and grade 100/130 (both of which are colored green) having TEL content of up to 4 ml/U.S. gallon are approved for use in all engines certificated for use with grade 100/130 fuel.

The operation of the aircraft is approved with an anti-icing additive in the fuel. When an anti-icing additive is used it must meet the specification MIL-I-27686, must be uniformly blended with the fuel while refueling, must not exceed .15% by volume of the refueled quantity, and to ensure its effectiveness should be blended at not less than .10% by volume. One and one half liquid ozs. per ten gallon of fuel would fall within this range. A blender supplied by the additive manufacturer should be used. Except for the information contained in this section, the manufacturer's mixing or blending instructions should be carefully followed.

CAUTIONS

Assure that the additive is directed into the flowing fuel stream. The additive flow should start after and stop before the fuel flow. Do not permit the concentrated additive to come in contact with the aircraft painted surfaces or the interior surfaces of the fuel tanks.

Some fuels have anti-icing additives pre-blended in the fuel at the refinery, so no further blending should be performed.

Fuel additive can not be used as a substitute for preflight draining of the fuel system drains.

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the filler located on the forward slope of the wing. Each wing holds a maximum of 38.5 U.S. gallons. There is approximately 25 gallons in the fuel tank when fuel level is even with the bottom of the filler neck indicator. When using less than the standard 77 gallon capacity, fuel should be distributed equally between each side.

(d) Draining Fuel Strainer, Sumps and Lines

The fuel strainer, located on the lower left side of the fire wall, is provided with a quick drain which should be drained before the first flight of the day or after refueling, to check for fuel contamination. If contamination is found, fuel should be drained until the contamination stops. If contamination persists after draining fuel for a minute, contact a mechanic to check the fuel system.

Each fuel tank is provided with a fuel quick drain to check for contamination. Each tank should be checked for contamination in accordance with the above procedure.

(c) Draining Fuel System

The bulk of the fuel may be drained from the fuel cells by the use of a siphon hose placed in the cell or tank through the filler neck. The remainder of the fuel may be drained by opening all the drain valves.

CAUTION

When draining fuel, be sure that no fire hazard exists before starting the engine.

8.23 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressure of 27 psi for the nose tire and 30 psi for the main tires. All wheels and tires are balanced before original installation, and the relationship of tire, tube, and wheel should be maintained upon reinstallation. In the installation of new components, it may be necessary to rebalance the wheels with the tires mounted. Unbalanced wheels can cause extreme vibration in the landing gear. When checking tire pressure, examine the tires for wear, cuts, bruises, and slippage.

8.25 BATTERY SERVICE

Access to the 12-volt battery is gained by removing the upper cowl. It is mounted to the forward right side of the face of the fire wall. The battery container has a plastic drain tube which is normally closed off with a cap. The cap should be opened periodically to remove battery acid which may have collected in the tube.

The battery fluid level must not be brought above the baffle plates. It should be checked every 30 days to determine that the fluid level is proper and the connections are tight and free of corrosion. Do not fill the battery with acid - use water only.

If the battery is not properly charged, recharge it starting with a rate of four amperes and finishing with a rate of two amperes. The battery should be removed from the airplane for charging, and quick charges are not recommended.

The external power receptacle, if installed, is located on the right side of the fuselage just aft of the fire wall.

Refer to the Arrow IV Service Manual for battery servicing procedure.

8.27 CLEANING

(a) Cleaning Engine Compartment

Before cleaning the engine compartment, place a strip of tape on the magneto vents to prevent any solvent from entering these units.

(1) Place a large pan under the engine to catch waste.

(2) With the engine cowling removed, spray or brush the engine with solvent or a mixture of solvent and degreaser. In order to remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.

CAUTION

Do not spray solvent into the alternator, vacuum pump, starter, or air intakes.

(3) Allow the solvent to remain on the engine from five to ten minutes. Then rinse the engine clean with additional solvent and allow it to dry.

CAUTION

Do not operate the engine until excess solvent has evaporated or otherwise been removed.

(4) Remove the protective tape from the magnetos.
(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart

(b) Cleaning Landing Gear

Before cleaning the landing gear, place a plastic cover or similar material over the wheel and brake assembly.

(1) Place a pan under the gear to catch waste.
(2) Spray or brush the gear area with solvent or a mixture of solvent and degreaser, as desired. Where heavy grease and dirt deposits have collected, it may be necessary to brush areas that were sprayed, in order to clean them.
(3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow to dry.
(4) Remove the cover from the wheel and remove the catch pan.
(5) Lubricate the gear in accordance with the Lubrication Chart.
(6) Caution: Do not brush the micro switches.

(c) Cleaning Exterior Surfaces

The airplane should be washed with a mild soap and water. Harsh abrasives or alkaline soaps or detergents could make scratches on painted or plastic surfaces or could cause corrosion of metal. Cover areas where cleaning solution could cause damage. To wash the airplane, use the following procedure:

(1) Flush away loose dirt with water.
(2) Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush.
(3) To remove exhaust stains, allow the solution to remain on the surface longer.

(4) To remove stubborn oil and grease, use a cloth dampened with naphtha.
(5) Rinse all surfaces thoroughly.
(6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

(d) Cleaning Windshield and Windows

(1) Remove dirt, mud and other loose particles from exterior surfaces with clean water.
(2) Wash with mild soap and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.
(3) Remove oil and grease with a cloth moistened with kerosene.

CAUTION

Do not use gasoline, alcohol, benzene, carbon tetrachloride, thinner, acetone, or window cleaning sprays.

(4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.
(5) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax.

(e) Cleaning Headliner, Side Panels and Seats

(1) Clean headliner, side panels, and seats with a stiff bristle brush, and vacuum where necessary.
(2) Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Carefully follow the manufacturer's instructions. Avoid soaking or harsh rubbing.

CAUTION

Solvent cleaners require adequate ventilation.

(3) Leather should be cleaned with saddle soap or a mild hand soap and water.

(f) Cleaning Carpets

To clean carpets, first remove loose dirt with a whisk broom or vacuum. For soiled spots and stubborn stains use a noninflammable dry cleaning fluid. Floor carpets may be cleaned like any household carpet.

8.29 WINTERIZATION

For winter operation a winterization kit is installed on the inlet opening of the oil cooler outboard chamber of the plenum chamber. This kit should be installed whenever the ambient temperature is 50° F or less. When the kit is not being used it can be stowed on the bracket provided for this purpose on the top side of the oil cooler plenum chamber.

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SUPPLEMENTS

SECTION 9

SUPPLEMENTS

9.1 GENERAL

This section provides information in the form of Supplements which are necessary for efficient operation of the airplane when equipped with one or more of the various optional systems and equipment not provided with the standard airplane.

All of the Supplements provided by this section are "FAA Approved" and consecutively numbered as a permanent part of this Handbook. The information contained in each Supplement applies only when the related equipment is installed in the airplane.

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SUPPLEMENT 1

AIR CONDITIONING INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional air conditioning system is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional air conditioning system is installed.

SECTION 2 - LIMITATIONS

(a) To insure maximum climb performance the air conditioner must be turned "OFF" manually prior to takeoff to disengage the compressor and retract the condenser door. Also the air conditioner must be turned "OFF" manually before the landing approach in preparation for a possible go-around.

(b) Placards
In full view of the pilot, in the area of the air conditioner controls when the air conditioner is installed:

"WARNING - AIR CONDITIONER MUST
BE OFF TO INSURE NORMAL TAKEOFF
CLIMB PERFORMANCE."

In full view of the pilot, to the right of the engine gauges (condenser door light):

"AIR COND DOOR
OPEN"

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

Prior to takeoff, the air conditioner should be checked for proper operation as follows:

(a) Check aircraft master switch "ON".
(b) Turn the air conditioner control switch to "ON" and the fan switch to one of the operating positions - the "AIR COND DOOR OPEN" warning light will turn on, thereby indicating proper air conditioner condenser door actuation.
(c) Turn the air conditioner control switch to "OFF" - the "AIR COND DOOR OPEN" warning light will go out, thereby indicating the air conditioner condenser door is in the up position.
(d) If the "AIR COND DOOR OPEN" light does not respond as specified above, an air conditioner system or indicator bulb malfunction is indicated and further investigation should be conducted prior to flight.

The above operational check may be performed during flight if an in flight failure is suspected.

The condenser door light is located to the right of the engine instrument cluster in front of the pilot. The door light illuminates when the door is open and is off when the door is closed.

SECTION 5 - PERFORMANCE

Operation of the air conditioner will cause slight decreases in cruise speed and range. Power from the engine is required to run the compressor, and the condenser door, when extended, causes a slight increase in drag. When the air conditioner is turned off there is normally no measurable difference in climb, cruise or range performance of the airplane.

NOTE

To insure maximum climb performance the air conditioner must be turned off manually before takeoff to disengage the compressor and retract the condenser door. Also the air conditioner must be turned off manually before the landing approach in preparation for a possible go-around.

Although the cruise speed and range are only slightly affected by the air conditioner operation, these changes should be considered in preflight planning. To be conservative, the following figures assume that the compressor is operating continuously while the airplane is airborne. This will be the case only in extremely hot weather.

(a) The decrease in true airspeed is approximately 6 KTS at all power settings.

(b) The decrease in range may be as much as 40 nautical miles for the 72 gallon capacity.

The climb performance is not compromised measurably with the air conditioner operating since the compressor is declutched and the condenser door is retracted, both automatically, when a full throttle position is selected. When the full throttle position is not used or in the event of a malfunction which would cause the compressor to operate and the condenser door to be extended, a decrease in rate of climb of as much as 100 fpm can be expected at all altitudes. Should a malfunction occur which prevents condenser door retraction when the compressor is turned off, a decrease in rate of climb of as much as 50 fpm can be expected.

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SUPPLEMENT 2

PIPER ELECTRIC PITCH TRIM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Piper Electric Pitch Trim is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement had been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Piper Electric Pitch Trim is installed.

SECTION 2 - LIMITATIONS

No changes of the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

The following information applies in case of electric trim malfunction:

(a) In case of malfunction, disengage electric pitch trim by activating pitch trim switch on instrument panel to OFF position.

(b) In case of a malfunction, the electric pitch trim circuit breaker may be manually disengaged (pulled out).

(c) In an emergency, electric pitch trim may be overpowered using manual pitch trim, and or control wheel pressure.

(d) In cruise configuration, a malfunction can result in a 20° pitch change and 600 ft. altitude variation.

(e) In approach configuration, a malfunction can result in a 11° pitch change and 200 ft. altitude loss.

SECTION 4 - NORMAL PROCEDURES

The electric trim system may be turned ON or OFF by a switch located above the ignition switch. The pitch trim may be changed when the electric trim system is turned on either by moving the manual pitch trim control wheel or by operating the trim control switch on the pilot's control yoke. To prevent excessive speed increase in the event of an electric trim run-away malfunction, the system incorporates an automatic disconnect feature which renders the system inoperative above approximately 169 KIAS. The disconnected condition does not affect the manual trim system.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 3

AUTOFLITE II AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional AutoFlite II Autopilot is installed in accordance with STC SA3162SW-D. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional AutoFlite II Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot operation prohibited above 175 KIAS.
(b) Autopilot must be OFF for takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) In case of malfunction, depress interrupt switch on pilot's control wheel, or overpower autopilot at either control wheel.
(b) AutoFlite II master switch - OFF.
(c) In climb, cruise or descent configuration a malfunction with a 3 second delay in recovery initiation may result in a 45° bank and a 300 foot altitude loss. Maximum altitude loss measured at 175 KIAS in a descent.
(d) In approach configuration, coupled or uncoupled; a malfunction with a 1 second delay in recovery initiation may result in a 16° bank and a 80 foot altitude loss.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT INSPECTION

(a) AutoFlite II master switch - ON.
(b) Rotate turn command knob to left and right. Aircraft control wheels should rotate in corresponding directions.
(c) With AutoFlite II on, rotate aircraft control wheel to left and right. Only light forces should be required to override roll servo clutch.
(d) AutoFlite II master switch - OFF - rotate control wheel left and right to assure disengagement.

IN-FLIGHT PROCEDURE

(a) Engagement
  (1) Check turn command knob in center detent position.
  (2) AutoFlite II master switch - ON.

(b) Disengagement
  (1) AutoFlite II master switch - OFF.

(c) Heading Changes
  (1) Move trim knob on instrument for drift correction from a constant heading.
  (2) Move turn command knob for left or right banked turns. Rotation of knob to stop will yield an appropriate bank angle to obtain an approximate standard rate turn. Intermediate settings may be used for lesser turn rates.

(d) OMNI Tracker
  (1) Turn command knob - move to center detent position and push IN to engage tracker. Aircraft will track desired radial established on NAV I (or as selected, if equipped with a NAV selector switch).

NOTE

Tracker must be engaged within 10° of being "on course," i.e. VOR course needle centered and aircraft heading within 10° of VOR course.

(2) Trim knob - push IN for high sensitivity. Use high sensitivity position for localizer tracking and as desired for OMNI tracking.

(e) Maintain directional trim during all autopilot operations.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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SUPPLEMENT 4

AUTOCONTROL IIIB AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation o the airplane when the optional Piper AutoControl IIIB is installed i accordance with STC SA3161SW-D. The information contained within thi supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Piper AutoControl IIIB Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot operation prohibited above 175 KIAS.
(b) Autopilot OFF for takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) In an emergency the autopilot can be disconnected by:
  (1) Pushing the roll ON-OFF rocker switch -OFF.
  (2) Pulling the autopilot circuit breaker.
(b) The autopilot can be overpowered at either control wheel.
(c) An autopilot runaway, with a 3 second delay in the initiation of recovery, while operating in a climb, cruise or descending flight, could result in a 45° bank and a 300 foot altitude loss. Maximum altitude loss measured at 175 KIAS in a descent.
(d) An autopilot runaway, with a 1 second delay in the initiation of recovery, during an approach operation, coupled or uncoupled, could result in a 16° bank and a 80 foot altitude loss.

(e) Emergency operation with optional NSD 360A (HSI) - Slaved and/or Non-Slaved:

NSD 360A

(1) Appearance of HDG flag:
   a. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.)
   b. Check compass circuit breaker.
   c. Observe display for proper operation.

(2) To disable heading card - pull circuit breaker and use magnetic compass for directional data. (Factory installations may utilize NSD and electric trim circuit breaker.)

NOTE

If heading card is not operational, autopilot should not be used.

(3) With card disabled, VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.

(4) Slaving Failure - (i.e. failure to self-correct for gyro drift):
   a. Check that gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
   b. Check for HDG flag.
   c. Check compass circuit breaker.
   d. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

   e. Select slaving amplifier No. 2, if equipped. If not equipped, proceed with item g below.
   f. Reset heading card while checking slaving meter. If proper slaving indication is not obtained,
   g. Switch to free gyro mode and periodically set card as unslaved gyro.

NOTE

In the localizer mode, the TO-FROM arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT INSPECTION

(a) AUTOPILOT

(1) Place Radio Coupler (if installed) in HDG mode and place the AP ON-OFF switch to the ON position to engage the roll section. Rotate roll command knob left and right and observe that control wheel describes a corresponding left and right turn, then center knob.

(2) Set proper D.G. heading on D.G. and turn HDG bug to aircraft heading. Engage HDG mode rocker switch and rotate HDG bug right and left. Aircraft control wheel should turn same direction as bug. Grasp control wheel and manually override servo, both directions.

(b) RADIO COUPLER - (OPTIONAL)

(1) Tune and identify VOR or VOT station. Position Radio Coupler to OMNI mode. Engage autopilot ON and HDG switches. Set HDG bug to aircraft heading and rotate O.B.S. to cause OMNI indicator needle to swing left and right slowly. Observe that control wheel rotates in direction of needle movement.

(2) Disengage AP ON-OFF switch. Reset Radio Coupler control to HDG.

IN-FLIGHT

(a) Trim airplane (ball centered).

(b) Check air pressure/vacuum to ascertain that the directional gyro and attitude gyro are receiving sufficient air.

(c) Roll Section

(1) To engage, center ROLL knob, push AP ON-OFF switch to On position. To turn, rotate control ROLL knob in desired direction (Maximum angle of bank should not exceed 30°.)

(2) For heading mode, set directional gyro with magnetic compass. Push directional gyro HDG knob in, rotate bug to aircraft heading. Push console heading rocker (HDG) switch to ON position. To select a new aircraft heading, push D.G. heading knob IN and rotate, in desired direction of turn, to the desired heading.

(d) Radio Coupling VOR-ILS with HSI Type Instrument Display - (Optional)

(1) VOR Navigation

a. Tune and identify VOR station. Select desired course with O.B.S. (HSI Course Knob).

b. Select OMNI mode on radio coupler.

c. Select HDG mode on autopilot console to engage coupler. Aircraft will turn to a 45° intercept angle to intercept the selected VOR course. Intercept angle magnitude depends on radio needle off course magnitude, 100% needle deflection will result in 45° intercept with the intercept angle diminishing as the needle off set diminishes.

d. NAV mode - NAV mode provides reduced VOR sensitivity for tracking weak, or noisy VOR signals. NAV mode should be selected after the aircraft is established on course.

(2) ILS-LOC Front Course

a. Set inbound, front, localizer course on O.B.S. (HSI Course Knob).

b. Select LOC-Normal on radio coupler to intercept and track inbound on the localizer. Select LOC-REV to intercept and track outbound to the procedure turn area.

c. Select HDG mode on autopilot console to engage coupler.

(3) ILS - Back Course

a. Set inbound, front localizer course on O.B.S. (HSI Course Knob).

b. Select LOC-REV on radio coupler to intercept and track inbound on the back localizer course. Select LOC-NORM to intercept outbound on the back course to the procedure turn area.

(c) Select HDG mode on autopilot console to engage coupler.

(e) Radio Coupling - VOR/ILS with standard directional gyro-(Optional)

Radio Coupler operation in conjunction with a standard directional gyro and VOR/LOC display differs from operation with an integrated display (HSI) only in one respect. The HDG bug is used as the radio course datum and therefore must be set to match the desired VOR course as selected on the O.B.S.

(1) For VOR Intercepts and Tracking:
Select the desired VOR course and set the HDG bug to the same heading. Select OMNI mode on the coupler and HDG mode on the autopilot console.

(2) For ILS Front Course Intercepts and Tracking:
Tune the localizer frequency and place the HDG bug on the inbound, front course heading. Select LOC-NORM mode on the coupler and HDG mode on the autopilot console.

(3) For LOC Back Course Intercepts and Tracking:
Tune the localizer frequency and place the HDG bug on the inbound course heading to the airport. Select LOC-REV mode with coupler and HDG mode on the autopilot console.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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SUPPLEMENT 5

ALTIMATIC IIIC AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional AltiMatic IIIC Autopilot is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook based on EDO-AIRE Mitchell STC SA3323SW-D and must remain in this handbook at all times when the optional AltiMatic IIIC Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Maximum speed for autopilot operation in 175 KIAS. (Autopilot Vmo)
(b) A Placard stating "Conduct trim check prior to flight - (See POH)" to be installed in clear view of the pilot.
(c) Autopilot OFF during takeoff and landing.
(d) During autopilot operation, the pilot must be in his seat with the safety belt fastened.

SECTION 3 - EMERGENCY PROCEDURES

This aircraft is equipped with a Master Disconnect/Interrupt Switch on the pilot's control wheel. When the switch button is depressed it will disconnect the autopilot. When depressed and held it will interrupt all Electric Elevator Trim Operations. Trim operations will be restored when the switch is released. If an autopilot or trim emergency is encountered, do not attempt to determine which system is at fault. Immediately depress and hold the Master Disconnect/Interrupt button. Turn off autopilot and trim master switch and retrim aircraft, then release the interrupt switch.

NOTE

During examination of this supplement, the pilot is advised to locate and identify the autopilot controls, the trim master switch and circuit breaker for both systems.

(a) In the event of an autopilot malfunction the autopilot can be:
(1) Overpowered at either control wheel.

CAUTION

Do not overpower autopilot pitch axis for periods longer than 3 seconds because the autotrim system will operate in a direction to oppose the pilot and will, thereby, cause an increase in the pitch overpower forces.

(2) Disconnected by depressing the Master Disconnect/Interrupt Switch.
(3) Disconnected by depressing the Trim Switch "AP OFF" bar.
(4) Disconnected by pushing the roll rocker switch "OFF".

(b) In the event of a trim malfunction:
(1) Depress and hold the Master Trim Interrupt Switch.
(2) Trim Master Switch - "OFF." Retrim aircraft as necessary using manual trim system.
(3) Release Master Interrupt Switch - be alert for possible trim action.
(4) Trim Circuit Breaker - Pull. Do not operate trim until problem is corrected.
(5) If the trim system operates only in one direction, pull the circuit breaker and do not operate the trim system until corrective action is taken. Monitor autopilot operation closely when operating without trim follow-up.

(c) If a trim runaway occurs with the autopilot operating, the above procedure will disconnect the autopilot which will immediately result in higher control wheel forces. Be prepared to manually retrim, as necessary to eliminate undesirable forces.

(d) Altitude Loss During Malfunction:

(1) An autopilot malfunction during climb, cruise or descent with a 3 second delay in recovery initiation could result in as much as 55° of bank and 500 foot of altitude loss. Maximum altitude loss was recorded at 175 KIAS during descent.

(2) An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 16° of bank and 100 foot altitude loss. Maximum altitude loss measured in approach configuration and operating either coupled or uncoupled.

(e) Emergency Operation With Optional NSD 360A (HSI) - Slaved and/or Non-Slaved:

NSD 360A

(1) Appearance of HDG Flag:

a. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).

b. Check compass circuit breaker.

c. Observe display for proper operation.

(2) To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

(3) With card disabled, VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.

(4) Slaving Failure - (i.e. failure to self-correct for gyro drift):

a. Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.

b. Check for HDG Flag.

c. Check compass circuit breaker.

d. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

e. Select slaving amplifier No. 2, if equipped. If not equipped, proceed with g below.
f. Reset heading card while checking slaving meter. If proper slaving indication is not obtained,
g. Switch to free gyro and periodically set card as unslaved gyro.

NOTE

In the localizer mode the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT INSPECTION - AUTOPILOT

(a) Roll Section
  (1) Place Radio Coupler in "Heading" mode and place roll rocker switch "ON" to engage roll section. Rotate roll command knob left and right and observe that control wheel describes a corresponding left and right turn, then center knob.
  (2) Set proper D.G. Heading on D.G. and turn Heading Bug to aircraft heading. Engage "Heading" mode rocker switch and rotate heading bug right and left. Aircraft control wheel should turn same direction as bug. Grasp control wheel and manually override servo, both directions.
  (3) Disengage autopilot by depressing trim switch. Check aileron operation is free and autopilot is disconnected from controls.

(b) Pitch Section
  (1) Engage "Roll" rocker switch.
  (2) Center pitch command disc and engage "Pitch" rocker switch.
  (3) Rotate pitch command disc full UP and full DOWN and check that control wheel moves same direction. Check to see that servo can be overridden by hand at control wheel.

NOTE

Autopilot might not be able to raise elevators, on ground, without assistance from pilot.

(4) Hold control wheel and disengage autopilot by pressing Master Autopilot Disconnect/Trim Interrupt Switch button. Check Roll and Pitch controls to assure autopilot has disconnected.

TRIM SYSTEM

General

This aircraft is equipped with a Command Trim System designed to withstand any type of single malfunction, either mechanical or electrical, without uncontrolled operation resulting. The preflight check procedure is designed to uncover hidden failures that might otherwise go undetected. Proper operation of the electric trim system is predicated on conducting the following preflight check before each flight. If the trim system fails any portion of the procedure, pull the trim circuit breaker out until trim system is repaired. Substitution of any trim system component for another model is not authorized. For emergency interrupt information, refer to Section 3 of this Supplement.

Command Electric Trim Switch

The Command Electric Trim Switch on the left hand portion of the pilot's control wheel has two functions:

(1) When the top bar (AP OFF) is pressed, it disconnects the Autopilot.

(2) When the top bar is pressed AND the rocker is moved forward, nose down trim will occur, when moved aft, nose up trim will occur.

(a) Preflight: Command Trim - Before Each Flight

(1) Check trim circuit breaker - IN.

(2) Trim Master Switch - ON.

(3) AP OFF - Check normal trim operation - UP. Grasp trim wheel and check override capability. Check nose down operation. Recheck override.

(4) With trim operating - depress interrupt switch - trim should stop - release interrupt switch - trim should operate.

(5) Activate center bar only. Push rocker fore and aft only. Trim should not operate with either separate action.

(b) Autotrim - Before Each Flight

(1) AP ON - (Roll and Pitch Sections) Check automatic operation by activating autopilot pitch command UP then DN. Observe trim operation follows pitch command direction.

NOTE

In autopilot mode, there will be approximately a 3 second delay between operation of pitch command and operation of trim.

(2) Press center bar (AP OFF) - release - check autopilot disengagement.

(3) Rotate trim wheel to check manual trim operation. Reset to takeoff position prior to takeoff.

AUTOPILOT IN-FLIGHT PROCEDURE

(a) Trim airplane (ball centered).

(b) Check air pressure or vacuum to ascertain that the directional gyro and attitude gyro are receiving sufficient air.

(c) Roll Section

(1) To engage - Center ROLL knob, push ROLL rocker to "ON" position. To turn, rotate console ROLL knob in desired direction.

(2) For heading mode, set directional gyro with magnetic compass. Push directional gyro HDG knob in, rotate to select desired heading. Push console heading rocker (HDG) to "ON" position. (Maximum angle to bank will be 20° with heading lock engaged.)

(d) Pitch Section (Roll section must be engaged prior to pitch section engagement).

(1) Center pitch trim indicator with the pitch command disc.

(2) Engage pitch rocker switch. To change attitude, rotate pitch command disc in the desired direction.

(e) Altitude Hold

Upon reaching desired or cruising altitude, engage altitude hold mode rocker switch. As long as Altitude Hold mode rocker is engaged, aircraft will maintain selected altitude. For maximum passenger comfort, rate of climb or descent should be reduced to approximately 500 FPM prior to altitude hold engagement. For accurate Altitude Holding below 80 KIAS lower flaps one or two notches.

NOTE

Prior to disengaging Altitude Hold mode, rotate Pitch Command Disc to center.

(f) Radio Coupling VOR-ILS with H.S.I. type instrument display (Optional)

(1) VOR Navigation

a. Tune and identify VOR Station. Select desired course by rotating CRS knob of H.S.I.

b. Select OMNI mode on Radio Coupler.

c. Select HDG mode on autopilot console to engage coupler. Aircraft will turn to a 45° intercept angle to intercept the selected VOR course. Intercept angle magnitude depends on radio needle off - course magnitude, 100% needle deflection will result in 45° intercept angle, diminishing as the needle off-set diminishes.

d. NAV mode - NAV mode provides reduced VOR sensitivity for tracking weak, or noisy, VOR signals. NAV mode should be selected after the aircraft is established on course.

(2) ILS-LOC Front Course

a. Set inbound, front, localizer course with H.S.I. course knob.

b. Select LOC-Normal on Radio Coupler to intercept and track inbound on the localizer. Select LOC-REV to intercept and track the localizer course outbound to procedure turn area.

c. Select HDG mode on autopilot console to engage coupler.

(3) ILS - Back Course
   a. Set inbound, front, localizer course with H.S.I. course knob.
   b. Select LOC-REV, on radio coupler to intercept and track inbound on the back localizer course. Select LOC-NORM to intercept and track outbound on the back course to the procedure turn area.
   c. Engage HDG mode on autopilot console to engage coupler.

(g) Radio Coupling - VOR/ILS with standard directional gyro. (Optional)
Radio Coupler operation in conjunction with a standard directional gyro and VOR/LOC display differs from operation with an integrated display (H.S.I.) only in one respect. The HDG bug is used as the radio course datum and therefore must be set to match the desired VOR/ILS course as selected on the O.B.S.
(1) For VOR Intercepts and Tracking:
Select the desired VOR Course and set the HDG bug to the same heading. Select OMNI mode on the coupler and engage HDG mode on the autopilot console.
(2) For ILS Front Course Intercepts and Tracking:
Tune the localizer frequency and place the HDG bug on the inbound, front course heading. Select LOC-NORM mode on the coupler and engage HDG mode on the autopilot console.
(3) For LOC Back Course Intercepts and Tracking:
Tune the localizer frequency and place the HDG bug on the inbound course heading to the airport. Select LOC-REV mode on the coupler and engage HDG mode on the autopilot console.

(h) Coupled Approach Operations
(1) VOR or LOC
   a. After arrival at the VOR Station, track outbound to the procedure turn area as described in Section 4 (f) or (g) as appropriate. Slow to 90-100 KIAS and lower flaps as desired.
   b. Use HDG mode and Pitch or Altitude Hold modes as appropriate during procedure turn.

c. At the F.A.F. inbound, return to pitch mode for control of descent and lower landing gear.

d. At the M.D.A. select altitude hold mode and add power for level flight. Monitor altimeter to assure accurate altitude control is being provided by the autopilot.

e. Go-Around - For missed approach select desired pitch altitude with pitch command disc and disengage altitude hold mode. This will initiate the pitch up attitude change. Immediately add takeoff power and monitor Altimeter and rate of climb for positive climb indication. After climb is established, retract flaps and gear. Adjust attitude as necessary for desired airspeed and select HDG mode for turn from the VOR final approach course.

(2) ILS - Front Course Approach With Glide Slope Capture. (Optional)

a. Track inbound to LOM as described in Section 4(f) or (g) above and in Altitude Hold mode.

b. Inbound to LOM slow to 90 to 100 KIAS and lower flaps as desired.

c. Automatic Glide Slope capture will occur at Glide Slope intercept if the following conditions are met:

1. Coupler in LOC-Normal mode.
2. Altitude Hold mode engaged (Altitude Rocker on Console).
3. Under Glide Slope for more than 20 seconds.
4. Localizer radio frequency selected on NAV Receiver.

d. At Glide Slope Intercept immediately lower landing gear and reduce power to maintain approximately 80-90 KIAS on final approach. Glide Slope capture is indicated by lighting of the green Glide Slope engage Annunicator Lamp and by a slight pitch down of the aircraft.

e. Monitor localizer and Glide Slope raw data throughout approach. Adjust power as necessary to maintain correct final approach airspeed. All power changes should be of small magnitude and smoothly applied for best tracking performance. Do not change aircraft configuration during approach while autopilot is engaged.

f. Conduct missed approach maneuver as described in (h)(l) e. above.

NOTE

Glide Slope Coupler will not automatically decouple from Glide Slope. Decoupling may be accomplished by any of the following means:

1. Disengage Altitude Mode.
2. Switch Radio Coupler to HDG Mode.
3. Disengage Autopilot.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 6

KNS 80 NAVIGATION SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional KNS 80 Navigation System is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional KNS 80 Navigation System is installed.

SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

No changes to basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4- NORMAL PROCEDURES

(a) KNS 80 OPERATION

The KNS 80 can be operated in any of 3 basic modes: (a) VOR, (b) RNAV, or (c) ILS. To change from one mode to another, the appropriate pushbutton switch is pressed, except that the ILS mode is entered automatically whenever an ILS frequency is channeled in the USE waypoint. The display will annunciate the mode by lighting a message above the pushbutton. In addition to the standard VOR and RNAV en route (RNV ENR) modes, the KNS 80 has a constant course width or parallel VOR mode (VOR PAR) and an RNAV approach mode (RNV APR). To place the unit in either of these secondary modes the VOR pushbutton or the RNAV pushbutton, as the case may be, is pushed a second time. Repetitive pushing of the VOR button will cause the system to alternate between the VOR and VOR PAR modes, while repetitive pushing of the RNAV button causes the system to alternate between RNV ENR and RNV APR modes.

(b) CONTROLS

(1) VOR BUTTON

Momentary pushbutton.

When pushed while system is in either RNV mode causes system to go to VOR mode. Otherwise the button causes system to toggle between VOR and VOR PAR modes.

(2) RNAV BUTTON

Momentary pushbutton.

When pushed while system is in either VOR mode causes system to go to RNV ENR mode. Otherwise the button causes system to toggle between RNV ENR and RNV APR modes.

(3) HOLD BUTTON

Two position pushbutton.

When in depressed position, inhibits DME from channeling to a new station when the VOR frequency is changed. Pushing the button again releases the button and channels the DME to the station paired with the VOR station.

(4) USE BUTTON

Momentary pushbutton.

Causes active waypoint to take on same value as displayed waypoint and data display to go to FRQ mode.

(5) DSP BUTTON
Momentary pushbutton.
Causes displayed waypoint to increment by 1 and data display to go to frequency mode.

(6) DATA BUTTON
Momentary pushbutton.
Causes waypoint data display to change from FRQ to RAD to DST and back to FRQ.

(7) OFF/PULL ID CONTROL
a. Rotate counterclockwise to switch off power to the KNS 80.
b. Rotate clockwise to increase audio level.
c. Pull switch out to hear VOR Ident.

(8) DATA INPUT CONTROL
Dual concentric knobs. Center knob has "in" and "out" positions.
a. Frequency Data
Outer knob varies 1 MHz digit.
A carryover occurs from the tens to hundreds place.
Rollover occurs from 117 to 108.
Center knob varies frequency in .05 MHz steps regardless of whether the switch is in its in or out position.

b. Radial Data
Outer knob varies 10 degree digit.
A carryover occurs from units to tens to hundreds position.
A rollover to zero occurs at 360 degrees.
Center knob "in" position varies 1 degree digit.
Center knob "out" position varies 0.1 degree digit.

c. Distance Data
Outer knob varies 10 NM digit.
A carryover occurs from the tens to hundreds place.
A rollover to zero occurs at 200 NM.
Center knob "in" position varies 1 NM digit.
Center knob "out" position varies 0.1 NM digit.

(9) COURSE SELECT KNOB
Located in CDI unit.
Selects desired course through the VOR ground station or waypoint.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 7

ANS 351 AREA NAVIGATION COMPUTER

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional ANS 351 Area Navigation Computer is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional ANS 351 Area Navigation Computer is installed.

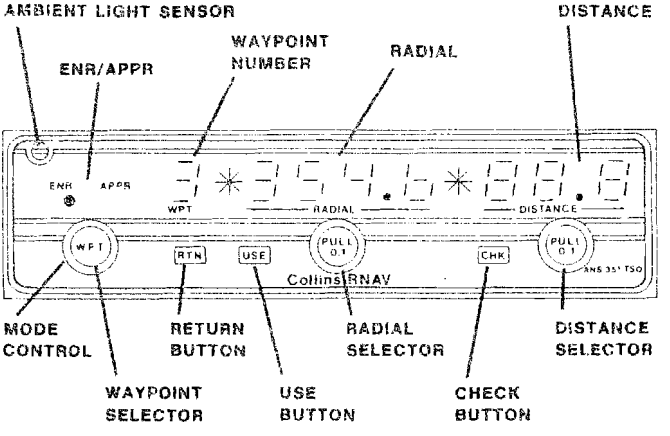
SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

No changes to basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES



ANS 351 AREA NAVIGATION COMPUTER, CONTROLS AND INDICATORS

(a) CONTROLS

CONTROL OR INDICATOR	FUNCTION
Mode Control	Selects ENR (enroute) or APPR (approach) modes of operation. In the enroute mode. CDI deviation is 1 mile/dot. 5 miles full scale. In approach. CDI deflection is 1/4 mile/dot, 1-1/4 miles full scale.
Waypoint Selector	Sequences display waypoints from 1 through 8 Winking waypoint number indicates inactive waypoints; steadily-on-waypoint number indicates active waypoint.
Return Button	Depressing RTN (return) button returns the display to the active waypoint when an inactive waypoint is currently being displayed.

CONTROL OR INDICATOR	FUNCTION
Use Button	Depressing the USE button converts the waypoint being displayed into the active waypoint.
Radial Selector	Two concentric knobs set radial information into the display. Knobs control information as follows: Large knob: Changes display in 10-degree increments. Small knob pushed in: Changes display 1-degree increments. Small knob pulled out: Changes display in 0.1- degree increments.
Distance Selector	Two concentric knobs set distance information in nautical miles into the display. Knobs control information as follows: Large knob: Changes display in 10-mile increments. Small knob pushed in: Changes display 1-mile increments. Small knob pulled out: Changes display in 0.1- mile divisions from 00.0 through 100 miles. Beyond 100 nmi, changes display in 1-mile increments.
Check Button	Depressing CHK (check) button causes DME and bearing indicators to display raw distance and bearing information. RNAV computation, CDI deviation, to/from display, and autopilot tracking of RNAV path remain unaffected. The check button is spring-loaded to prevent permanent actuation.
Ambient Light Sensor	Automatically adjusts display lighting intensity as a function of cockpit ambient light.

(b) AREA NAVIGATION WAYPOINT PROGRAMMING

(1) Presentation Of Waypoint On Ground

Waypoints are entered after engine start, since the waypoint information will probably be lost during the low-voltage condition occuring during the engine cranking. Waypoint data should always be written in flight planning form to facilitate checking later in flight. When power is first applied to the ANS 351 and the system is in the RNAV mode, waypoint number 1 will be active, (waypoint number not blinking) and waypoint bearing and distance preset to zero will appear.

a. Waypoint number 1 coordinates are set into the ANS-351 using concentric knobs under bearing and distance display fields.
b. The waypoint selection knob is then rotated to select waypoint number 2. Note that the waypoint number is blinking, indicating that the waypoint is at this point inactive. Waypoint number 2 bearing and distance definitions are then set into the ANS 351.
c. Set up the rest of the desired waypoints as described above.
d. Press the RTN (return) pushbutton to display the active waypoint.

(2) Changing Waypoints In Flight

To change a waypoint in flight, rotate the waypoint selector until the desired waypoint number and coordinates are displayed on the ANS 351.

a. Verify that the waypoint definition is correct by comparing the display with the flight plan.
b. Uncouple the autopilot if tracking RNAV deviation.
c. Select the desired reference facility frequency on the associated NAV receiver.
d. Depress the USE pushbutton and note that the waypoint identification number stops winking.
e. Select the desired course on OBS.
f. Recouple the autopilot after deviation and distance-to-waypoint indications have stabilized.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 8

CENTURY 21 AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Century 21 Autopilot is installed in accordance with STC 3360SW-D. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Century 21 Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Maximum airspeed for autopilot operation is 175 KIAS.
(b) Autopilot OFF during takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT

In the event of an autopilot malfunction, or anytime the autopilot is not performing as commanded, do not attempt to identify the problem. Regain control of the aircraft by overpowering and immediately disconnecting the autopilot by depressing the AP ON-OFF switch on the programmer OFF.

Do not operate until the system failure has been identified and corrected.

(1) Altitude Loss During Malfunction:

a. An autopilot malfunction during climb, cruise or descent with a 3 second delay in recovery initiation could result in as much as 58° of bank and 300' altitude loss. Maximum altitude loss was recorded at 175 KIAS during descent.

b. An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 15° bank and 80' altitude loss. Maximum altitude loss measured in approach configuration, gear down, and operating either coupled or uncoupled.

(b) COMPASS SYSTEM

(1) Emergency Operation With Optional NSD 360A (HSI) Slaved and/or Non-Slaved:

NSD 360A

a. Appearance of HDG Flag:
   1. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).
   2. Check compass circuit breaker.
   3. Observe display for proper operation.

b. To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

c. With card disabled VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.

d. Slaving Failure - (i.e. failure to self correct for gyro drift):
   1. Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
   2. Check for HDG Flag.
   3. Check compass circuit breaker.
   4. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

5. Select slaving amplifier No. 2, if equipped.
6. Reset heading card while checking slaving meter. If proper slaving indication is not obtained, switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE

In the localizer mode, the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

Refer to Edo-Aire Mitchell Century 21 Autopilot Operator's Manual, P/N 68S805, dated 1-79 for Autopilot Description and Normal Operating Procedures.

(a) PREFLIGHT PROCEDURES

NOTE

During system functional check the system must be provided adequate D.C. voltage (12.0 VDC min.) and instrument air (4.2 in. Hg. min.). It is recommended that the engine be operated to provide the necessary power and that the aircraft be positioned in a level attitude, during the functional check.

(b) AUTOPILOT WITH STANDARD D.G.

(1) Engage autopilot.
(2) Control wheel movement should correspond to HDG command input.
(3) Grasp control wheel and override roll servo actuator to assure override capability.
(4) With HDG bug centered select NAV or APPR mode and note control wheel movement toward VOR needle offset.
(5) Select REV mode and note control wheel movement opposite VOR needle offset.
(6) Disengage autopilot.
(7) Check aileron controls through full travel to assure complete autopilot disengagement.

(c) AUTOPILOT WITH COMPASS SYSTEM (NSD 360A)
(For other compass systems, refer to appropriate manufacturer's instructions)

(1) Check slaving switch in slave or slave 1 or 2 position, as appropriate. (Slaving systems with R.M.I. output provide only slave and free gyro positions.)
(2) Rotate card to center slaving meter - check HDG displayed with magnetic compass HDG.
(3) Perform standard VOR receiver check.
(4) Perform Steps (1) - (7) in Section 4 item (b) except in Steps (4) and (5) substitute course arrow for HDG bug when checking control wheel movement in relation to L/R needle. HDG bug is inoperative with NAV, APPR, or REV mode selected.

(d) IN-FLIGHT PROCEDURE

(1) Trim aircraft for existing flight condition (all axes).
(2) Rotate heading bug to desired heading. Engage autopilot.
(3) During maneuvering flight - control aircraft through use of the HDG bug. (HDG mode)
(4) For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in the Century 21 Operator's Manual.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 9

CENTURY 41 AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Century 41 Autopilot Model AK863 or Century 41 Flight Director Autopilot Model AK863FD is installed in accordance with STC 3359SW. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Century 41 Autopilot or the Century 41 Flight Director Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot use prohibited above 175 KIAS.
(b) Autopilot OFF during takeoff and landing.
(c) Required Placard, P/N 13A990-1 stating "Conduct trim check prior to first flight of day - (See A.F.M.)" to be installed in clear view of pilot.
(d) Autopilot coupled Go-Around maneuvers prohibited [See Section 4 item (a)].
(e) Category I operations only.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT

In the event of an autopilot malfunction, or anytime the autopilot is not performing as commanded, do not attempt to identify the problem system. Regain control by overpowering and immediately disconnecting the autopilot. This will disable both the autotrim system and the autopilot system. If the malfunction was in the autotrim system there may be residual control wheel force after the system is OFF. Be prepared for any residual trim force and retrim, as necessary, using the aircraft's primary trim control system.

NOTE

Do not overpower autopilot in pitch for more than approximately 3 seconds as the autotrim system will cause an increase in pitch overpower forces.

(1) Autopilot may be disconnected by:
   a. Depressing "AP OFF" bar on pilot's trim switch.
   b. Depressing the AP ON-OFF switch on the programmer.
   c. Depressing master disconnect switch on pilot's control wheel.

(2) Autotrim may be disconnected by:
   a. Depressing the autopilot ON-OFF switch - OFF.
   b. Placing the autotrim master switch - OFF.
   c. Depressing master disconnect switch on pilot's control wheel.

   After failed system has been identified, pull system circuit breaker and do not operate until the system has been corrected.

(3) Altitude Loss During Malfunction:
   a. An autopilot malfunction during climb or cruise with a 3 second delay in recovery initiation could result in as much as 58° bank and 400' altitude loss. Maximum altitude loss measured at 175 KIAS during descent.
   b. An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 15° bank and 80' altitude loss. Maximum altitude loss measured in approach configuration, gear down, and operating either coupled or uncoupled.

(b) COMPASS SYSTEM

(1) Emergency Operation With Optional NSD 360A (HSI) Slaved and /or Non-Slaved:

NSD 360A

a. Appearance of HDG Flag:
   1. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).
   2. Check compass circuit breaker.
   3. Observe display for proper operation.

b. To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

c. With card disabled VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.

d. Slaving Failure - (i.e. failure to self correct for gyro drift):
   1. Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
   2. Check for HDG Flag.
   3. Check compass circuit breaker.
   4. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

   5. Select slaving amplifier No. 2, if equipped. If not equipped, proceed with No. 7.

6. Reset heading card while checking slaving meter. If proper slaving indication is not obtained,
7. Switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE

In the localizer mode, the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

(a) NORMAL OPERATING PROCEDURES

NOTE

This autopilot is equipped with an A/P "OFF" warning horn that will sound for approximately 4 seconds anytime the autopilot is disengaged. This will be accompanied by an "A/P" message flash on the autopilot remote annunciator for approximately 5 seconds.

The horn may be silenced before the 4 second time limit is up by:
(1) Pressing "T" bar atop command trim switch.
(2) Pressing Autopilot/Trim Master Disconnect Switch.
(3) Or by re-engaging the autopilot.

NOTE

If this autopilot is equipped with a Flight Director steering horizon the F/D must be switched on before the autopilot may be engaged. Any autopilot mode may be preselected and will be retained upon autopilot engagement.

CAUTIONS

Flight Director Autopilot versions only are equipped with a remote go-around switch. When G/A mode is selected the AUTOPILOT WILL DISCONNECT and warning horn will sound. Pilot may use Flight Director steering for missed approach guidance and after aircraft is stabilized in a proper climb with gear and flaps up autopilot may be re-engaged and will retain G/A mode. Autopilot only versions do not have a G/A switch.

To avoid inadvertent or false glideslope captures while operating on the localizer use NAV mode instead of APR mode.

Refer to Edo-Aire Mitchell Century 41 Operator's Manual, P/N 68S803, dated 1-79 for additional System Description and Normal Operating Procedures.

(b) PREFLIGHT PROCEDURES

NOTE

During system functional check the system must be provided adequate D.C. voltage (12.0 VDC min.) and instrument air (4.2 in. Hg. min.). It is recommended that the engine be operated to provide the necessary power and that the aircraft be positioned in a level attitude, during the functional check.

(1) AUTOPILOT (F/D Switch ON if F/D Equipped)

a. Engage autopilot by pushing programmer OFF - ON switch ON.

b. Rotate D.G. HDG bug left then right and verify that control wheel movement corresponds to HDG command input.

c. Press pitch modifier button first up then down and note that pitch control follows pitch command input. Autotrim should follow pitch command input after approximately three second delay.

d. Grasp control wheel and override roll and pitch servo actuators to assure override capability.
e. Hold control yoke and disengage autopilot by activating the control wheel trim switch.
f. Check controls through full travel in roll and pitch to assure complete autopilot disengagement.
g. Retrim aircraft for takeoff.

(c) TRIM SYSTEM

The autopilot is provided with an electric elevator trim system having two modes of operation. When the autopilot is engaged and the trim master switch is ON, automatic electric trim (autotrim) is provided. When the autopilot is disengaged, command electric elevator trim is available by use of the control wheel switch provided or by use of the primary trim control wheel. The electric elevator trim system has been designed to withstand any type of single failure, either mechanical or electrical, without uncontrolled operation resulting. The automated system self test circuit provided, in conjunction with a functional check, described below, will uncover internal failures that otherwise could remain undetected and thus compromise the fail-safe properties of the system. Proper operation of the system is, therefore, predicated on conducting the following preflight check before first flight of each day. If the trim system fails any portion of this test, turn the autotrim master switch OFF and pull the autotrim circuit breaker, until the system is corrected.

The command electric trim switch on the left portion of the pilot's control wheel has two functions:

(1) When the top bar (AP OFF) is pressed, it disconnects the autopilot.
(2) When the top bar is pressed and the rocker is moved forward, nose down trim will occur; when moved aft, nose up trim will occur.

Command Trim - Before the First Flight of Each Day

(1) Trim master switch - ON.
(2) Verify normal trim UP and DOWN operation with control wheel switch.
(3) Press - center bar only - then release center bar.
(4) Push rocker fore and aft - only. Trim should not operate with either separate action.

Any failure of the preceding operations indicates that a failure exists in the system and the Command Trim shall not be operated until the failure has been identified and corrected.

Autotrim - Before the First Flight of Each Day

(1) Check trim master switch ON, autopilot OFF.

(2) Press and hold TEST pushbutton on Mode Annunciator. Verify the following sequence. (Each sequence will last approximately two seconds.):
   a. All annunciations light with FAIL and AP flashing.
   b. Autotrim flashes, goes steady, then flashes.
   c. All lights go steady.
   d. After three to five seconds, AUTOTRIM and FAIL flash continually.

(3) With TEST button on the Mode Annunciator still depressed, verify Trim will not operate in either direction with the Control Wheel Switch.

(4) Release TEST pushbutton. All lights except HDG and ATT shall extinguish.

Any deviation from the above sequence indicates that a failure exists in either the primary system or in the monitor circuits. The autopilot and trim system shall not be operated until the failure has been identified and corrected.

CAUTION

Recheck trim position prior to initiating take-off.

(d) FLIGHT DIRECTOR

(1) Check circuit breaker - IN.

(2) Flight director switch on steering horizon - ON. (Adjacent to instrument on single cue horizon, if installed)

(3) Pitch modifier DN - UP - check pitch steering indicator moves appropriately.

(4) HDG bug RT - LT - check roll steering indicator moves appropriately.

(e) COMPASS SYSTEM (NSD 360A)
For other compass systems, refer to appropriate manufacturer's instructions)

(1) Check slaving switch in slave or slave 1 or 2 position, as appropriate. (Slaving systems with R.M.I. output provide only slave and free gyro positions.)
(2) Rotate card to center slaving meter - check HDG displayed with magnetic compass HDG.
(3) Perform standard VOR receiver check.
(4) NAV - APPR - Engage NAV or APPR mode switch and observe steering bar indicates turn toward the VOR needle.

NOTE

If the Omni Bearing Selector is more than 45° from the aircraft heading, the flight director steering bar will only indicate a turn toward the omni bearing.

(f) IN-FLIGHT PROCEDURE - FLIGHT DIRECTOR
(1) Century 41 circuit breaker - IN. Flight director switch - ON.
(2) Adjust HDG bug to aircraft heading and select desired pitch attitude by activation of the CWS (Pitch Synch) switch or the modifier switch.
(3) Maneuver aircraft manually to satisfy the commands presented. Select other modes as desired; refer to Century 41 Operator's Manual for mode description.

(g) IN-FLIGHT PROCEDURE - AUTOPILOT/FLIGHT DIRECTOR AUTOPILOT
(1) Flight director switch - ON, if F/D equipped. Rotate heading bug to desired heading.
(2) Trim aircraft for existing flight condition (all axes). Engage autopilot.
(3) During maneuvering flight - control aircraft through use of the HDG bug and the pitch modifier. (HDG-ATT modes) (For use of pitch synch switch see Operator's Manual.)
(4) For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in Operator's Manual. For specific instructions relating to coupled instrument approach operations, refer to Special Operations and Information Section 4, item (i).

(h) IN-FLIGHT PROCEDURE - COMMAND/AUTOTRIM SYSTEM

(1) Trim master switch - ON.

(2) When the autopilot is engaged, pitch trim is accomplished and maintained automatically.

(3) With the autopilot OFF, command trim is obtained by pressing and rocking the combination TRIM-AP disconnect bar on the pilot's control wheel trim switch.

(i) SPECIAL OPERATIONS AND INFORMATION

(1) Altitude Hold Operation:
For best results, reduce rate of climb or descent to 1000 FPM before engaging altitude hold mode.

(2) Instrument Approach Operations:
Initial and/or intermediate approach segments should be conducted between 95-110 KIAS with the flaps extended as desired. Upon intercepting the glide path or when passing the final approach fix (FAF) immediately lower the landing gear and reduce the power for approximately 80-95 KIAS on the final approach segment. Adjust power as necessary during remainder of approach to maintain correct airspeed. Monitor course guidance information (raw data) throughout the approach. All power changes should be of small magnitude and smoothly applied for best tracking performance. Do not change aircraft configuration during approach while autopilot is engaged. For approaches without glide path coupling, adjust pitch attitude in conjunction with power to maintain desired airspeed and descent rate.

NOTE

Flight director or autopilot will not decouple from the GS or localizer in the event of radio failure, however, warnings will flash in the mode appropriate to the failure. Monitor course guidance raw data during the approach to assure signal quality.

(3) Instrument Approach Go-Around Maneuver (Flight Director Version Only):

a. Select GA mode at the remote GA switch. Autopilot will disconnect and warning horn will sound.
b. Add takeoff power, or power as desired.
c. Check the correct attitude and that a positive rate of climb is indicated, then raise gear and flaps.
d. Pilot may hand fly aircraft with reference to flight director steering information.
e. After aircraft is established in climb, gear and flaps up, autopilot may be re-engaged by pushing "ON" button on console if flight director steering is switched on.
f. Set desired HDG and select HDG mode for lateral maneuvering.

SECTION 5

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 10

PIPER CONTROL WHEEL CLOCK INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Piper Control Wheel Clock is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Piper Control Wheel Clock is installed.

SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) SETTING
While in the CLOCK mode, the time and the date can be set by the operation of the RST button.

(b) DATE SETTING

Pressing the RST button once will cause the date to appear with the month flashing. Pressing the ST-SP button will advance the month at one per second, or at one per push, until the right month appears.

Pressing the RST button once again will cause the date to flash, and it can be set in a similar manner.

(c) TIME SETTING

The RST button must now be pressed two times to cause the hours digits to flash. The correct hour can be set in as described above.

Pressing the RST button once again will now cause the minutes digits to flash. The minutes should be set to the next minute to come up at the zero seconds time mark. The RST button is pressed once more to hold the time displayed. At the time mark, the ST-SP button is pressed momentarily to begin the time counting at the exact second.

If the minutes are not advanced when they are flashing in the set mode, pressing the RST button will return the clock to the normal timekeeping mode without altering the minutes timing. This feature is useful when changing time zones, when only the hours are to be changed.

(d) AUTOMATIC DATE ADVANCE

The calendar function will automatically advance the date correctly according to the four year perpetual calendar. One day must be added manually on Feb. 29 on leap year. The date advances correctly at midnight each day.

(e) DISPLAY TEST

Pressing both the RST and ST-SP buttons at the same time will result in a display test function.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

TABLE OF CONTENTS

SECTION 10

SAFETY TIPS

SECTION 10

SAFETY TIPS

10.1 GENERAL

This section provides safety tips of particular value in the operation of the Arrow IV.

10.3 SAFETY TIPS

(a) Learn to trim for takeoff so that only a very light back pressure on the control wheel is required to lift the airplane off the ground.

(b) The best speed for takeoff is 70 KIAS under normal conditions. Trying to pull the airplane off the ground at too low an airspeed decreases the controllability of the airplane in the event of engine failure.

(c) Flaps may be lowered at airspeeds up to 108 KIAS. To reduce flap operating loads, it is desirable to have the airplane at a slower speed before extending the flaps. The flap step will not support weight if the flaps are in any extended position. The flaps must be placed in the "UP" position before they will lock and support weight on the step.

(d) Before attempting to reset any circuit breaker, allow a two to five minute cooling off period.

(e) Before starting the engine, check that all radio switches, light switches and the pitot heat switch are in the off position so as not to create an overloaded condition when the starter is engaged.

(f) Anti-collision lights should not be operating when flying through cloud, fog or haze, since reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

(g) The rudder pedals are suspended from a torque tube which extends across the fuselage. The pilot should become familiar with the proper positioning of his feet on the rudder pedals so as to avoid interference with the torque tube when moving the rudder pedals or operating the toe brakes.

(h) In an effort to avoid accidents, pilots should obtain and study the safety related information made available in FAA publications such as regulations, advisory circulars, Aviation News, AIM and safety aids.

(i) Prolonged slips or skids which result in excess of 2000 ft. of altitude loss, or other radical or extreme maneuvers which could cause uncovering of the fuel outlet must be avoided as fuel flow interruption may occur when tank being used is not full.