SARATOGA SP

PA-32R-301

PILOT'S OPERATING HANDBOOK

DUPLICATE

AND

FAA APPROVED AIRPLANE FLIGHT MANUAL

AIRPLANE SERIAL NO. 32R-8213025

AIRPLANE REGIST. NO. ______________

PA-32R-301
REPORT: VB-1080 FAA APPROVED BY: Ward Evans
WARD EVANS
D.O.A. No. SO-1
PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

DATE OF APPROVAL:
NOVEMBER 8, 1979

FAA APPROVED I N NORMAL CATEGORY BASE ON CAR 3. THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR 3 AND CONSITTUTES THE APPROVED AIRPLANE FLIGHT MANUAL AND MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES

PIPER

WARNING

EXTREME CARE MUST BE EXERCISED TO LIMIT THE USE OF THIS HANDBOOK TO APPLICABLE AIRCRAFT. THIS HANDBOOK IS VALID FOR USE WITH THE AIRPLANE IDENTIFIED ON THE FACE OF THE TITLE PAGE. SUBSEQUENT REVISIONS SUPPLIED BY PIPER AIRCRAFT CORPORATION MUST BE PROPERLY INSERTED.

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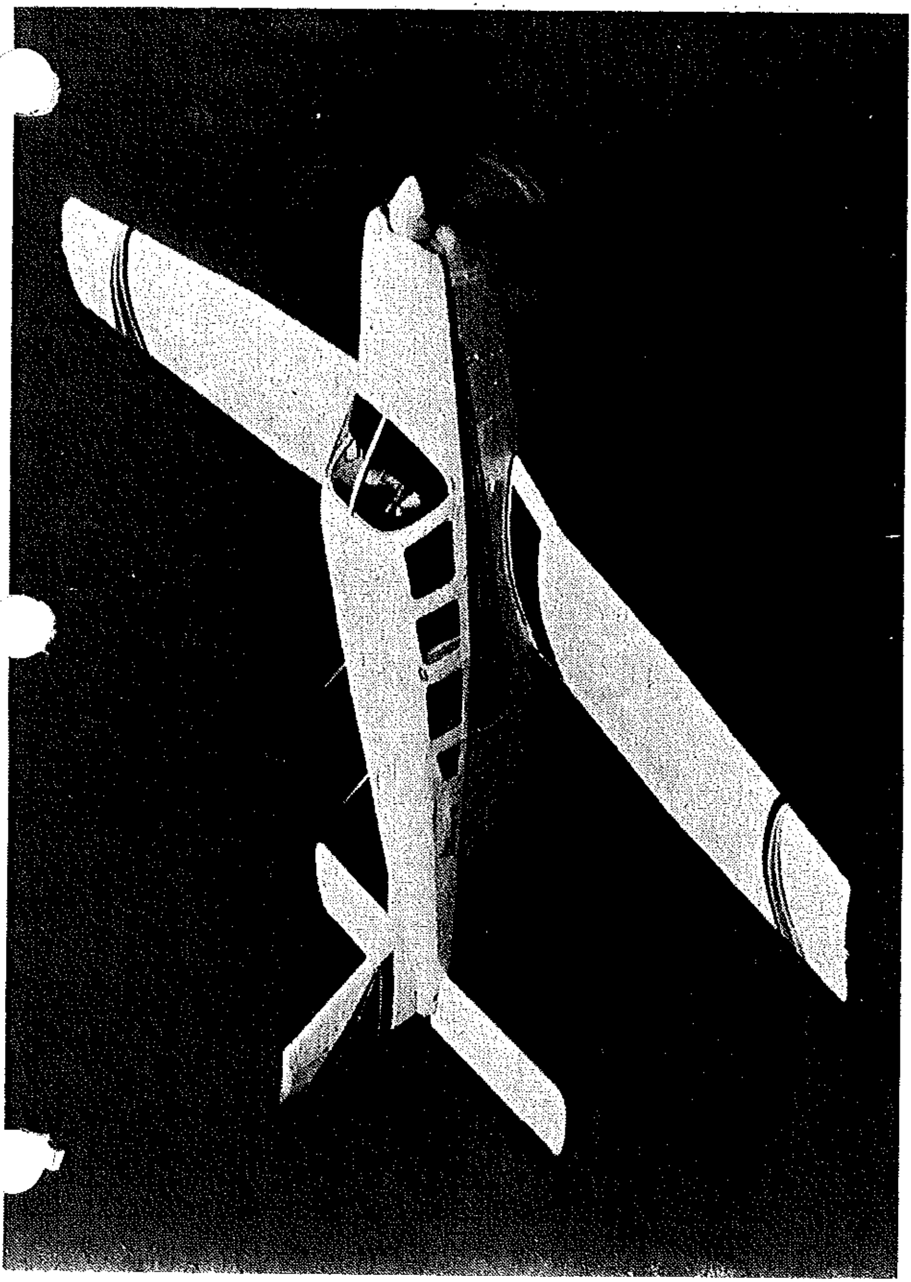


APPLICABILITY

Application of this handbook is limited to the specific Piper PA-32R-301 model airplane designated by serial 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, with the exception of the equipment list, will be kept current by revisions distributed to the airplane owners. The equipment list was current at the time the airplane was licensed by the manufacturer and thereafter must be maintained by the owner.

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 2-12, 3-1 through 3-18, 4-1 through 4-28, 5-1 through 5-38, 6-1 through 6-58, 7-1 through 7-35, 8-1 through 8-17, 9-1 through 9-8, 10-1 through 10-2.

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-32R-301, Saratoga SP Pilot's Operating Handbook, REPORT: VB-1080 issued November 8, 1979.

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 (PR800404)	6-40	Revised info.	Ward Evans Ward Evans April 4, 1980
	6-41	Revised info.	
	9-i	Added info.	
	9-9 thru 9-58	Added Supplements 3 thru 7.	
Rev. 2 (PR800602)	9-9 thru 9-56	Relocated info.	Ward Evans Ward Evans June 2, 1980
	9-57, 9-58	Deleted pages.	
Rev. 3 (PR801006)	1-4	Revised para. 1.7.	
	2-3	Revised para. 2.7.	
	2-11	Revised placard.	
	2-12	Added placard.	
	5-19	Revised fig. 5-17.	
	6-i	Revised pg. nos.	
	6-6	Revised fig. 6-5.	
	6-24	Revised item 47; added items 49 and 50.	
	6-29	Revised item 103, moved items 105 and 107 to pg. 6-30.	
	6-30	Relocated items 105 and 107 from pg. 6-29; moved items 115 to pg. 6-31.	
	6-31	Relocated item 115 from pg. 6-30; moved item 121 to pg. 6-32.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev 3 (cont) (PR801006)	6-32	Relocated item 121 from pg. 6-31; renumbered items; moved to pg. 6-32a.	
	6-32a	New pg.; relocated renumbered items from pg. 6-32.	
	6-32b	New pg.; Added new items 139 thru 143; revised and relocated item 145 from pg. 6-33.	
	6-33	Moved item 145 to pg. 6-32b.	
	6-40	Revised item 217.	
	6-41	Added new items 221 and 223; Renumbered and moved old item 221 to pg. 6-42 as item 259.	
	6-41a	New pg.; Added new items 231 thru 239.	
	6-41b	New pg.; added new items 241 thru 251.	
	6-42	Relocated old item 221 as item 259 from pg. 6-41; renumbered items; moved items to pg. 6-42a.	
	6-42a	New pg.; relocated renumbered items from pg. 6-42 and 6-43.	
	6-42b	New pg.; relocated renumbered items from pg. 6-43 and 6-44.	
	6-43	Relocated items to pgs. 6-42a and 6-42b; added renumbered items from pg. 6-44 and 6-45.	
	6-44	Moved renumbered item to pg. 6-43; relocated renumbered items from pg. 6-45 and 6-46.	
	6-45	Moved renumbered items to pg. 6-44; relocated renumbered items from pg. 6-46; added new items 303 thru 307.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 (cont) (PR801006)	6-46	Moved renumbered items to pg. 6-45; relocate renumbered items from pg. 6-47; added items 309 and 315.	
	6-46a	New pg.; relocated renumbered items from pg. 6-47; added item 317.	
	6-46b	New pg.; relocated renumbered items from pg. 6-48 and 6-49.	
	6-47	Moved renumbered items to pg. 6-46 and 6-46a; relocated renumbered items from pg. 6-48 and 6-49.	
	6-48	Moved renumbered items to pg. 6-47 and 6-46b; relocated renumbered items from pg. 6-50.	
	6-49	Moved renumbered items to pg. 6-46b and 6-47; relocated renumbered items from pg. 6-51.	
	6-50	Moved renumbered items to pg. 6-48; relocated renumbered items from pg. 6-52; added item 362.	
	6-51	Moved renumbered items to pg. 6-49; relocated renumbered items from pg. 6-52 and 6-53.	
	6-52	Moved renumbered items to pg. 6-50 and 6-51; relocated renumbered items from pg. 6-54.	
	6-53	Moved renumbered items to pg. 6-51; relocated renumbered items from pg. 6-55 and 6-56.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 (cont) (PR801006)	6-54	Relocated renumbered items from pg. 6-56.	
	6-55	Moved renumbered items to pg. 6-53; added new items 415 thru 423.	
	6-56	Moved renumbered items to pgs. 6-53 and 6-54; relocated renumbered items from pg. 6-57.	
	6-57	Moved renumbered items to pg. 6-56; relocated info. from pg. 6-58.	
	6-58	Moved info. to pg. 6-57; deleted page.	
	7-18	Revised fig. 7-17.	
	7-22	Revised fig. 7-21.	
	7-26	Revised para. 7.23.	
	8-1	Revised para. 8.1.	
	8-9	Revised fig. 8-1.	
	8-12	Revised para. 8.21.	
	8-12a, 8-12b	New pages; cont. revision para. 8.21.	
	8-13	Relocated info. to pg. 8-12b.	
	8-14	Relocated info. to pg. 8-13.	
	9-i	Added Supplements 8 thru 13 with pg. no.	
	9-57 thru 9-60	Added Supplement 8 (Century 21 Autopilot Installation).	
	9-61 thru 9-70	Added Supplement 9 (Century 41 Autopilot Installation).	
	9-71 thru 9-74	Added Supplement 10 (KNS 80 Navigation System).	
	9-75 thru 9-78	Added Supplement 11 (ANS 351 Area Navigation Computer).	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 (cont) (PR801006)	9-79 thru 9-82	Added Supplement 12 (RCA Weatherscout Weather Radar System).	
	9-83, 9-84	Added Supplement 13 (Piper Control Wheel Clock Installation).	Ward Evans Oct. 6, 1980
Rev. 4 (PR810320)	3-i	Revised Table of Contents.	
	3-5	Changed Alternator Failure to Electrical Failures; added Electrical Overload.	
	3-6	Cont. 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	Changed title and revised text of para. 3.25.	
	3-16	Added para. 3.26; moved para. 3.27 to pg. 3-17.	
	3-17	Relocated para. 3.27 from pg. 3-16; moved para. 3.33 to pg. 3-18.	
	3-18	Relocated para. 3.33 from pg. 3-17.	
	4-4	Corrected Report No.	
	4-5	Corrected Report No.	
	6-i	Changed pg. no.	
	6-6	Revised fig. 6-5.	
	6-21	Revised item 13.	
	6-28	Revised item 97.	
	6-29	Revised items 99 and 101; moved item 103 to pg. 6-30.	
	6-30	Relocated item 103 from pg. 6-29; moved items 111 and 113 to pg. 6-31.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 4 (cont) (PR810320)	6-31	Relocated items 111 and 113 from pg. 6-30.	
	6-38	Added item 194.	
	6-44	Added item 286; moved item 293 to pg. 6-45.	
	6-45	Relocated item 293; moved items 305 and 307 to pg. 6-46.	
	6-46	Relocated item 305 and 307 from pg. 6-45; moved item 315 to pg. 6-47.	
	6-46a	Relocated item 315 from pg. 6-46; moved item 323 to pg. 6-46b.	
	6-46b	Relocated item 323 from pg. 6-46a.	
	6-54	Revised items 409 and 411.	
	6-55	Revised items 415 thru 423; moved items 421 and 423 to pg. 6-56.	
	6-56	Relocated items 421 and 423; moved items 431, 433 and 435 to pg. 6-57.	
	6-57	Relocated items 431, 433 and 435 from pg. 6-56.	
	7-16, 7-17	Revised para. 7.15.	
	7-18	Revised fig. 7-17.	Ward Evans
	9-61	Revised Sec. 2 (c).	Ward Evans
	9-73	Revised Sec. 4 (8)a and (8)b.	March 20, 1981
Rev. 5 (PR810828)	ii	Revised Warning.	
	1-5	Revised para. 1.13.	
	2-3	Revised para. 2.7.	
	2-12	Corrected heading.	
	4-i	Changed pg. nos.	
	4-4	Revised para. 4.5.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 (cont) (PR810828)	4-5	Revised para. 4.5.	
	4-6	Revised para. 4.5.	
	4-8	Revised para. 4.5.	
	4-10	Revised para. 4.5.	
	4-11	Corrected heading.	
	4-13	Corrected heading.	
	4-14	Revised para. 4.7.	
	4-15	Revised para. 4.7.	
	4-16	Revised para. 4.7; moved para. 4.9 to pg. 4-17.	
	4-17	Relocated para. 4.9 from pg. 4-16; moved para. 4.11 (d) to pg. 4-18.	
	4-18	Relocated para. 4.11 (d) from pg. 4-17; moved info. to new pg. 4-18a.	
	4-18a	New pg; relocated info. from pg. 4-18; relocated paras. 4.13 and 4.15 from pg. 4-19.	
	4-18b	New pg.	
	4-19	Moved para. 4.13 and 4.15 to pg. 4-18a; relocated info. from pg. 4-20.	
	4-20	Moved info. to pg. 4-19; relocated info. from pg. 4-21.	
	4-21	Moved info. to pg. 4-20; added Note.	
	4-25	Added Note; moved para. 4.27 info. and para. 4.29 to pg. 4-26.	
	4-26	Relocated para. 4.27 info. and para. 4.29 from pg. 4-25; moved para. 4.33 and 4.35 to pg. 4-27.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 (cont) (PR810828)	4-27	Relocated para. 4.33 and 4.35 from pg. 4-26; moved para. 4.39 to pg. 4-28.	
	4-28	Relocated para. 4.39 from pg. 4-27; moved para. 4.41 to pg. 4-29.	
	4-29	Relocated para. 4.41 from pg. 4-28.	
	6-26	Revised items 59 thru 63.	
	6-31	Revised items 111 and 115.	
	6-32a	Revised item 127.	
	6-35	Added new item 168; removed item 173.	
	6-39	Revised item 197.	
	6-41	Revised item 223.	
	6-42b	Added new items 280 and 281; renumbered and moved item 282 to pg. 6-42c.	
	6-42c	New pg; relocated item 282 from pg. 6-42b, and item 283 from pg. 6-43.	
	6-42d	New pg.	
	6-43	Moved item 283 to pg. 6-42c; relocated items 286 and 287 from pg. 6-44.	
	6-44	Moved items 286 and 287 to pg. 6-43; added new item 288.	
	6-46a	Revised item 317; moved items 319 and 321 to pg. 6-46b.	
	6-46b	Relocated items 319 and 321 from pg. 6-46a; moved items 333 and 335 to pg. 6-46c.	
	6-46c	New pg; relocated items 333 and 335 from pg. 6-46b.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 (cont) (PR810828)	6-46d	New pg.	
	6-50	Revised item 361.	
	6-56	Revised item 425.	
	6-57	Added new item 437.	
	7-17	Revised para. 7.15.	
	8-i	Changed pg. nos.	
	8-10	Revised para. 8.15.	
	9-i	Changed pg. no.	
	9-62	Revised Section 3.	
	9-66	Revised Section 4 (c).	
	9-67	Revised Section 4 (c).	
	9-69	Revised Section 4 (i).	
	9-76	Revised Section 3.	
	9-78	Revised Section 3 (b).	Ward Evans
	9-80	Revised Section 4 (3).	Ward Evans
	9-84	Revised Section 4 (c).	Aug. 28, 1981
Rev. 6 (PR811218)	1-6	Revised para. 1.19.	
	2-12	Corrected error.	
	4-18	Revised para. 4.11; moved info. to pg. 4-18a.	
	4-18a	Relocated info. from pg. 4-18.	
	6-19	Revised para. 6.13.	
	6-31	Corrected heading error.	
	6-45	Revised item 297.	
	6-46a	Revised item 317c.	
	6-46d	Relocated items 337 and 339 from pg. 6-47.	
	6-47	Moved item 337 and 339 to pg. 6-46d; relocated item 343 from pg. 6-48.	
	6-48	Moved item 343 to pg. 6-47; relocated item 351 and 353 from pg. 6-49.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 6 (cont) (PR811218)	6-49	Moved item 351 and 353 to pg. 6-48; relocated item 361 from pg. 6-50.	
	6-50	Moved item 361 to pg. 6-49; added new item 363 and renumbered previous item to 364; revised item 365.	
	7-8	Revised para. 7.9.	
	7-26	Added info. to para. 7.23.	Ward Evans
	9-62	Revised Supplement 9, Section 3 (3) a.	Ward Evans Dec. 18, 1981
Rev. 7 (PR820719)	Title Pg.	Revised title pg.	
	iii	Revised info.	
	1-i	Removed conversion factor index.	
	1-4	Revised para. 1.5 specifications.	
	2-3	Revised para. 2.7 specifications.	
	3-i	Expanded emerg. index; moved info. to new pg. 3-ii.	
	3-ii	New pg.; relocated info. from pg. 3-i.	
	3-3	Revised Engine Power Loss In Flight procedure (mixture).	
	4-i	Expanded normal index; moved info. to new pg. 4-ii.	
	4-ii	New pg.; relocated info. from pg. 4-i.	
	4-8	Revised Ground Check (vacuum).	
	4-13	Corrected grammar.	
	4-19	Revised Ground Check (vacuum).	
	4-24	Corrected error.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 7 (cont) (PR820719)	6-i	Revised index pg.	
	6-2	Revised para. 6.3.	
	6-6	Revised fig. 6-5 info.	
	6-7	Revised fig. 6-7 info.	
	6-11	Revised fig. 6-9 info.	
	6-15	Revised para. 6.11.	
	7-17	Revised para. 7.15.	
	7-22	Revised fig. 7-21.	
	7-23	Added info. to para. 7.19.	
	7-26	Revised para. 7.23; moved info. to pg. 7-27.	
	7-27	Relocated info. from pg. 7-26; moved info. to pg. 7-28.	
	7-28	Relocated info. from pg. 7-27; added info. to para. 7.25; moved info. to pg. 7-30.	
	7-30	Relocated info. from pg. 7-28; revised para. 7.31; moved info. to pg. 7-31.	
	7-31	Relocated info. from pg. 7-30; moved info. to pg. 7-32.	
	7-32	Relocated info. from pg. 7-31.	
	8-16	Changed caution note format; moved info. to pg. 8-17.	Ward Evans
	8-17	Relocated info. from pg. 8-16.	Ward Evans
	9-7	Revised Supplement 2 - Section 3.	July 19, 1982
Rev. 8 (PR831011)	1-8	Revised terminology.	
	1-9	Deleted MEA.	
	1-12	Deleted para. 1.21.	
	2-11	Relocated fuel placard to pg. 2-12.	
	2-12	Added fuel placard from pg. 2-11; added new fuel placard.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 8 (cont) (PR831011)	5-6	Deleted Fig. no.	
	5-7	Revised item (3).	
	5-9	Revised para. 5.7.	
	5-25	Revised Fig. 5-27.	
	5-27	Revised Fig. 5-29 (deleted graph).	
	5-28	Revised Fig. 5-31.	
	5-29	Revised Fig. 5-33 (deleted graph).	
	5-30	Revised Fig. 5-35.	
	5-31	Revised Fig. 5-37 (deleted graph).	
	5-32	Revised Fig. 5-39.	
	6-1	Revised para. 6.1.	
	6-5	Revised para. 6.5.	
	6-11	Revised Fig. 6-9.	
	7-20	Added Caution.	
	8-2	Revised para. 8.3.	
	8-3	Revised para. 8.5.	
	8-4	Deleted para. 8.5 info.	
	9-i	Revised Table of Contents.	
	9-85 thru 9-110	Added pages; added new Supplement 14 (King 150 Series Flight Control System).	Ward Evans Ward Evans Oct. 11, 1983
Rev. 9 (PR840917)	vii, 1-i	Revised Table of Contents.	
	1-4	Relocated para. 1.9 to pg. 1-5; revised para. 1.7.	
	1-5	Added para. 1.9 from pg. 1-4.	
	1-8	Revised para. 1.19 (b).	
	2-3	Revised para. 2.7 (g).	
	3-1	Revised para. 3.1.	
	3-3	Revised para. 3.3.	
	3-12	Revised para. 3.13 (a).	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 9 (cont) (PR840917)	3-13	Revised para. 3.13 (b).	
	4-ii	Revised Table of Contents.	
	4-1	Revised para. 4.1 and 4.3.	
	4-3	Revised para. 4.5.	
	4-4 thru 4-10	Revised para. 4.5. info.	
	4-13	Revised para. 4.7.	
	4-14	Added para. 4.7 info. from pg. 4-15; revised para. 4.7 info.	
	4-15	Relocated para. 4.7 info. to pg. 4-14; revised para. 4.7 info.	
	4-17	Revised para. 4.9.	
	4-18a	Revised para. 4.15.	
	4-19	Revised para. 4.17.	
	4-21	Added para. 4.21 from pg. 4-22; revised para. 4.19 info.	
	4-22	Relocated para. 4.21 to pg. 4-21; revised para. 4.21 info.	
	4-26	Revised para. 4.29.	
	4-27	Revised para. 4.33 and para. 4.35.	
	5-1	Revised para. 5.1.	
	5-3 thru 5-8	Revised para. 5.5 (Flight Planning Example).	
	5-9	Revised para. 5.7 (List of Figures).	
	5-27	Revised Figure 5-29.	
	6-21	Revised item 15.	
	7-i	Revised Table of Contents.	
	7-2	Revised para. 7.3 info.	
	7-5	Revised Figure 7-1.	
	7-12	Relocated para. 7.13 info. to pg. 7-13; revised para. 7.11 info.	
	7-12a	Added pg.; added Figure 7-10.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 9 (cont) (PR840917)	7-12b	Added pg.	
	7-13	Added para. 7.13 info. from pg. 7-12.	
	7-17	Relocated para. 7.15 info. to pg. 7-19; revised para. 7.15 info.	
	7-18	Revised Figure 7-17.	
	7-19	Added para. 7.15 info. from pg. 7-17.	
	7-22	Revised Figure 7-21.	
	7-23	Added para. 7.21 from pg. 7-24.	
	7-24	Relocated para. 7.21 to pg. 7-23; added para. 7.23 from pg. 7-26.	
	7-26	Relocated para. 7.23 to pg. 7-24; revised para. 7.23 info.	
	8-12	Revised para. 8.21 (b).	
	9-i	Revised Table of Contents.	
	9-30, 9-44	Revised item (c).	
	9-85 thru 9-110	Revised Supplement 14 (King KAP/KFC 150 Series Flight Control System).	
	9-111 thru 9-114	Added pgs.; added new info. to Supplement 14 (King KAP/ KFC 150 Series Flight Control System).	
	9-115 thru 9-120	Added pgs.; added new Supplement 15 (Sperry Weatherscout Weather Radar System).	
	9-121 thru 9-126	These pgs. intentionally left blank.	
	9-127 thru 9-146	Added pgs.; added new Supplement 17 (Century 31 Autopilot Model AK896).	
	10-i	Revised Table of Contents.	
	10-1	Revised Title; revised para. 10.1 and 10.3.	Ward Evans
	10-2	Revised Title.	Ward Evans Sept. 17, 1984

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 10 (PR850628)	3-3	Revised para. 3.3.	
	3-11, 3-12	Revised para. 3.13.	
	4-22	Revised para. 4.21.	
	7-12	Revised para. 7.11.	D.H. Trompler June 28, 1985
Rev. 11 (PR860901)	vi-m, n	Added revision 11	
	2-4	Revised para. 2.7.	
	2-10	Revised para. 2.27.	
	3-2, 3-3, 3-7	Revised para. 3.3.	
	3-9, 3-10	Revised para. 3.9.	
	3-11, 3-12, 3-13	Revised para. 3.13.	
	3-17	Revised para. 3.29.	
	4-9	Revised para. 4.5.	
	4-20	Revised para. 4.19.	
	4-22	Revised para. 4.21.	
	4-23	Revised para. 4.23.	
	4-28, 4-29	Revised para. 4.39.	
	7-5	Revised figure 7-1.	
	7-6	Revised figure 7-3; Revised para. 7.9.	
	7-7, 7-8	Revised para. 7.9.	
	7-9	Revised figure 7-5.	
	7-10	Revised figure 7-7.	
	7-11	Revised figure 7-9.	
	7-22	Revised figure 7-21.	
	9-i	Added Supplement 18 to Table of Contents	

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
	9-147 thru 9-154	Added Suppplement 18, Auxiliary Vacumm System	D. H. Trompler Oct. 22, 1986 Date
Rev. 12 (PR861210)	2-10	Revised para. 2.27.	
	3-7	Revised para. 3.3.	
	3-13	Corrected typo.	
	3-17	Revised para. 3.29.	
	5-34	Revised fig. 5-43.	
	7-7	Revised para. 7.9.	
	7-10	Revised fig. 7-7.	
	7-10a	New Page.	
	7-10b	New Page.	
	7-11	Revised fig. 7-9.	D. H. Trompler
	7-12	Revised para. 7.11.	
	9-149, 9-154	Corrected typo.	Dec. 11, 1986 Date
Rev. 13 (891113)	7-10	Amended fig. 7-7 title.	
	7-10a	Amended fig.7-7a title.	
	7-10b	Fig. 7-7b added.	
	7-10c	Page added. Fig. 7-7c added.	
	7-10d	Page added.	
	7-11	Amended fig. 7-9 title.	
	7-26	Revised para. 7.23.	
	7-32	Relocated info. from page 7-33.	
	7-33	Moved info. to page 7-32 Relocated info. from page 7-34.	
	7-34	Moved info. to page 7-33. Added ELT 910 info. Moved info. to page 7-35/	
	7-35	Relocated info. from page 7-34.	
	8-1	Revised para. 8.1.	
	8-2	Revised paras. 8.1 and 8.3.	
	8-3	Revised para. 8-3.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
	8-11	Revised para. 8.19.	
	9-13	Revised Section 3, para. (a).	
	9-155 thru 9-160	Pages added. Added Supplement 19.	D. H. Trompler March 26, 1990 Date
Rev. 14 (900918)	3-ii	Revised Table of Contents.	
	3-7	Revised Emergency Landing Gear Extension checklist.	
	3-12	Revised para. 3.13.	
	3-17	Revised para. 3.29. Moved para. 3.31 to page 3-18.	
	3-18	Relocated para. 3.31 from page 3-17. Moved info. to page 3-19	
	3-19	Page added. Relocated info. from page 3-18.	
	3-20	Page added.	
	8-3	Revised para. 8 .5.	
	9-i	Added Supplement 19 to Table of Contents.	
	9-155	Revised Supplement title.	D. H. Trompler Sept. 28, 1990 Date
Rev. 15 (PR920815)	9-i	Added Supplement 20 to Table of Contents.	
	9-161 thru 9-167	Added Supplement 20 (Bendix/King KLN 88 Loran C Navigation System with KAP KFC 150 Autopilot System	Wm R Moreu W.R. Moreu Augt. 15, 1992 Date

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date

TABLE OF CONTENTS

SECTION 1

GENERAL

1.1 INTRODUCTION

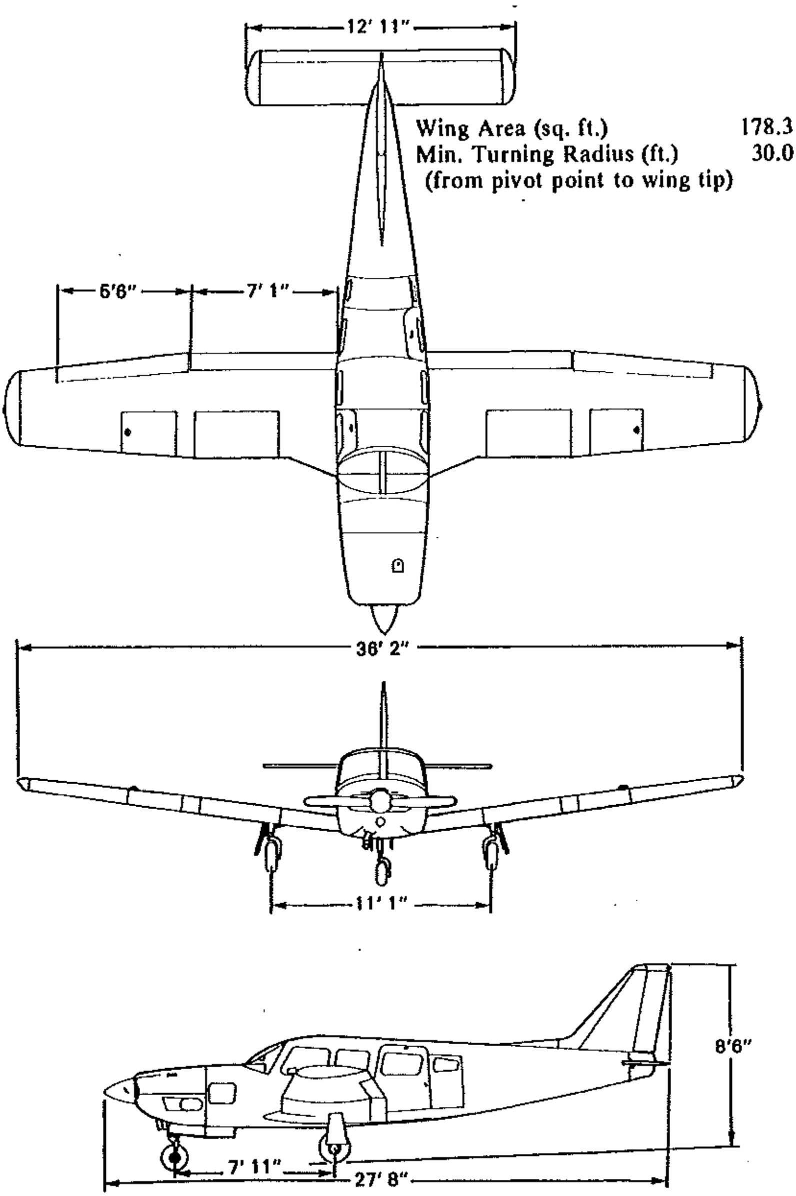
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by FAR/CAR. It also contains supplemental data supplied by the airplane manufacturer.

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 in 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 responsibleb 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 ENGINE

2 BLADE PROPELLER

(a) Number of Engines		1
(b) Engine Manufacturer		Lycoming
(c) Engine Model Number		IO-540-K1G5D
	Max. Cont. Power	T. O. Power-5 Min. Limit
(d) Rated Horsepower	294	300
(e) Rated Speed (rpm)	2600	2700
(f) Bore (inches)		5.125
(g) Stroke (inches)		4.375
(h) Displacement (cubic inches)		541.5
(i) Compression Ratio		8.7:1
(j) Engine Type		Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled, Fuel Injected

3 BLADE PROPELLER

(a) Number of Engines	1
(b) Engine Manufacturer	Lycoming
(c) Engine Model Number	IO-540-K1G5D
(d) Rated Horsepower	300
(e) Rated Speed (rpm)	2700
(f) Bore (inches)	5.125
(g) Stroke (inches)	4.375
(h) Displacement (cubic inches)	541.5
(i) Compression Ratio	8.7:1
(j) Engine Type	Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled, Fuel Injected

1.5 PROPELLER

2 BLADE PROPELLER

(a) Number of Propellers	1
(b) Propeller Manufacturer	Hartzell

(c) Blade Model	F8475D-4
(d) Number of Blades	2
(e) Hub Model	HC-C2Y(K,R)-1( )F
(f) Propeller Diameter (inches)	
(1) Minimum	78.5
(2) Maximum	80
(g) Propeller Type	Constant Speed, Hydraulically Actuated

3 BLADE PROPELLER

(a) Number of Propellers	1
(b) Propeller Manufacturer	Hartzell
(c) Blade Model	F7663R-O
(d) Number of Blades	3
(e) Hub Model	HC-C3YR-1( )F
(f) Propeller Diameter (inches)	
(1) Minimum	76
(2) Maximum	78
(g) Propeller Type	Constant Speed, Hydraulically Actuated

1.7 FUEL

AVGAS ONLY

(a) Fuel Capacity (U.S. gal.) (total)	107
(b) Usable Fuel (U.S. gal.) (total)	102
(c) Fuel Grade, Aviation	
(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. quarts) 12

(b) Oil Specification Refer to latest issue of Lycoming Service Instruction 1014.

(c) Oil Viscosity per Average Ambient Temp. for Starting

	SINGLE	MULTI
(1) Above 60° F	50	40 or 50
(2) 30° F to 90° F	40	40
(3) 0° to 70° F	30	40 or 20W-30
(4) Below 10° F	20	20W-30

1.11 MAXIMUM WEIGHTS

(a) Maximum Takeoff Weight (lbs.) 3600

(b) Maximum Landing Weight (lbs.) 3600

(c) Maximum Ramp Weight (lbs.) 3615

	FORWARD	AFT
(d) Maximum Weights in Baggage Compartments	100	100

1.13 STANDARD AIRPLANE WEIGHTS

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

1.15 BAGGAGE SPACE

	FORWARD	AFT
(a) Compartment Volume (cubic feet)	7.0	17.3
(b) Entry Width (inches)	16.0	48.0
(c) Entry Height (inches)	22.0	26.0

1.17 SPECIFIC LOADING

(a) Wing Loading (lbs. per sq. ft.) 20.2

(b) Power Loading (lbs. per hp) 12.0

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 Airpseed 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 (1013.2 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 (-0.003564° 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 (1013.2 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.
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.

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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 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.	197	189
Maximum Structural Cruising Speed (V_{NO}) - Do not exceed this speed except in smooth air and then only with caution.	154	150
Design Maneuvering Speed (V_A) - Do not make full or abrupt control movements above this speed.		
At 3600 LBS. G.W.	134	132
At 2230 LBS. G.W.	105	104

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.	112	109
Maximum Landing Gear Extension Speed (V_{LO}) - Do not exceed this speed when extending the landing gear.	132	130
Maximum Landing Gear Retraction Speed (V_{LO}) - Do not exceed this speed when retracting the landing gear.	110	109
Maximum Landing Gear Extended Speed (V_{LE}) Do not exceed this speed with the landing gear extended.	132	130

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS
Red Radial Line (Never Exceed)	197 KTS
Yellow Arc (Caution Range - Smooth Air Only)	154 KTS to 197 KTS
Green Arc (Normal Operating Range)	60 KTS to 154 KTS
White Arc (Flap Down)	57 KTS to 112 KTS

2.7 POWER PLANT LIMITATIONS

2 BLADE PROPELLER

(a) Number of Engines		1
(b) Engine Manufacturer		Lycoming
(c) Engine Model No.		IO-540-K1G5D
(d) Engine Operating Limits	Max. Cont. Power	T.O. Power-5 Min. Limit
(1) Maximum Horse Power	294	300
(2) Maximum Engine Speed (RPM)	2600	2700
(3) Maximum Oil Temperature (°F)	245	245

(e) Oil Pressure
Minimum (red line) — 25 PSI
Maximum (red line) — 100 PSI

(f) Fuel Flow/Pressure
Maximum (red line) — 35 gal/hr; 14 PSI

(g) Fuel (AVGAS ONLY)
(minimum grade) — 100 or 100LL Aviation Grade

(h) Number of Propellers — 1

(i) Propeller Manufacturer — Hartzell

(j) Propeller Hub and Blade Model — HC-C2Y(K,R)-1( )F/F8475D-4

(k) Propeller Diameter (inches)
Minimum — 78.5
Maximum — 80

(l) Blade Angle Limits
Low Pitch Stop — 13.5° ± 0.2°
High Pitch Stop — 34° ± 1°

3 BLADE PROPELLER

(a) Number of Engines	1
(b) Engine Manufacturer	Lycoming
(c) Engine Model No.	IO-540-K1G5D
(d) Engine Operating Limits	
(1) Maximum Horse Power	300
(2) Maximum Rotation Speed (RPM)	2700
(3) Maximum Oil Temperature (°F)	245
(e) Oil Pressure	
Minimum (red line)	25 PSI
Maximum (red line)	100 PSI
(f) Fuel Flow/Pressure	
Maximum (red line)	35 gal/hr; 14 PSI
(g) Fuel Grade (minimum grade)	100 - Green or 100LL - Blue Aviation Grade
(h) Number of Propellers	1
(i) Propeller Manufacturer	Hartzell
(j) Propeller Hub and Blade Model	HC-C3YR-1 ( )F/ F7663R-0
(k) Propeller Diameter (inches)	
Minimum	76
Maximum	78
(l) Blade Angle Limits	
Low Pitch Stop	12.4° ± 0.2°
High Pitch Stop	32.0° ± 1.0°

2.9 POWER PLANT INSTRUMENT MARKINGS

(a) Tachometer	
(1) 2 Blade Propeller	
Green Arc (Normal Operating Range)	500 to 2600 RPM
Yellow Arc (5 Minute Limit)	2600 to 2700 RPM
Red Line (Maximum)	2700 RPM
(2) 3 Blade Propeller	
Green Arc (Normal Operating Range)	500 to 2700 RPM
Red Line (Maximum)	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 (Caution Range) (Start and Warm Up)	90 PSI to 100 PSI
Red Line (Minimum)	25 PSI
Red Line (Maximum)	100 PSI
(d) Fuel Flow/Pressure	
Green Arc (Normal Operating Range)	0 gal/hr. to 34.9 gal/hr.
Red Line (Maximum)	35 gal/hr.: 14 PSI

2.11 WEIGHT LIMITS

(a) Maximum Takeoff Weight	3600 LBS.
(b) Maximum Ramp Weight	3615 LBS.
(c) Maximum Baggage (100 lbs. each compartment)	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
3600	91.4	95.0
3200	83.5	95.0
2400 (and less)	78.0	95.0

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 untapered and inboard 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
(c) Positive Load Factor - Flaps Down (Maximum)	2.0 G
(d) Negative Load Factor - Flaps Down (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 .... 107 U.S. GAL.
(b) Unusable Fuel .... 5 U.S. GAL.
The unusable fuel for this airplane has been determined as 2.5 gallons in each wing in critical flight attitudes (2.5 gallons is the total per side, each side having two interconnected tanks).
(c) Usable Fuel .... 102 U.S. GAL.
The usable fuel in this airplane has been determined as 51 gallons in each wing (51 gallons is the total per side, each side having two interconnected tanks).

2.25 NOISE LEVEL

The corrected noise level of this aircraft is 77.6 dB(A) for two bladed propeller installations and 78.4 dB(A) for three bladed propeller installations.

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 F.A.R. 36, Noise Standards - Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all F.A.R. 36 noise standards applicable to this type.

2.27 FLIGHT WITH REAR CABIN DOOR OR REAR CABIN DOOR AND CARGO DOOR REMOVED

The following limitations must be observed in the operation of this airplane with the rear cabin door or the rear cabin door and cargo door removed:

(a) The airplane may be flown with the rear cabin door or rear cabin door and cargo door removed. Flight with the front door removed is not approved.
(b) Maximum speed - 147 KIAS
(c) No smoking
(d) All loose articles must be tied down and stowed.
(e) Jumper's static lines must be kept free of pilot's control and control surfaces.
(f) Operation approved VFR flight conditions only.

2.29 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. NO ACROBATIC MANEUVERS INCLUDING SPINS, APPROVED.

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

In full view of the pilot, the following takeoff and landing checklists will be installed:

TAKEOFF CHECKLIST

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

LANDING CHECKLIST

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

The "AIR CONDITIONER OFF" item in the above takeoff and landing checklists is mandatory for air conditioned aircraft only.

On the instrument panel in full view of the pilot:

V_A 134 KIAS at 3600 LBS.
(See A.F.M.)

On the instrument panel in full view of the pilot:

DEMO X-WIND 17 KTS

In full view of the pilot: (For operations with the rear door removed)

FOR FLIGHT WITH THE DOOR REMOVED, SEE THE LIMITATIONS AND PROCEDURES SECTIONS OF THE AIRPLANE FLIGHT MANUAL.

In full view of the pilot:

V_{LO} 132 DN, 110 UP
V_{LE} 132 MAX

Near emergency gear lever (aircraft equipped with lever release):

EMERGENCY DOWN

Near emergency gear knob (aircraft equipped with cable release):

EMERGENCY GEAR EXT PULL

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

OVERRIDE ENGAGED

TO ENGAGE OVERRIDE:
LEVER UP, LATCH DOWN
TO RELEASE OVERRIDE:
LEVER FULL UP & RELEASE

On gear override latch (aircraft equipped with backup gear extender):

GEAR OVERRIDE LATCH

Near gear selector switch:

GEAR UP	110 KIAS MAX
DOWN	132 KIAS MAX

Adjacent to upper door latch (front and rear doors):

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 the inside of the forward baggage compartment:

MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS. SEE THE LIMITATIONS SECTION OF THE AIRPLANE FLIGHT MANUAL.

On aft baggage closeout:

MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS. NO HEAVY OBJECTS ON HAT SHELF.

On storm window:

DO NOT OPEN ABOVE 129 KIAS.

On executive writing table:

CAUTION — THIS TABLE MUST BE STOWED DURING TAKEOFF AND LANDING.

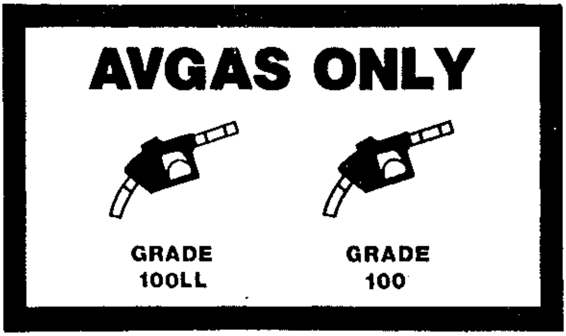
On the face of the tachometer (2 blade propeller only):

AFTER 5 MIN.
REDUCE POWER TO
2600 RPM

Adjacent to fuel tank filler caps:

FUEL — 100 OR 100LL
AVIATION GRADE

Adjacent to fuel tank filler caps (serial numbers 32R-8313010 and up):



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SECTION 3

EMERGENCY PROCEDURES

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SECTION 3 (cont)

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 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 in Section 9 (Supplements).

The first portion of this section consists of an abbreviated emergency checklist 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 a course of action for coping with the particular condition described, but are not a substitute for sound judgment and common sense. 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 a 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 CHECKLIST

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 flow 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
Mixture .... adjust as necessary

If power is not restored prepare for power off landing.

POWER OFF LANDING

On aircraft equipped with the backup gear extender, lock emergency gear lever in OVERRIDE ENGAGED position before airspeed drops to 106 KIAS to prevent landing gear from inadvertently free falling.

Trim for 80 KIAS
Locate suitable field.
Establish spiral pattern.
1000 ft. above field at downwind position for normal landing approach.
When field can easily be reached extend full flaps for shortest landing.

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

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

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 FLOW

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

ENGINE DRIVEN FUEL PUMP FAILURE

Throttle .... retard
Electric fuel pump .... ON
Throttle .... reset as required

CAUTIONS

If normal engine operation and fuel flow is not immediately re-established, the electric fuel pump should be turned OFF.

The lack of a fuel flow indication while the electric fuel pump is on could indicate a leak in the fuel system or fuel exhaustion.

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 2700 rpm

EMERGENCY LANDING GEAR EXTENSION

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

If landing gear does not check down and locked:
Airspeed....................below 92 KIAS

Landing gear selector....................DOWN
Emergency gear lever (aircraft equipped with backup gear extender)....................OVERRIDE ENGAGED (while fish tailing airplane)

If landing gear still does not check down and locked:
Emergency gear lever (aircraft equipped with lever release)....................*Hold* emergency gear lever in the EMERGENCY DOWN position, while fish tailing airplane, until gear is down and locked (under normal conditions will take approx. 10 seconds to be down and locked)

Emergency gear knob (aircraft equipped with cable release)....................PULL, while fish tailing airplane (under normal conditions will take approx. 10 seconds to be down and locked)

If all electrical power has been lost, the landing gear must be extended using the above procedures. The gear position indicator lights will not illuminate.

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 92 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, 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. Check the electric fuel pump to insure that it is ON and 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 103 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 latching 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 Power Off Landing procedure (refer to the emergency checklist 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 92 KIAS should be maintained.

If altitude permits, switch the fuel selector to another tank containing fuel and turn the electric fuel pump 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 flow 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 position, turn OFF the electric fuel pump and adjust the mixture control as necessary.

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 other fuel tanks. 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 flow 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 the emergency checklist 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 106 KIAS to prevent landing gear from inadvertently free falling on aircraft equipped with the backup gear extender, trim the aircraft for best gliding angle (80 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 no wind, 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, extend full flaps 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 airplanes equipped with the backup gear extender, the landing gear will free fall at airspeeds below approximately 103 KIAS and, under normal conditions, will take approximately 10 seconds to be down and locked. If a gear up landing is desired, it will be necessary to latch the override lever in the OVERRIDE ENGAGED position before the airspeed drops to 106 KIAS to prevent the landing gear from inadvertently free falling.

Touchdown should normally be made at the lowest possible airspeed.

(a) Gear Down Landing

When committed to a gear down emergency landing, select landing gear DOWN, close the throttle, turn the fuel selector valve to OFF and move the mixture to idle cut-off. After final flap setting, turn the master and ignition switches OFF. The seat belts and shoulder harness (if installed) should be tightened. Touchdown should be normally made at the lowest possible airspeed.

NOTE

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

(b) Gear Up Landing

On aircraft equipped with the backup gear extender, latch the emergency gear lever in the OVERRIDE ENGAGED position to prevent the gear from inadvertently extending at airspeeds below 103 KIAS.

When committed to landing, close the throttle, turn the fuel selector valve to OFF and move the mixture to idle cut-off. After final flap setting, turn the master and ignition switches OFF. The seat belts and shoulder harness (if installed) should be tightened. Touchdown should be normally made at the lowest possible airspeed.

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 by promptly identified through instrument readings, character of 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 FLOW

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

If loss of fuel pressure is due to failure of the engine driven fuel pump the electric fuel pump will supply sufficient fuel flow.

After fuel flow and power are regained, turn the electric fuel pump OFF. If fuel flow starts to drop, turn the electric fuel pump ON and land at the nearest suitable airport as soon as possible and have the cause investigated.

CAUTION

If normal engine operation and fuel flow is not immediately re-established, the electric fuel pump should be turned off. The lack of fuel flow indication could indicate a leak in the fuel system, or fuel exhaustion.

3.21 ENGINE DRIVEN FUEL PUMP FAILURE

If an engine driven fuel pump failure is indicated, retard the throttle and turn ON the electric fuel pump. The throttle should then be reset. A landing should be made at the nearest appropriate airport as soon as possible and the cause of the failure investigated.

CAUTION

If normal engine operation and fuel flow is not immediately re-established, the electric fuel pump should be turned off. The lack of a fuel flow indication could indicate a leak in the fuel system, or fuel exhaustion.

3.23 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.

3.25 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" 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.

3.26 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 conditons) 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.

3.27 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 2700 RPM.

3.29 EMERGENCY LANDING GEAR EXTENSION

Prior to proceeding with an emergency gear extension, check to insure that the master switch is ON and that the circuit breakers have not opened. If it is daytime, the radio lights should be turned off. Check the landing gear indicators for faulty bulbs.

NOTE

Refer to Par. 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 to below 92 KIAS. Move the landing gear selector to the DOWN position. On aircraft equipped with the backup gear extender, place the emergency gear lever in the OVERRIDE ENGAGED position and fishtail the airplane.

If the landing gear still does not check down and locked:

a. On airplanes equipped with the lever release, position and hold the emergency gear lever in the EMERGENCY DOWN position while fish tailing the airplane.
b. On airplanes equipped with the cable release, PULL the emergency extend knob while fish tailing the airplane.

Under normal conditions, either of the above procedures, as appropriate, will require approximately 10 seconds for the gear to extend and lock down.

If all electrical power has been lost, the landing gear must be extended using the above procedures. The gear position indicator lights will not illuminate.

3.31 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.

3.33 OPEN DOOR

The cabin door is double latched, so the chances of its springing open in flight at both the top and side 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 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 92 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 armrest while moving the latch handle to the latched position. If both latches are open, close the side latch then the top latch.

3.35 ENGINE ROUGHNESS

Engine roughness may be caused by dirt in the injector nozzles, induction filter 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

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SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

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

Normal procedures associated with those optional systems and equipment which require handbook supplements are provided in 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.

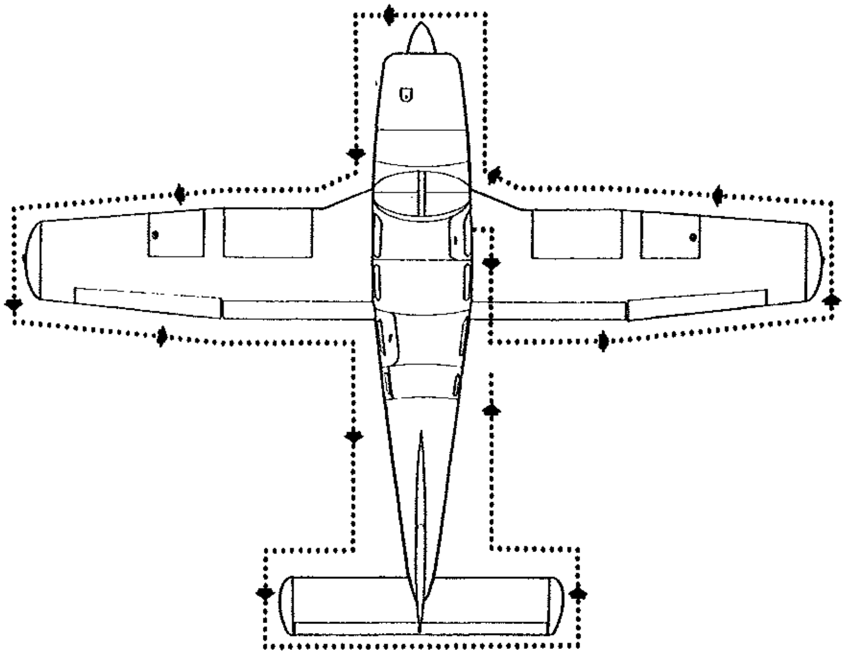
The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthy explanation. The short form checklist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

4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are those which are significant to the 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 down, flaps up .... 80 KIAS
gear up, flaps up .... 91 KIAS
(b) Best Angle of Climb Speed
gear down, flaps up .... 76 KIAS
gear up, flaps up .... 80 KIAS
(c) Turbulent Air Operating Speed (See Subsection 2.3) . 134 KIAS
(d) Maximum Flap Speed .... 112 KIAS
(e) Landing Final Approach Speed (Full Flaps) .... 79 KIAS
(f) Maximum Demonstrated Crosswind Velocity .... 17 KTS



WALK-AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECKLIST

PREFLIGHT CHECK

COCKPIT

Control wheel .... release restraints
Parking brake .... set
All switches .... OFF
Avionics .... OFF
Mixture .... idle cut-off
Master switch .... ON
Fuel gauges .... check quantity
Annunciator panel .... check
Flaps .... proper operation
Master switch .... OFF
Primary flight controls .... 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 sumps .... drain and check for water, sediment and proper fuel
Fuel quantity gauge .... check
Tie down and chock .... remove
Main gear strut .... proper inflation (4.5 ± .5 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
Chock .... remove
Nose gear strut .... proper inflation (3.25 ± .25 in.)
Nose wheel tire .... check
Engine baffle seals .... check
Oil .... check quantity
Dipstick .... properly seated
Oil filler cap .... secure
Fuel strainer drain .... place container under
Baggage door .... close and secure
Landing light .... check

LEFT WING

Surface condition .... clear of ice, frost, snow
Fresh air inlet .... clear
Tie down and chock .... remove
Main gear strut .... proper
inflation (4.5 ± .5 in.)
Tire .... check
Brake block and disc .... check
Fuel quantity gauge .... check
Fuel tank .... check supply
visually - secure cap
Fuel tank vent .... clear
Fuel tank sump .... drain and check for
water, sediment and proper fuel
Pitot/static head .... remove cover - holes clear
Wing tip and lights................................... check
Aileron and hinges .... check
Flap and hinges....................................... check

EMPENNAGE

Antennas .... check
General condition .... check
Baggage .... check
Tail lights .... check
Elevator .... check
Rudder .... check
Tie down .... remove

MISCELLANEOUS

Fuel strainer .... drain and check
for water and sediment
Master switch .... ON
Pitot heat switch .... ON
Interior lighting .... ON and check
Exterior lighting switches .... ON and check
Fuel strainer drain .... visually check
contents of container
and dispose - valve secure
Pitot .... check - warm
Stall warning horn .... check

All lighting switches .... OFF
Pitot heat switch .... OFF
Master switch .... OFF
Passengers .... board
All doors .... close and secure
Seat belts and harness .... fasten/adjust
check inertia reel

BEFORE STARTING ENGINE

Parking brake .... set
Propeller .... full INCREASE rpm
Fuel selector .... desired tank
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 .... 1000 to 1200 RPM

TAXIING

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

GROUND CHECK

Parking brake	set
Propeller	full INCREASE
Throttle	2000 RPM
Magnetos	max. drop 175 RPM - max. diff. 50 RPM
Vacuum	4.8″ to 5.2″ Hg.
Oil temperature	check
Oil pressure	check
Air conditioner	check
Annunciator panel	press-to-test
Propeller	exercise - then full INCREASE
Alternate air	check
Electric fuel pump	OFF
Fuel flow	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
Parking brake	release

TAKEOFF

NORMAL

Flaps .... retracted
Ttrim .... slightly aft of neutral
Accelerate to 74 to 80 KIAS, depending on aircraft weight.
Control wheel .... back pressure to rotate to climb attitude

SHORT OR SOFT FIELD, OBSTACLE CLEARANCE

Flaps ....25°
Trim .... slightly aft of neutral
Throttle .... full power prior to brake release
Accelerate to 58 to 66 KIAS depending on aircraft weight.
Control wheel .... back pressure to rotate to climb attitude
After breaking ground, accelerate to 61 to 71 KIAS depending on aircraft weight.
Gear (OVERRIDE ENGAGED on aircraft equipped with backup gear extender) ....UP
Accelerate to climb speed
Flaps .... retract slowly

CLIMB

Best rate (3600 lb) (gear down) (flaps up) ....80 KIAS
Best rate (3600 lb) (gear up) (flaps up) ....91 KIAS
Best angle (3600 lb) (gear down) (flaps up) ....76 KIAS
Best angle (3600 lb) (gear up) (flaps up) ....80 KIAS
En route..105 KIAS
Electric fuel pump .... OFF at a safe 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 - 132 KIAS max.
Flaps .... set - white arc
Air conditioner .... OFF

NORMAL TECHNIQUE

Flaps .... as required
Trim .... 95 KIAS
Throttle .... as required

SHORT FIELD TECHNIQUE

Flaps .... 40°
Trim .... 79 KIAS
Throttle .... as required

GO-AROUND

Propeller .... full INCREASE
Throttle .... full FORWARD
Control wheel .... back pressure to rotate to climb attitude
Airspeed .... 80 KIAS
Gear .... UP
Flaps .... retract slowly
Trim .... as required

STOPPING ENGINE

Flaps .... retract
Electric fuel pump .... OFF
Air conditioner .... OFF
Radios and electrical equipment .... 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 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 distance 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 and set the parking brake. Insure that all electrical switches and the magneto switch are OFF. Turn OFF all avionics equipment (to save power and prevent wear on the units). The mixture should be in idle cut-off. Turn ON the master switch, check the fuel quantity gauges for adequate supply, check that the annunciator panel illuminates and check the flaps for proper operation. Turn OFF the master switch. Check the primary flight controls 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 and secure the tow bar and baggage. 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 supply. Check the fuel indicator gauge. Each inboard tank is furnished with an external fuel quantity indicator to assist the pilot in determining fuel quantities of less than 35 gallons. 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.

Place a container under the quick drain. Drain the fuel tanks through the quick drain located at the lower inboard rear corner of each tank, making sure that enough fuel has been drained to verify the proper fuel and 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, complete a check of the landing gear. Check the gear strut for proper inflation; there should be 4.5 ±.5 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. The landing light should be clean and intact.

Remove the chock and check the nose gear strut for proper inflation; there should be 3.25 ±.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 and that the oil filler cap has been properly secured. Place a container under the fuel strainer valve located under the fuselage.

Close and secure the nose baggage door.

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 4.5 ±.5 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 supply. The quantity should match the indication that was on the fuel quantity gauge. Replace cap securely. (See RIGHT WING for further fuel system description.) The fuel tank vent should be clear of obstructions. Place a container under the quick drain. Drain enough fuel to verify the proper fuel and 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. Check that the static wicks are firmly attached and in good condition.

EMPENNAGE

Check the condition of any antennas located on the fuselage. All surfaces of the empennage should be examined for damage and operational interference. Fairings and access covers should be attached properly. Check the baggage to be sure it is stowed properly. Check that the lights on the tail are clean and intact. The elevator and rudder should be operational and free from interference of any type. Check the condition of the tabs and insure that all hinges and push rods are sound and operational. If the tail has been tied down, remove the tie down rope.

MISCELLANEOUS

Enter the cockpit and drain the fuel strainer by pressing down on the lever located on the right-hand side of the cabin, below the forward edge of center seat. The fuel selector should be positioned in the following sequence while draining the strainer: "OFF," "LEFT" and "RIGHT." This is done to insure that the fuel in the lines between each tank outlet and the fuel strainer is drained, as well as the fuel in the fuel strainer. When the fuel tanks are full, it will take approximately six seconds to drain all the fuel in one of the lines from a tank to the fuel strainer. If the fuel tanks are less than full, it will take a few seconds longer. After draining the fuel strainer, check for leakage and for water and sediment at the drain under the aircraft with the fuel selector on a tank position.

Turn the master switch "ON" and begin checking the interior lights by turning "ON" the necessary switches. After the interior lights are checked, turn "ON" the pitot heat switch and the exterior light switches. Next, perform a walk-around check on the exterior lights and examine and dispose of the contents in the container placed under the fuel strainer drain.

With 0° flaps check the stall warning horn by moving the inboard lift detector slightly up. Reset the flaps to 25° or 40° and check the outboard lift detector. Check the heated pitot head for proper heating.

CAUTION

Care should be taken when an operational check of the heated pitot head is being performed. The unit becomes very hot. Ground operation should be limited to three minutes maximum to avoid damaging the heating elements.

When all passengers are on board, the pilot should check the cabin doors for proper closing and latching procedures. The rear door should be closed, and the overhead latch button turned to the "LOCK" position. The front door should be gently pulled shut, the door handle firmly latched and the overhead latch button turned to the "LOCK" position. Seat belts on empty seats should be snugly fastened. All passengers should fasten their seat belts and shoulder harnesses.

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.

4.9 BEFORE STARTING ENGINE

Before starting the engine, the brakes should be set 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 all the circuit breakers are in and the radios are OFF.

4.11 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 for approximately 4 seconds. 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 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 retard the throttle.

(d) Starting Engine With External Power Sources

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 determine 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.

4.13 WARM-UP

Warm up the engine at 1000 to 1200 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 and the engine is warm.

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.

4.15 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 chocks have been removed and that propeller back blast and taxi areas are clear. Release the parking brake.

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.

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4.17 GROUND CHECK

Set the parking brake. 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 4.8" Hg. to 5.2" 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 briefly 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 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.

4.19 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 latching the emergency gear lever in the OVERRIDE ENGAGED position. If desired, the OVERRIDE ENGAGED position can be selected and latched 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.

If the airplane is to be operated with the rear cabin door removed, it is recommended that all passengers wear parachutes.

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 and check the engine gauges. The alternate air should be in the CLOSED position.

All seat backs should be erect.

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

The mixture and propeller control levers should be set, and the seat belts and shoulder harness should be 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 and the parking brake released. On air conditioned models, the air conditioner must be OFF to insure normal takeoff performance.

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.

4.21 TAKEOFF

NORMAL TECHNIQUE (See Chart, Section 5)

When the available runway length is well in excess of that required and obstacle clearance is no factor, the normal takeoff technique may be used. The flaps should be set in the retracted position and the pitch trim set slightly aft of neutral. Align the airplane with the runway, apply full power, and accelerate to 74 to 80 KIAS depending on weight. Apply back pressure to the control wheel to lift off, then control pitch attitude as required to attain the desired climb speed. Retract the landing gear when a straight-ahead landing on the runway is no longer possible.

MAXIMUM PERFORMANCE WITH FLAPS RETRACTED (See Chart, Section 5)

Align the airplane with the runway, set the brakes, adjust the pitch trim slightly aft of neutral, and advance the throttle to full power. Release the brakes and allow the airplane to accelerate to 63 to 68 KIAS, depending on weight, and apply back pressure to rotate for lift off. After breaking ground, accelerate to 67 to 74 KIAS, depending on weight, and retract the gear*. When clear of obstacles, increase the climb speed to that desired.

SHORT FIELD TECHNIQUE (See Chart, Section 5)

For short or soft field takeoff, flaps should be lowered to 25° and the pitch trim set slightly aft of neutral. Align the airplane with the runway, set the brakes, and advance the throttle to full power.

Release the brakes, allow the airplane to accelerate to 58 to 66 KIAS depending on weight, and apply back pressure to rotate for lift off. After breaking ground, accelerate to 61 to 71 KIAS depending on weight, and select gear UP*. Continue to climb while accelerating to the flaps up best rate-of-climb speed, 91 KIAS, if no obstacle is present, or to the flaps up best angle-of-climb speed, 80 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 latched 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 onto 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.

4.23 CLIMB

The best rate of climb at gross weight will be obtained at 91 KIAS. The best angle of climb may be obtained at 80 KIAS. At lighter than gross weight these speeds are reduced somewhat*. For climbing en route, a speed of 105 KIAS is recommended. This will produce better forward speed and increased visibility over the nose during the climb.

Upon reaching a safe 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 5000 feet 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.

4.25 CRUISING

The cruising speed 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 2300, 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 under 5000 feet.

*To obtain the performance presented in the Performance Section of this handbook, all parameters listed on the performance charts must be followed.

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 postion.

During flight, keep account of time and fuel used in connection with power settings to determine how the fuel flow and fuel quantity gauge 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 the fullest tank and the electric fuel pump switched to the ON position.

4.27 APPROACH AND LANDING

Accomplish the Landing Check List early in the landing approach.

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.

Depending on field length and other factors the following procedures are appropriate:

NORMAL TECHNIQUE (No Performance Chart Furnished)

When available runway length is in excess of required runway length, a normal approach and landing technique may be utilized. The aircraft should be flown down the final approach course at 95 KIAS with power required to maintain the desired approach angle. The amount of flap used during approach and landing and the speed of the aircraft at contact with the runway should be varied according to the landing surface, conditions of wind and aircraft loading. It is generally good practice to contact the ground at the minimum possible safe speed consistent with existing conditions. As landing distances with this technique will vary, performance charts are not furnished.

SHORT FIELD LANDING APPROACH POWER OFF (See Chart, Section 5)

When available runway length is minimal or obstacle clearance to landing is of major concern, this approach/landing technique may be employed. The aircraft should be flown on the final approach at 79 KIAS with full flaps, gear down and idle power. The glide path should be stabilized as early as possible. Reduce the speed slightly during landing flareout and contact the ground close to stall speed. After ground contact, retract the flaps and apply full aft travel on the control wheel and maximum braking consistent with existing conditions.

4.29 GO-AROUND

To initiate a go-around from a landing approach, the prop control should be set to full INCREASE and the throttle should be advanced to full throttle while the pitch attitude is increased to obtain the balked landing climb speed of 80 KIAS. Retract the landing gear and slowly retract the flaps when a positive climb is established. Allow the airplane to accelerate to the best angle of climb speed (80 KIAS) for obstacle clearance or to the best rate of climb speed (91 KIAS) if obstacles are not a factor. Reset the longitudinal trim as required.

4.31 STOPPING ENGINE

Prior to shutdown, all radio and electrical equipment should be turned OFF.

At the pilot's discretion, the flaps should be raised and the electric fuel pump turned OFF.

NOTE

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

The air conditioner 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

Set the parking brake. 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 Saratoga SP 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 with power off and full flaps is 57 KIAS. With the flaps up this speed is increased 3 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, setting the flaps to 25° or 40° and raising the outboard lift detector to determine if the horn is actuated. The flaps should then be reset to 0° and the inboard lift detector raised to determine if the horn is actuated.

4.37 TURBULENT AIR OPERATION

In keeping with good operating practice used in all aircraft, it is recommended that when turbulent air is encountered or expected, 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 the conditions.

4.39 LANDING GEAR

Some aircraft are equipped with an airspeed - power sensing system (backup 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 latch down. To release the override, pull lever up to disengage the latch, then release lever.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 throttle is not full power.

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.

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

WARNING

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

*Approximately 103 KIAS at any altitude, power off.

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 (Par. 3.29) is performed for training purposes, the following changes must be made to the procedure in order 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. The circuit breaker must be reset after completion of the 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 Saratoga SP is provided in this section.

Performance information associated with those optional systems and equipment which require handbook supplements is provided in 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 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 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 purposes.

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5.5 FLIGHT PLANNING EXAMPLE

For purposes of this example it is assumed that a 2 blade propeller is installed on the airplane.

(a) Aircraft Loading

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

The basic empty weight for the airplane as licensed at the factory has been entered in Figure 6-5. If any alterations to the airplane have been made affecting weight and balance, reference to the aircraft logbook and Weight and Balance Record (Figure 6-7) should be made to determine the current basic empty weight and C.G. location of the airplane.

Make use of 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.

After proper utilization of the information provided the following weights have been determined for consideration in the flight planning example.

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	2100 lbs.
(1)	Occupants (6 x 170 lbs.)	1020 lbs.
(3)	Baggage and Cargo	60 lbs.
(4)	Fuel (6 lb/gal. x 50)	300 lbs.
(5)	Takeoff Weight	3480 lbs.
(6)	Landing Weight (a)(5) minus (g)(1), (3480 lbs. minus 180 lbs.)	3300 lbs.

The takeoff weight is below the maximum of 3600 lbs. and the weight and balance calculations have determined the C.G. position within the approved limits.

(b) Takeoff and Landing

After determining the aircraft loading, all aspects of the takeoff and landing must be considered.

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

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff Performance and Takeoff Ground Roll graph (Figures 5-7, 5-9, 5-11, 5-13, 5-15 and 5-17) to determine the length of runway necessary for the takeoff and/or the barrier distance.

The landing distance calculations are performed in the same manner using the 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 flight have fallen well below the available runway lengths.

	Departure Airport	Destination Airport
(1) Pressure Altitude	1200 ft.	400 ft.
(2) Temperature	16°C	24°C
(3) Wind Component	10 KTS Headwind	5 KTS
(4) Runway Length Available	3000 ft.	4600 ft.
(5) Runway Required	1700 ft.*	1490 ft.**

*reference Figure 5-15
**reference Figure 5-45

NOTE

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

(c) Climb

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

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Distance, and Time to Climb graph (Figure 5-25). After the fuel, distance and time for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to graph (Figure 5-25). Now, 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, distance and time 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 the flight planning example.

(1) Cruise Pressure Altitude	6000 ft.
(2) Cruise OAT	6° C
(3) Time to Climb (8 min. minus 1.5 min.)	6.5 min.*
(4) Distance to Climb (11.5 nautical miles minus 2 nautical miles)	9.5 nautical miles*
(5) Fuel to Climb (3.5 gal minus .5 gal.)	3 gal.*

*reference Figure 5-25

(d) Descent

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

Utilizing the cruise pressure altitude and OAT, determine the basic fuel, distance and time for descent (Figure 5-41). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, distance and time values from the graph (Figure 5-41). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true fuel, distance and time values needed for the flight plan.

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

(1) Time to Descend (12 min. minus 1 min.)	11 min*
(2) Distance to Descend (28 nautical miles minus 2 nautical miles)	26 nautical miles*
(3) Fuel to Descend (3 gal. minus 0.5 gal.)	2.5 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 appropriate Avco Lycoming Operator's Manual and the Power Setting Table (Figure 5-27) 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 Speed Power graph (Figure 5-31).

Calculate the cruise fuel consumption for the cruise power setting from the information provided by the Avco Lycoming Operator's Manual.

*reference Figure 5-41

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 consumption by the cruise time.

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

(1) Total Distance	291.5 nautical miles
(2) Cruise Distance (e)(1) minus (c)(4) minus (d)(2), (291.5 nautical miles minus 9.5 nautical miles minus 26 nautical miles)	256 nautical miles
(3) Cruise Power	65% (economy)
(4) Cruise Speed	144.5 KTS TAS*
(5) Cruise Fuel Consumption	13.8 GPH
(6) Cruise Time (e)(2) divided by (e)(4), (256 nautical miles divided by 144.5 KTS)	1.77 hrs. (1 hr. 46 min.)
(7) Cruise Fuel (e)(5) multiplied by (e)(6), (13.8 GPH multiplied by 1.77 hrs.)	24.5 gal.

(f) Total Flight Time

The total flight time is determined by adding the time to climb, the time to descend and the cruise time. Remember! 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), (.11 hrs. plus .18 hrs. plus 1.77 hrs.)	2.06 hrs.
(6.5 min. plus 11 min. plus 1 hr. 46 min.)	2 hrs. 3.5 min.

*reference Figure 5-31

(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),	
(3.0 gal. plus 2.5 gal. plus 24.5 gal.)	30.0 gal.
(30.0 gal. multiplied by 6 lb/gal.)	180.0 lbs.

5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

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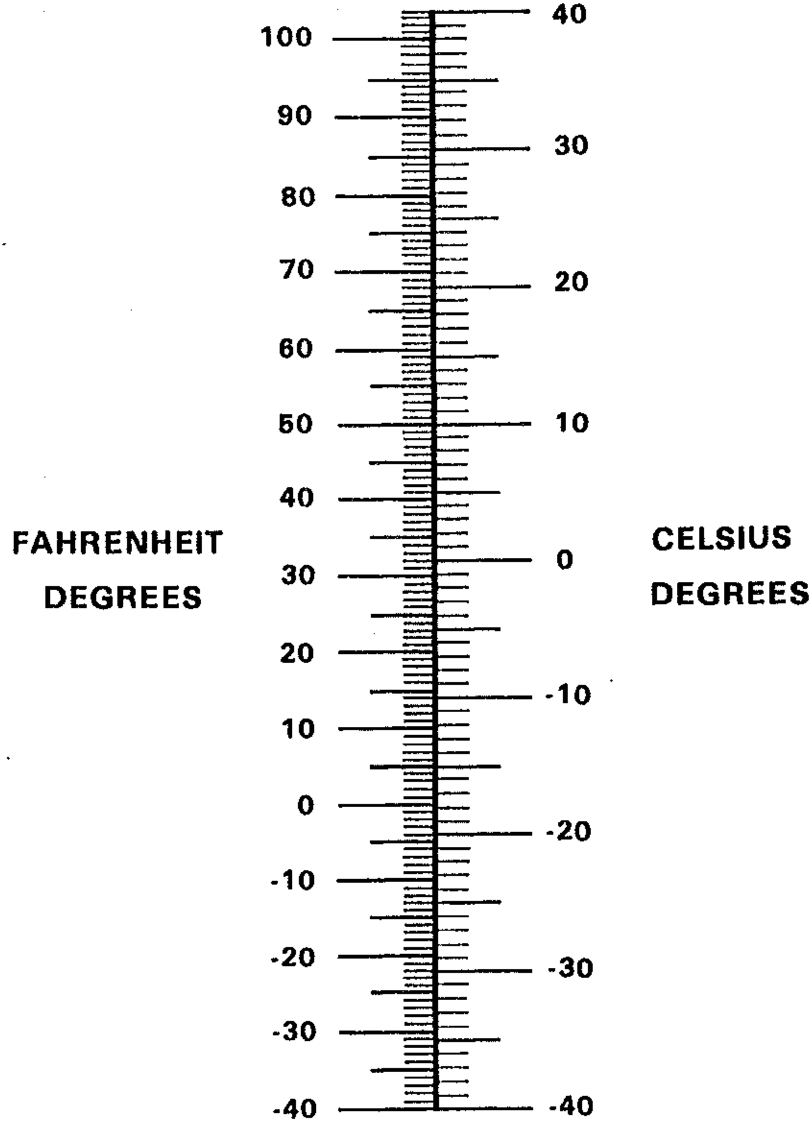
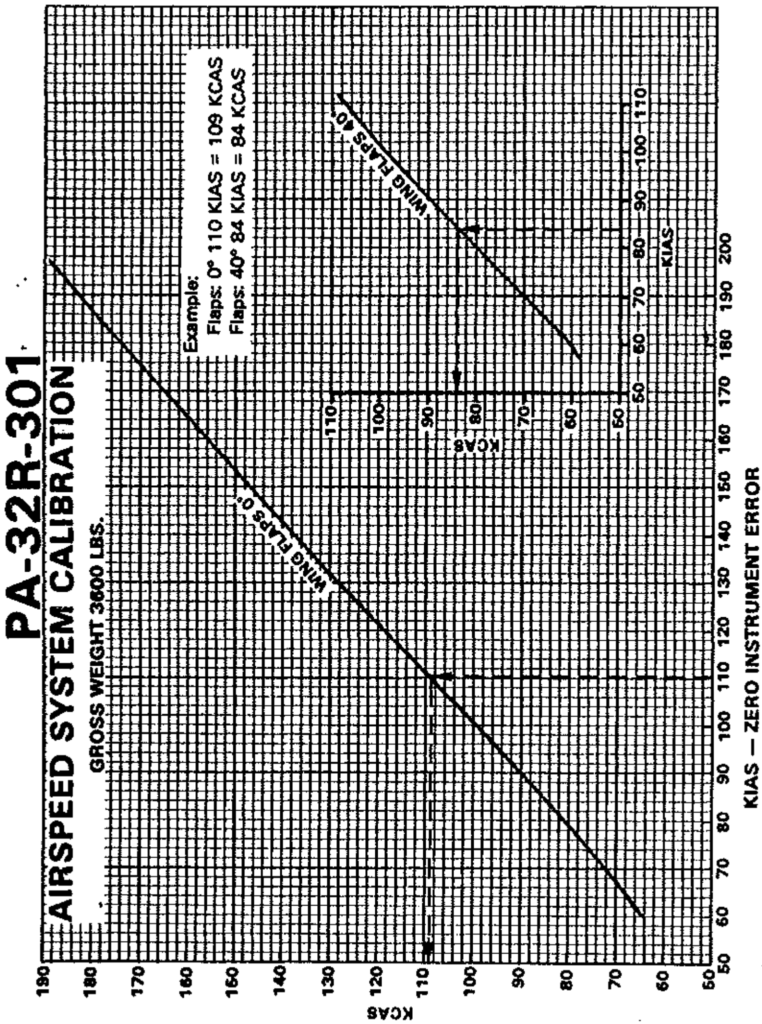
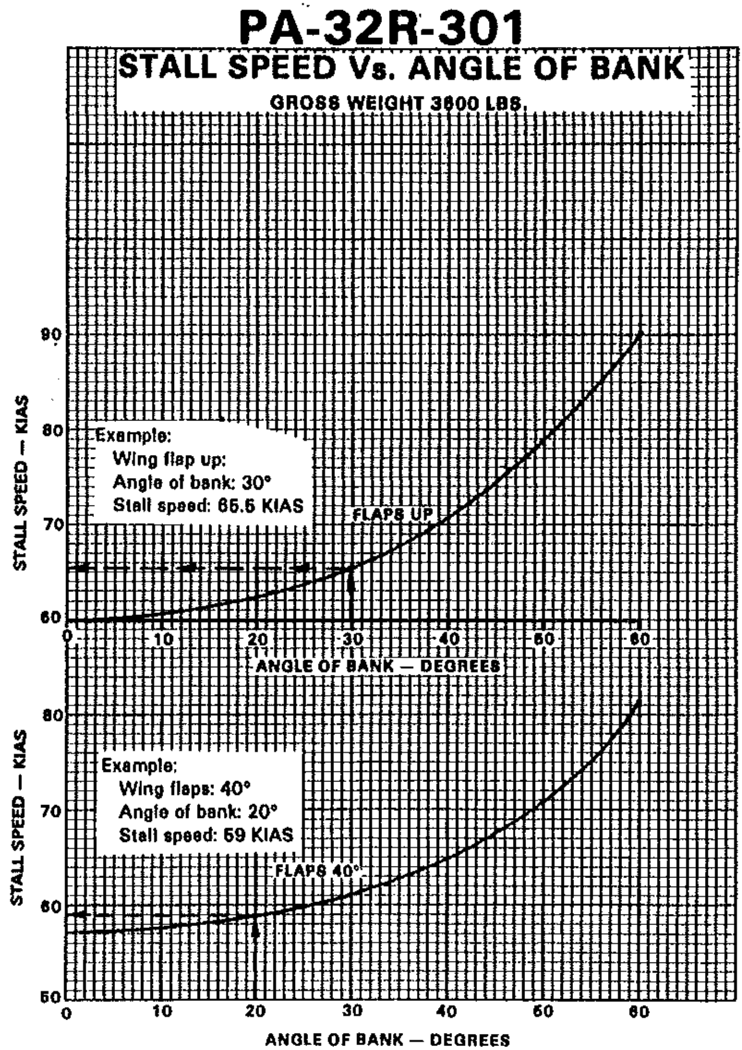


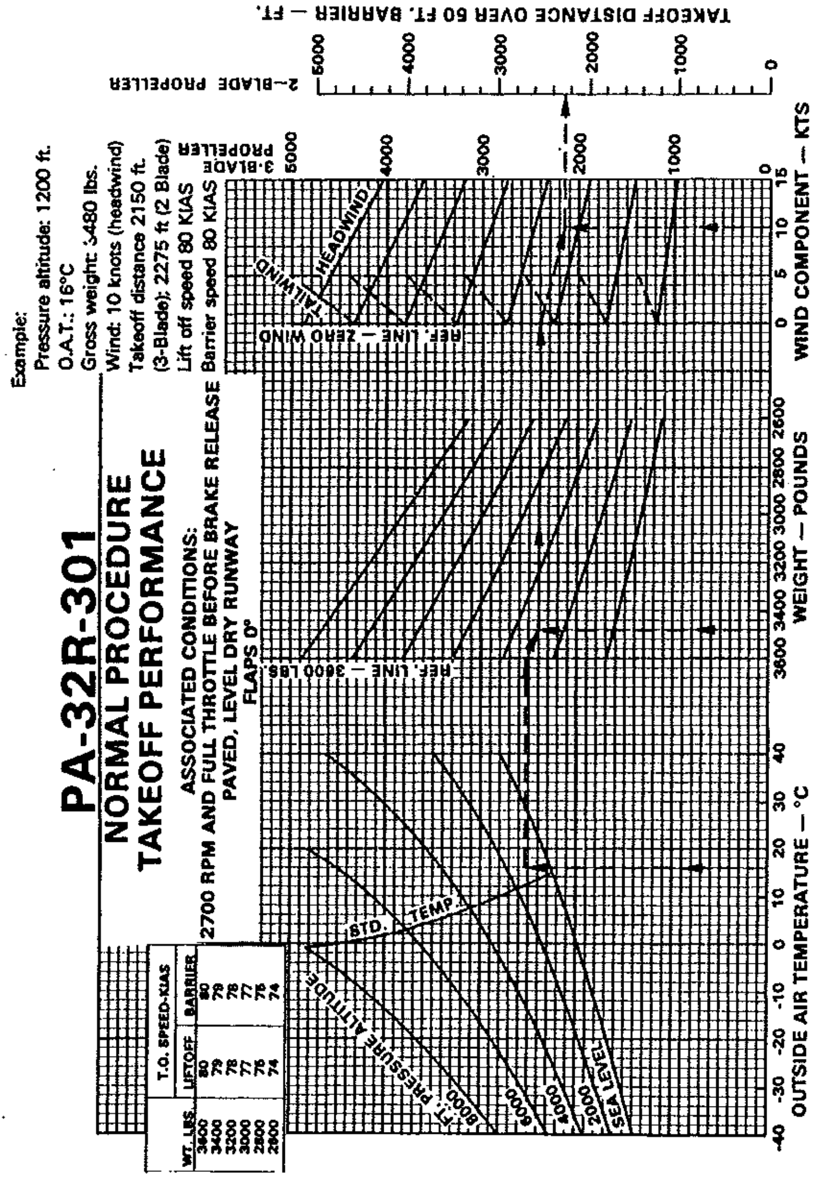
TEMPERATURE CONVERSION
Figure 5-1



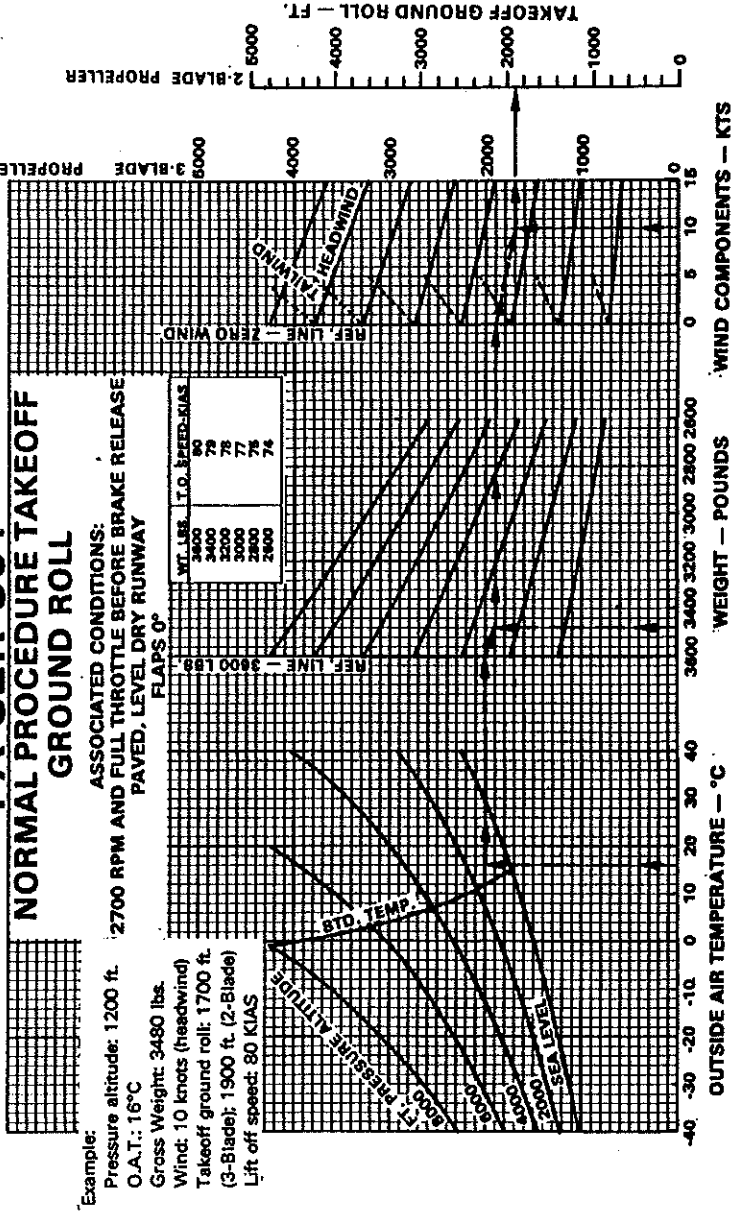
AIRSPEED SYSTEM CALIBRATION
Figure 5-3



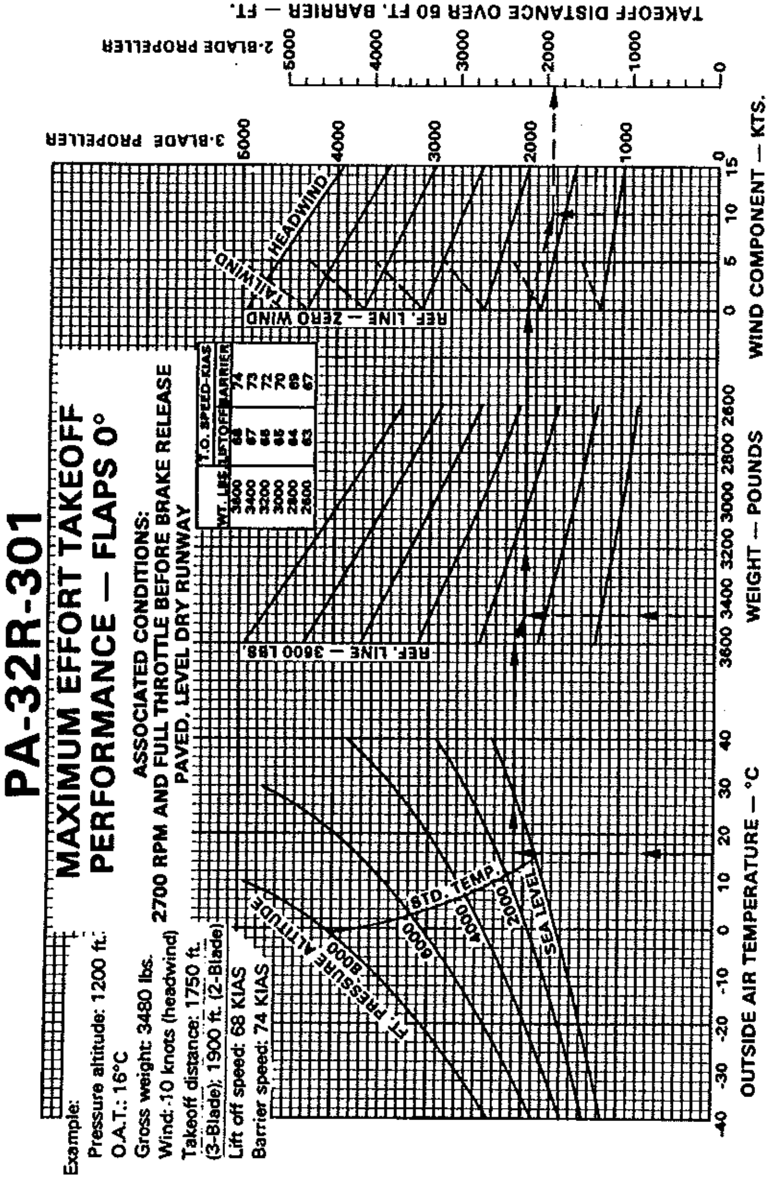
STALL SPEED VERUS ANGLE OF BANK
Figure 5-5



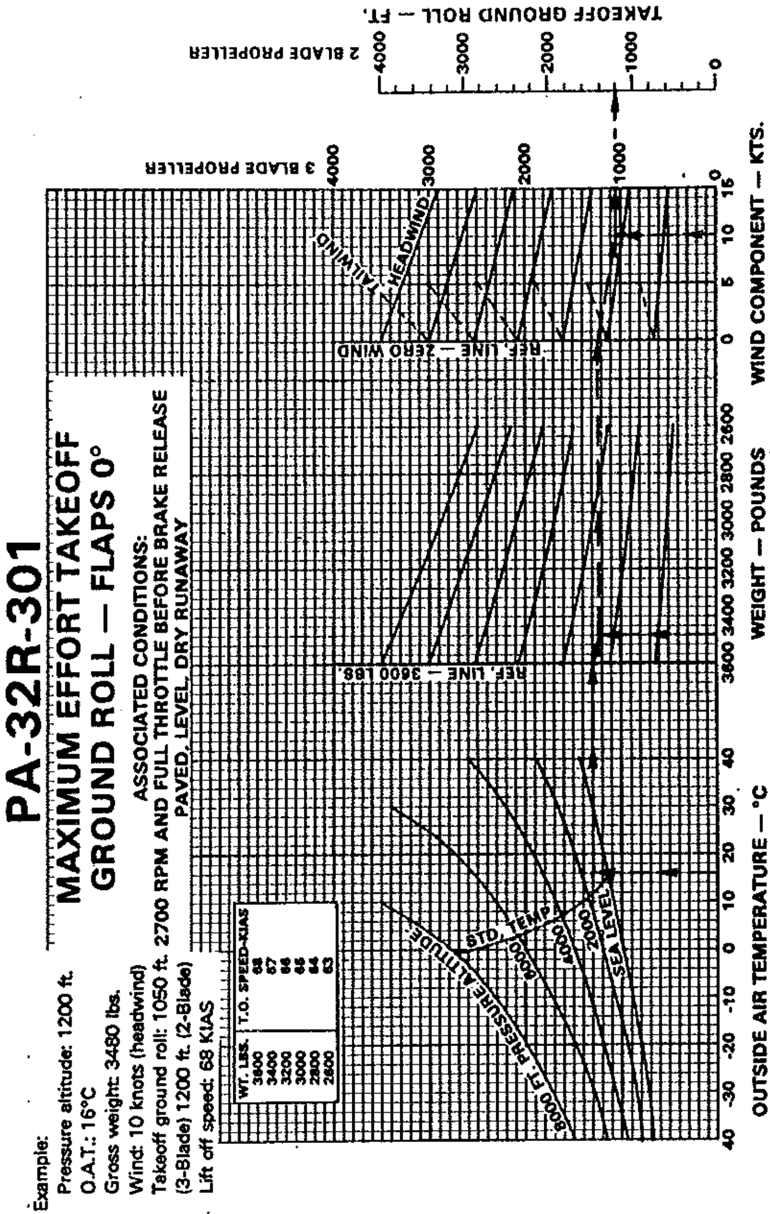
NORMAL PROCEDURE TAKEOFF PERFORMANCE
Figure 5-7



NORMAL PROCEDURE TAKEOFF GROUND ROLL
Figure 5-9

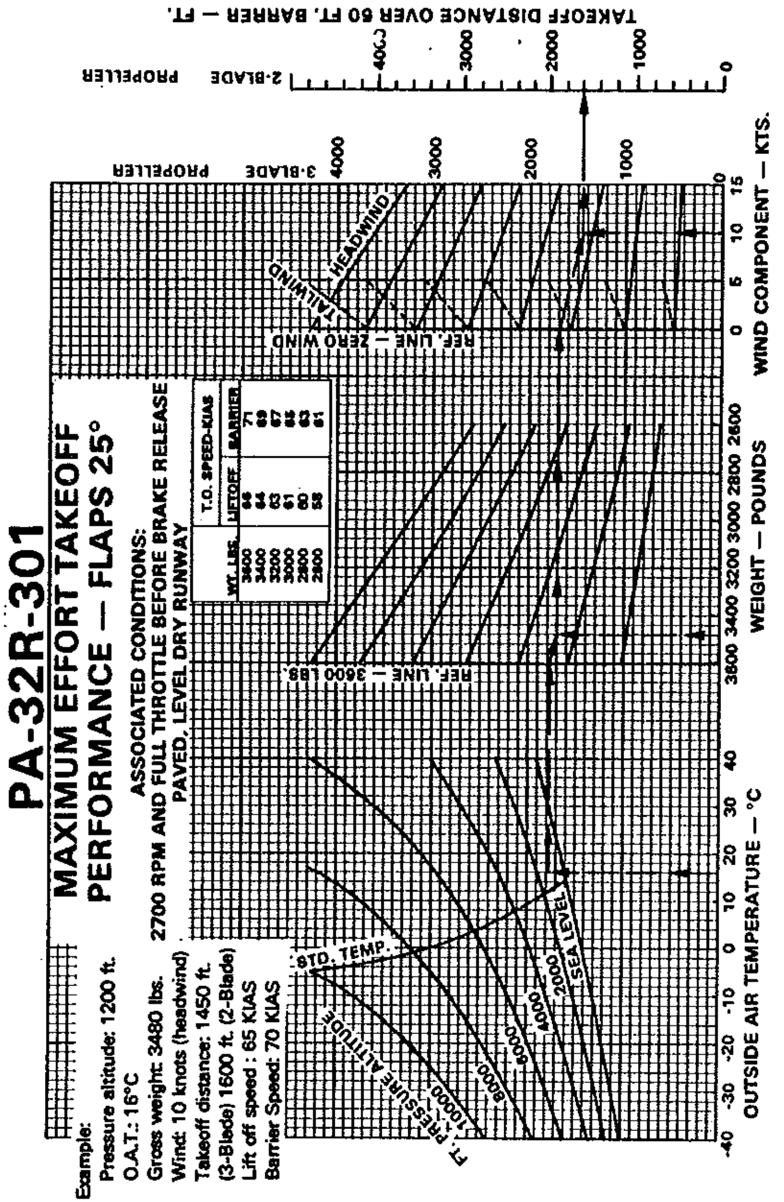


MAXIMUM EFFORT TAKEOFF PERFORMANCE - FLAPS 0°
Figure 5-11

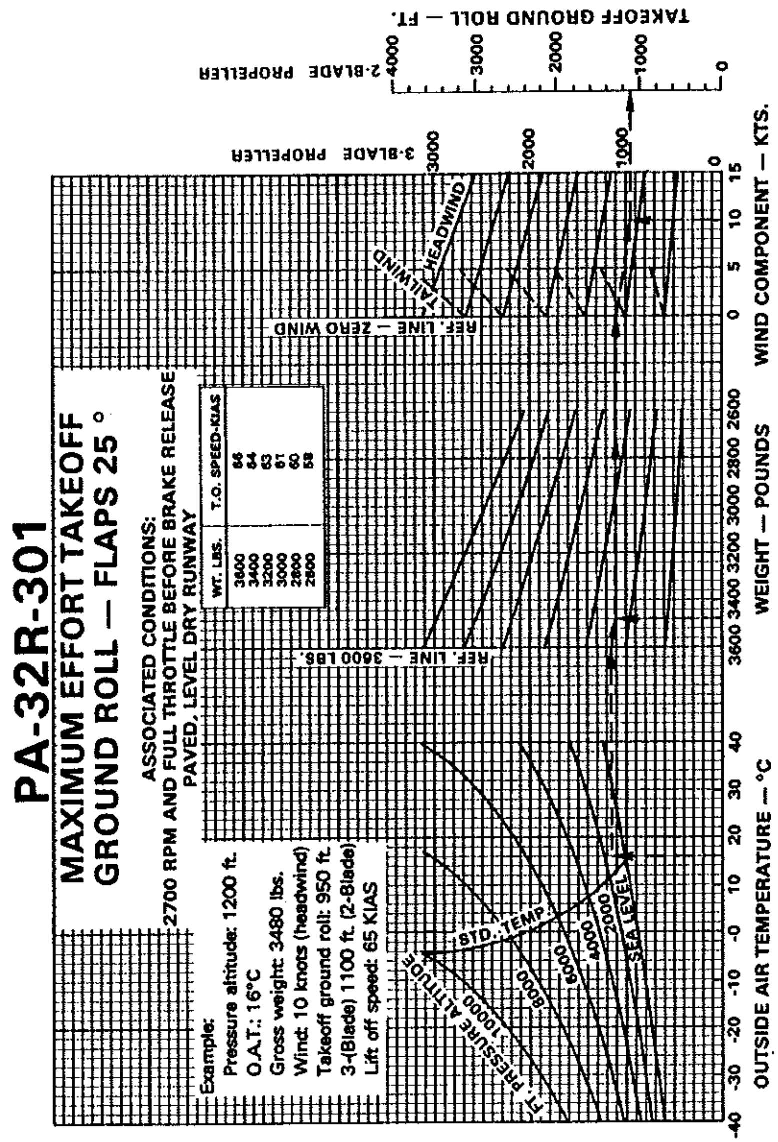


MAXIMUM EFFORT TAKEOFF GROUND ROLL — FLAPS 0°

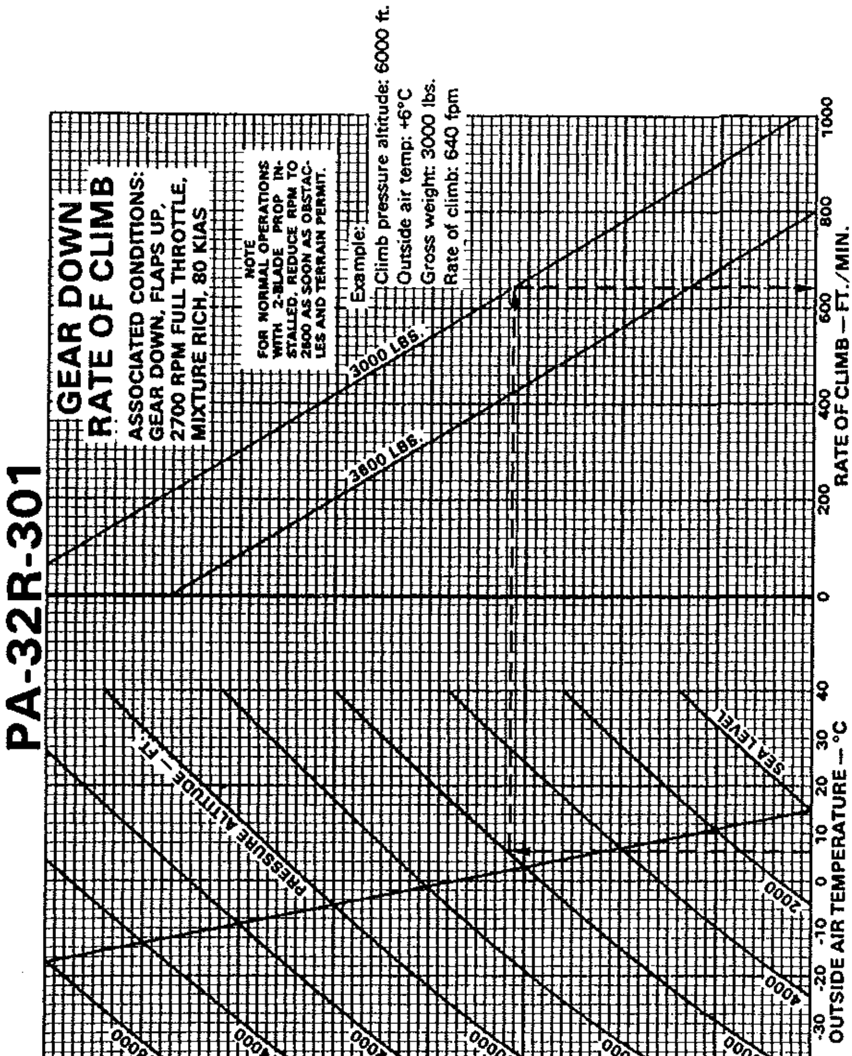
Figure 5-13



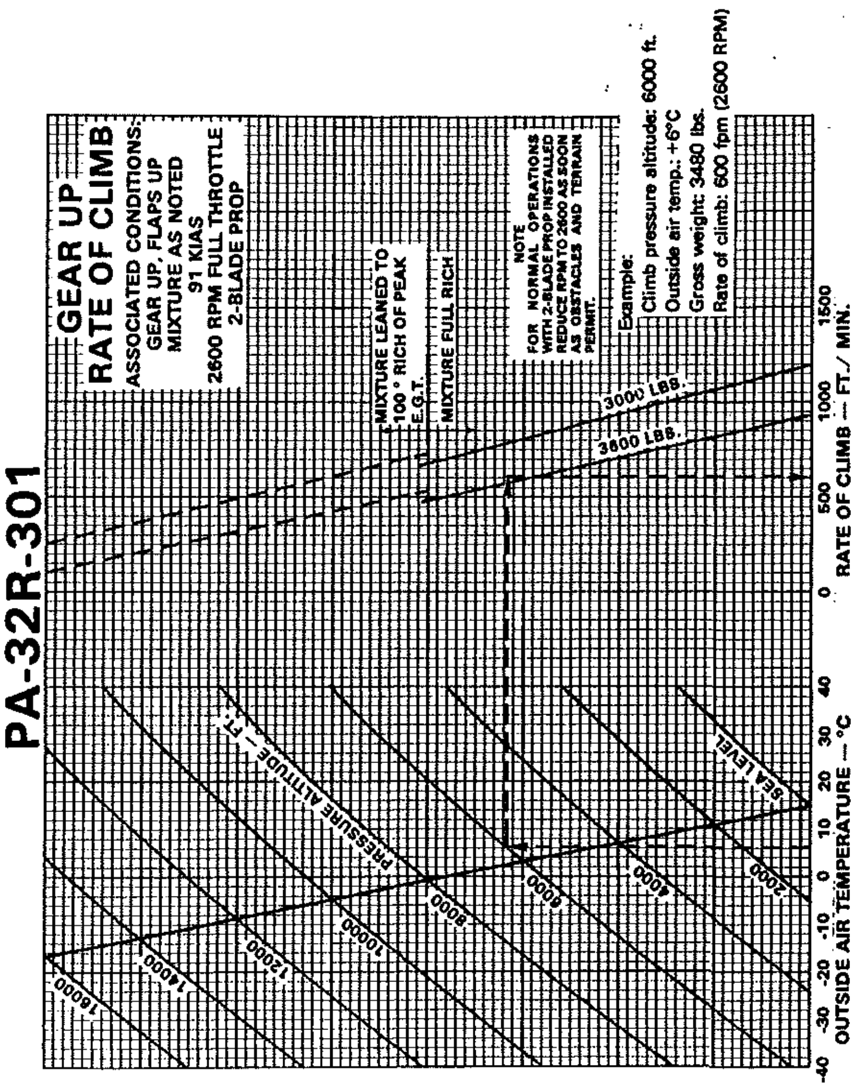
MAXIMUM EFFORT TAKEOFF PERFORMANCE - FLAPS 25°
Figure 5-15



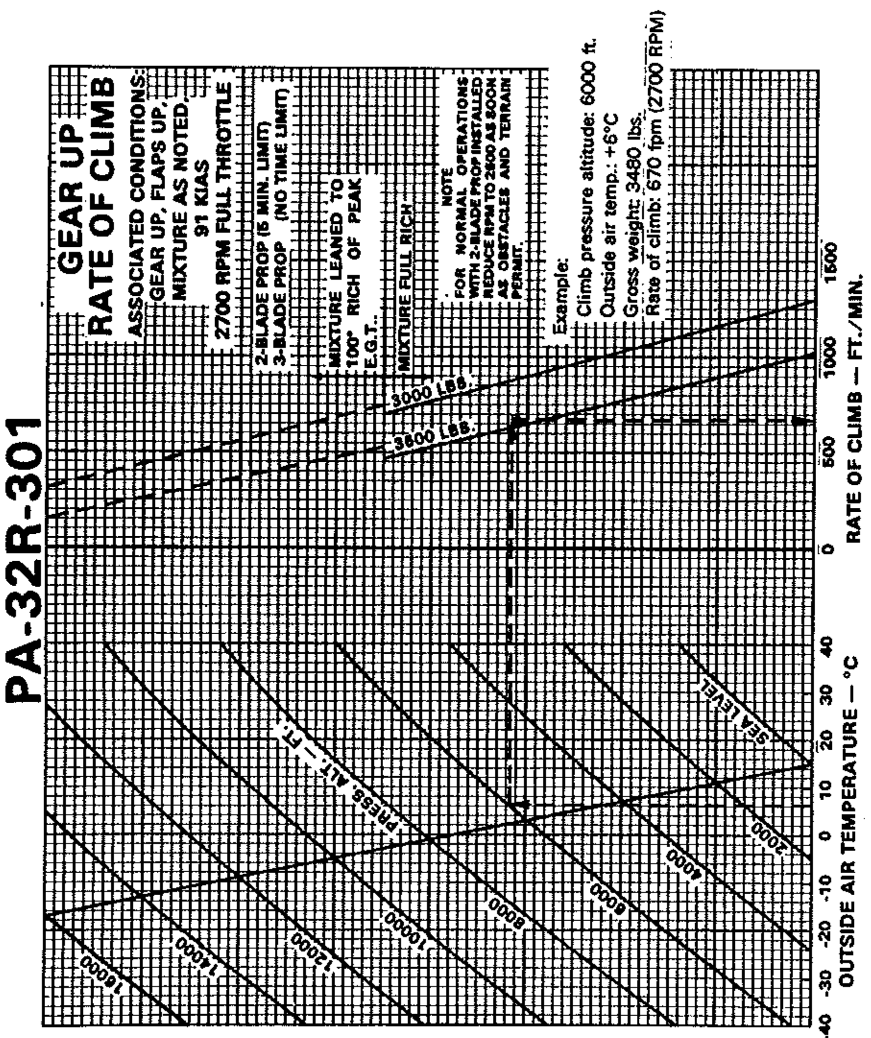
MAXIMUM EFFORT TAKEOFF GROUND ROLL — FLAPS 25°
Figure 5-17



GEAR DOWN RATE OF CLIMB
Figure 5-19

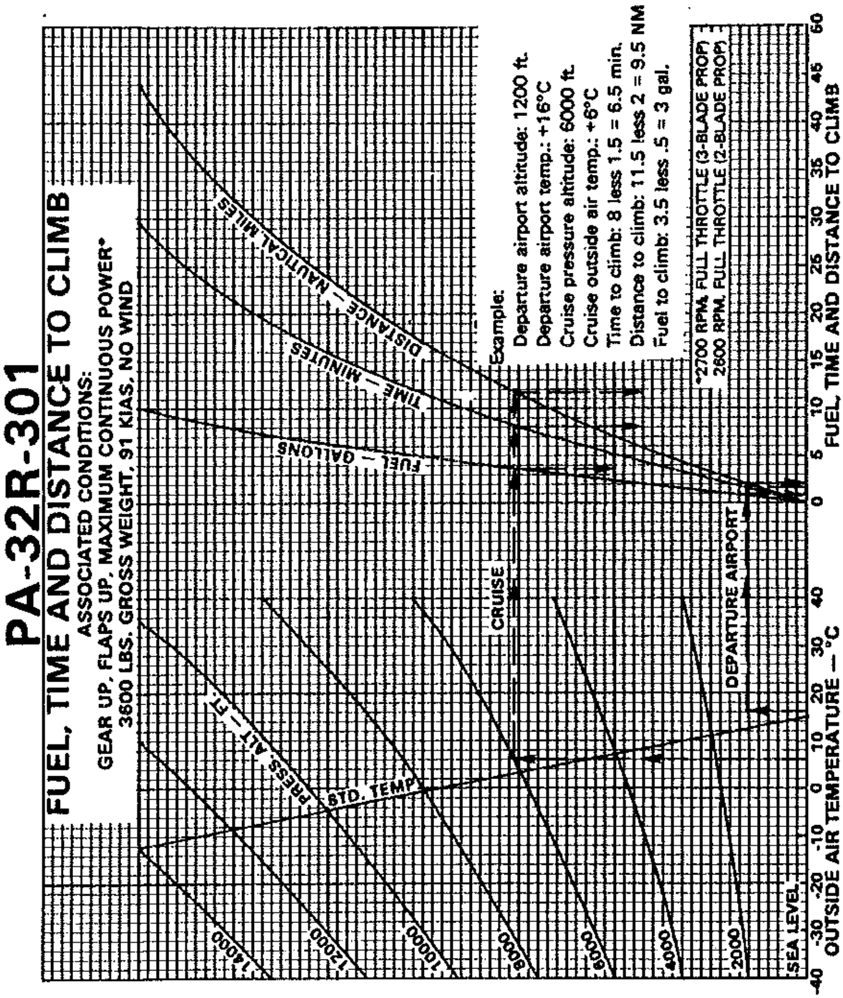


GEAR UP RATE OF CLIMB (2 BLADE PROPELLER - 2600 RPM)
Figure 5-21



GEAR UP RATE OF CLIMB (2 BLADE PROPELLER - 5 MIN LIMIT) (3 BLADE PROPELLER — NO TIME LIMIT)

Figure 5-23



FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-25

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LYCOMING MODEL IO-540-K, -L, -M SERIES, 300 HP ENGINE

Press. Alt. Feet	Std. Alt. Temp. °C	165 HP — 55% Rated, Approx. fuel 11.9 gal/hr., RPM & MAN. PRESS.				195 HP — 65% Rated, Approx. fuel 13.8 gal/hr., RPM & MAN. PRESS.				225 HP — 75% Rated, Approx. fuel 16.0 gal/hr., RPM & MAN. PRESS.		
		2100	2200	2300	2400	2100	2200	2300	2400	2200	2300	2400
SL	15	22.5	21.8	21.2	20.7	25.6	24.7	23.8	23.2	27.6	26.6	25.8
1000	13	22.3	21.6	21.0	20.5	25.3	24.4	23.5	22.9	27.3	26.3	25.5
2000	11	22.1	21.4	20.7	20.2	25.1	24.2	23.3	22.7	27.1	26.1	25.2
3000	9	21.9	21.2	20.5	20.0	24.8	23.9	23.0	22.5	26.8	25.8	24.9
4000	7	21.7	21.0	20.3	19.8	24.6	23.7	22.8	22.2	26.5	25.6	24.6
5000	5	21.5	20.8	20.1	19.6	24.3	23.5	22.5	22.0	—	25.3	24.4
6000	3	21.3	20.6	19.8	19.3	24.0	23.2	22.3	21.7	—	25.0	24.1
7000	1	21.0	20.4	19.6	19.1	23.7	22.9	22.0	21.5	—	—	23.8
8000	-1	20.8	20.2	19.4	18.9	—	22.5	21.8	21.2			
9000	-3	20.6	20.0	19.2	18.6	—	—	21.5	21.0			
10,000	-5	20.4	19.8	19.0	18.4	—	—	21.2	20.7			
11,000	-7	20.2	19.6	18.7	18.2	—	—	—	20.4			
12,000	-9	20.0	19.4	18.5	18.0							
13,000	-11	—	19.2	18.3	17.7							
14,000	-13	—	—	18.0	17.3							
15,000	-15	—	—	—	16.9							

To maintain constant power, correct manifold pressure approximately 0.16" Hg for each 5°C variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperature above standard; subtract for temperature below standard.

POWER SETTING TABLE
Figure 5-27

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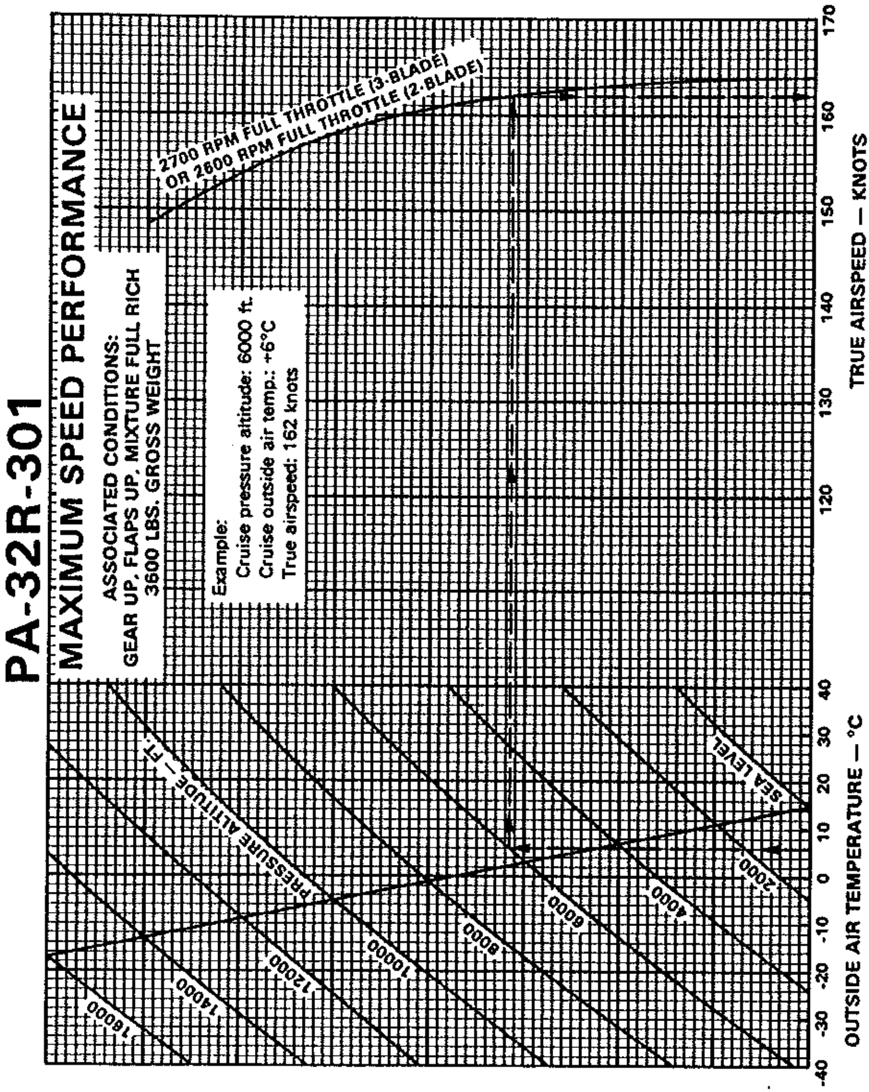
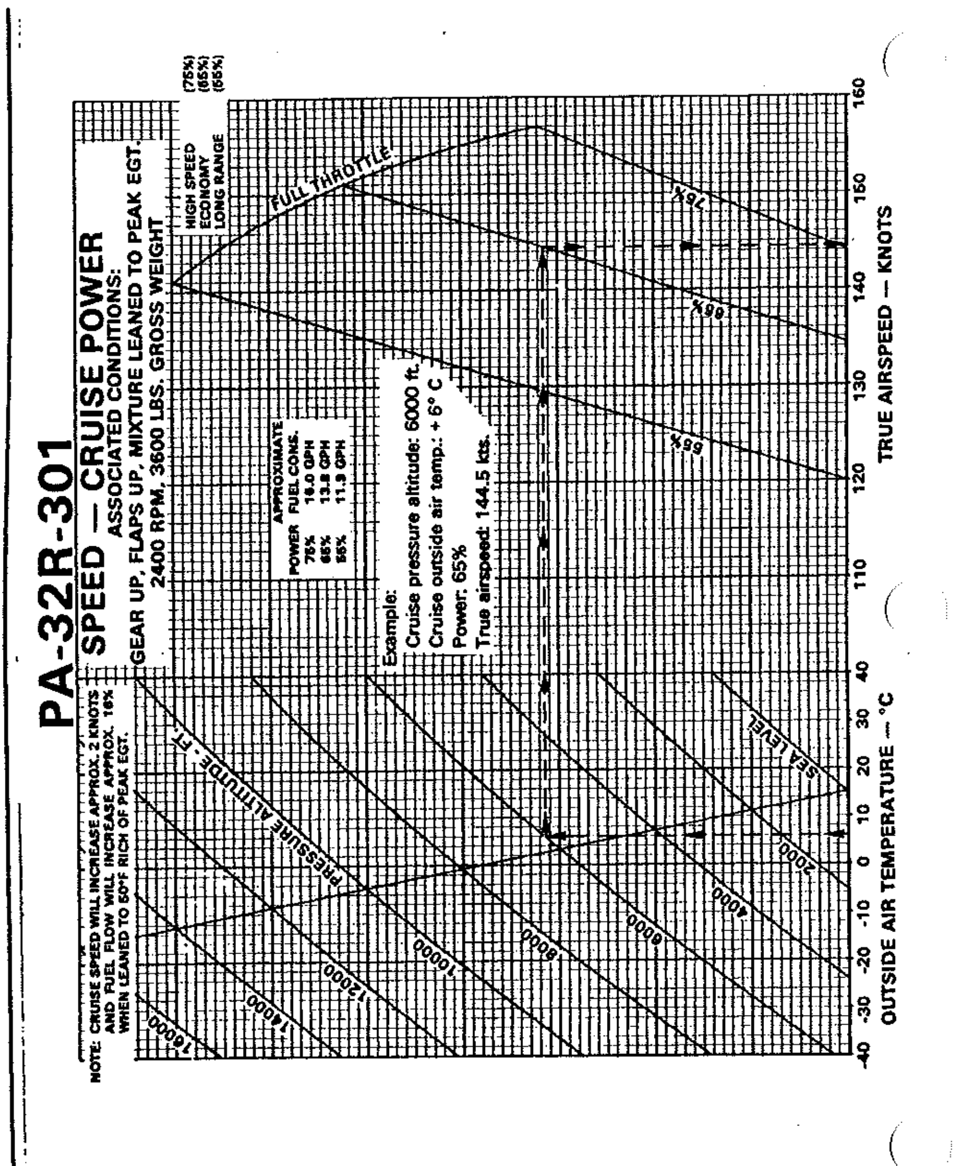


MAXIMUM SPEED - PERFORMANCE
Figure 5-29



SPEED - CRUISE POWER
Figure 5-31

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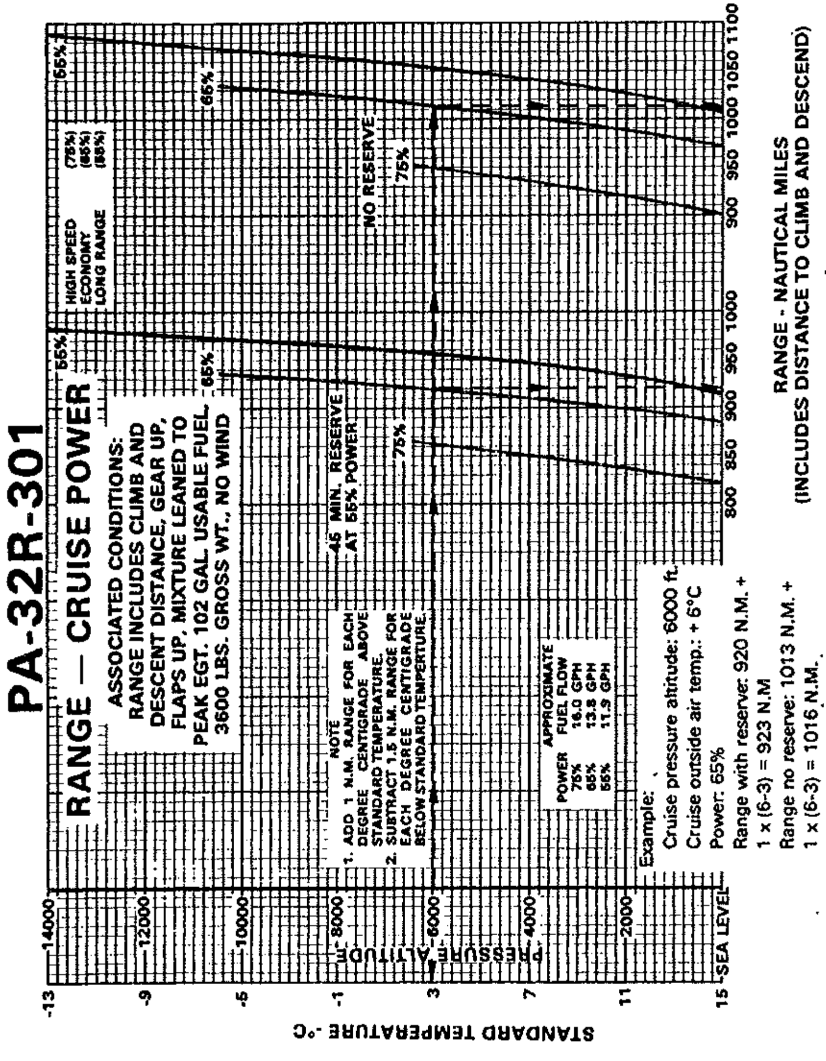
Figure 5-33



RANGE - CRUISE POWER
Figure 5-35

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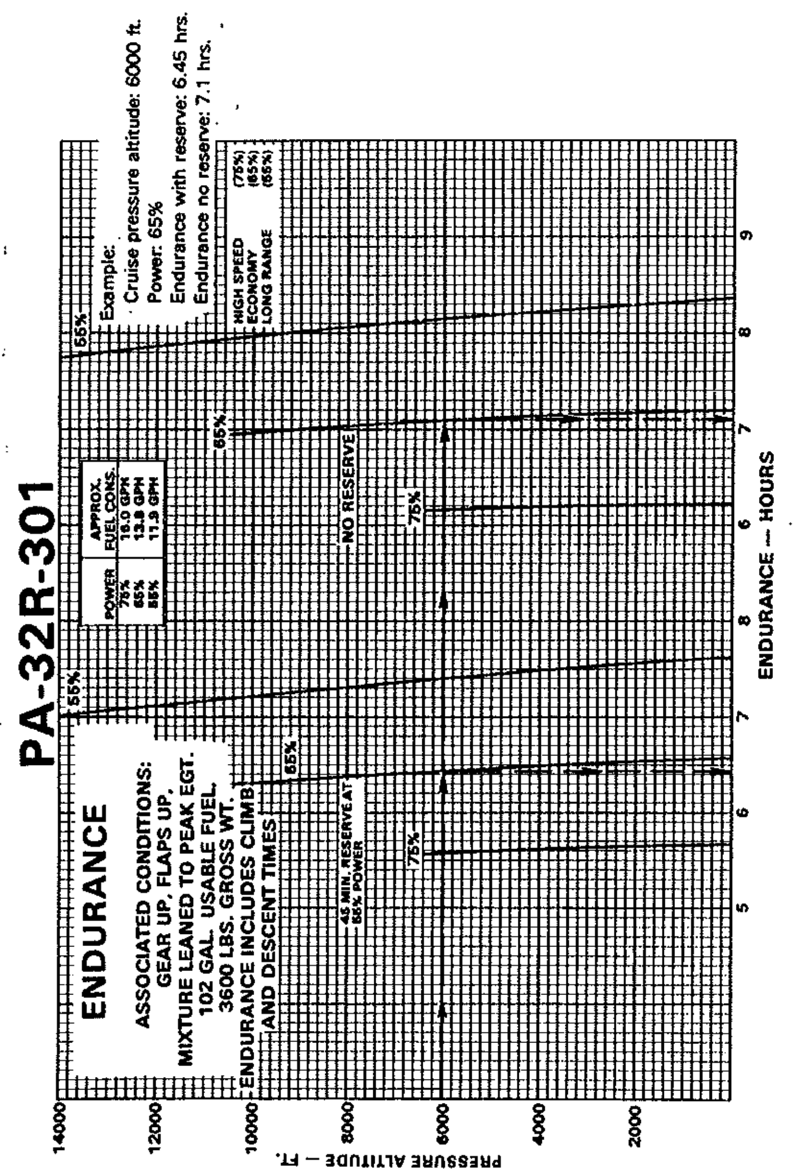
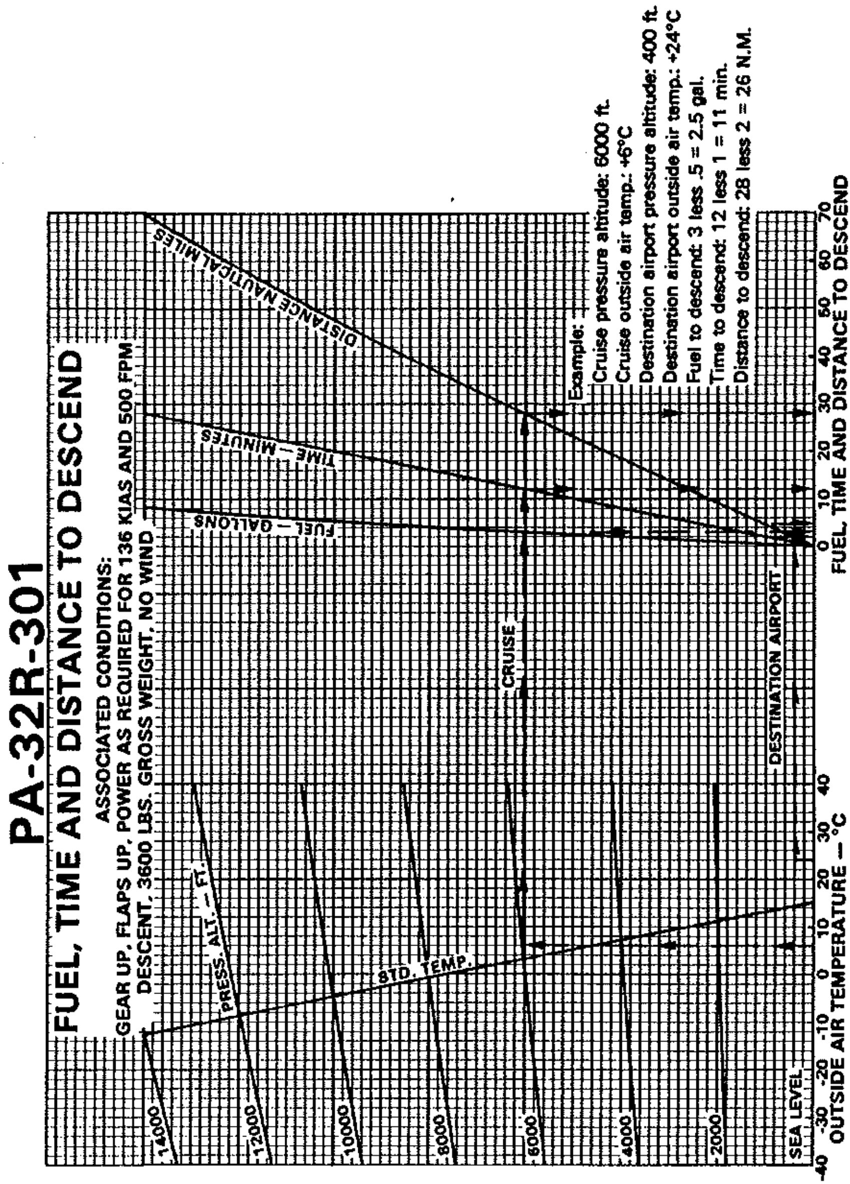
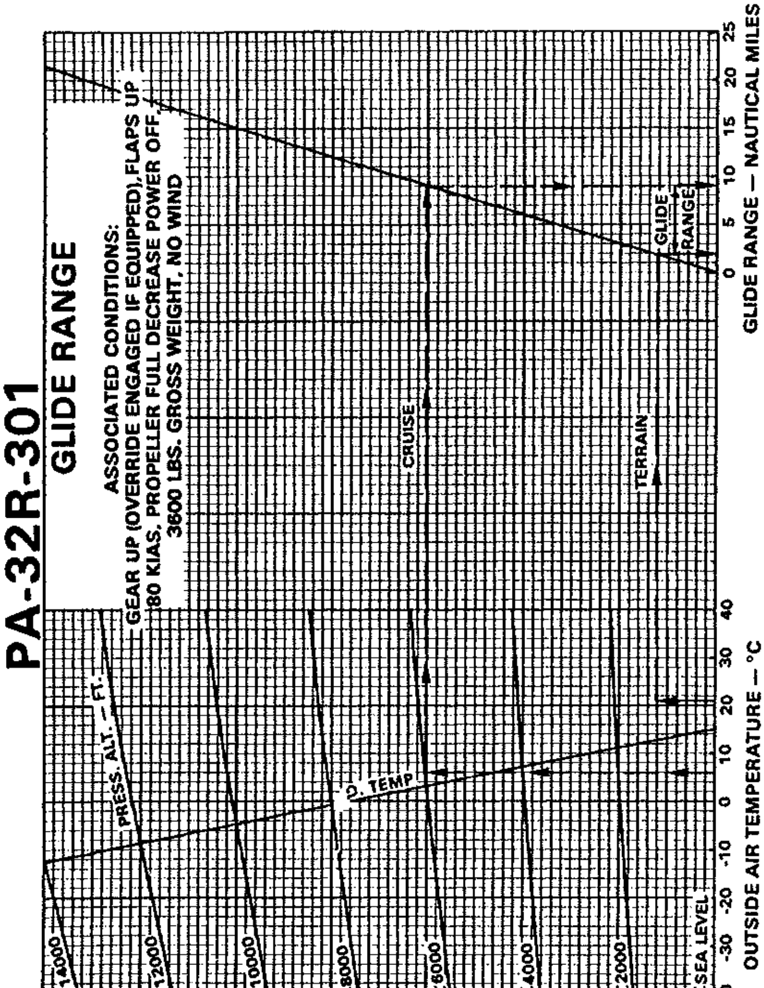
Figure 5-37



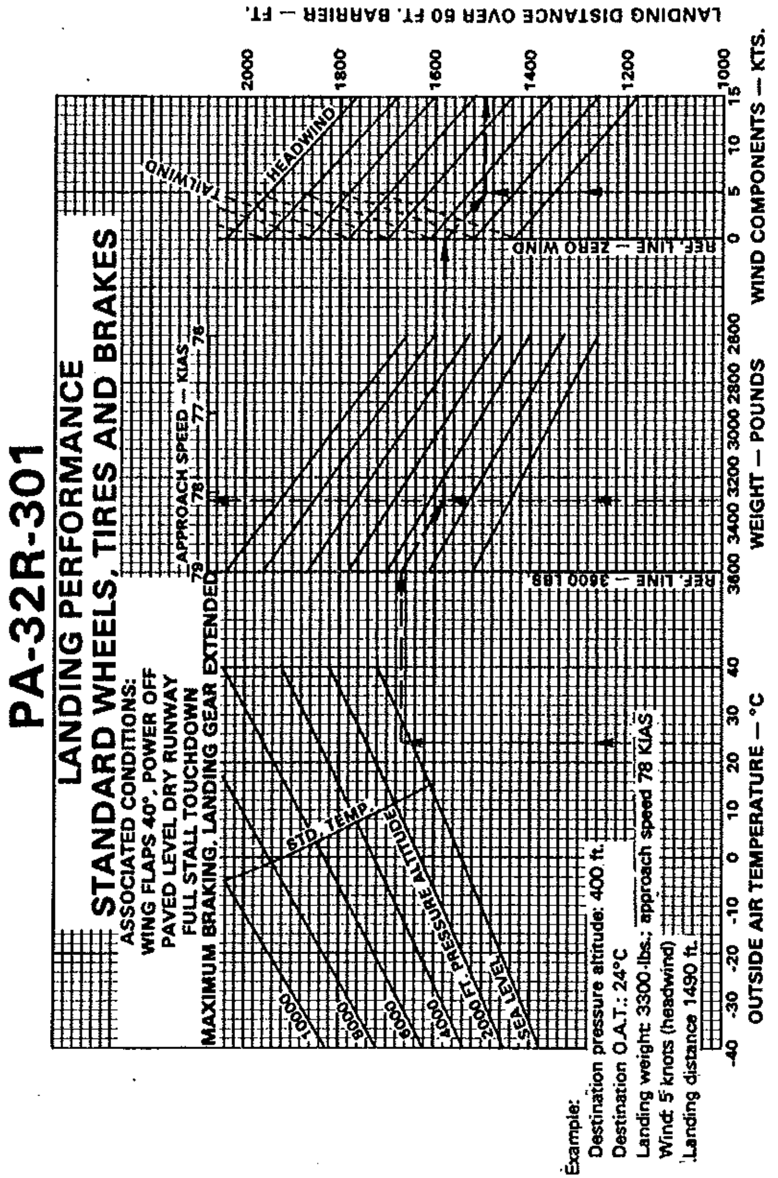
ENDURANCE
Figure 5-39



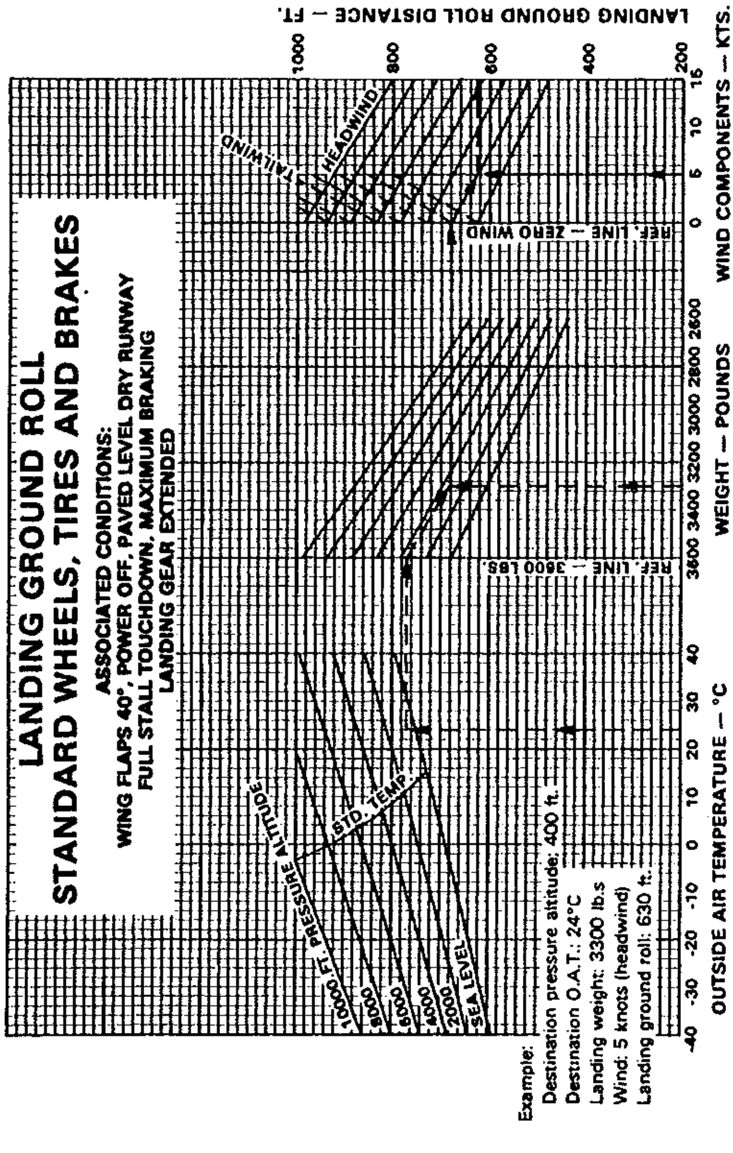
FUEL, TIME, AND DISTANCE TO DESCEND
Figure 5-41



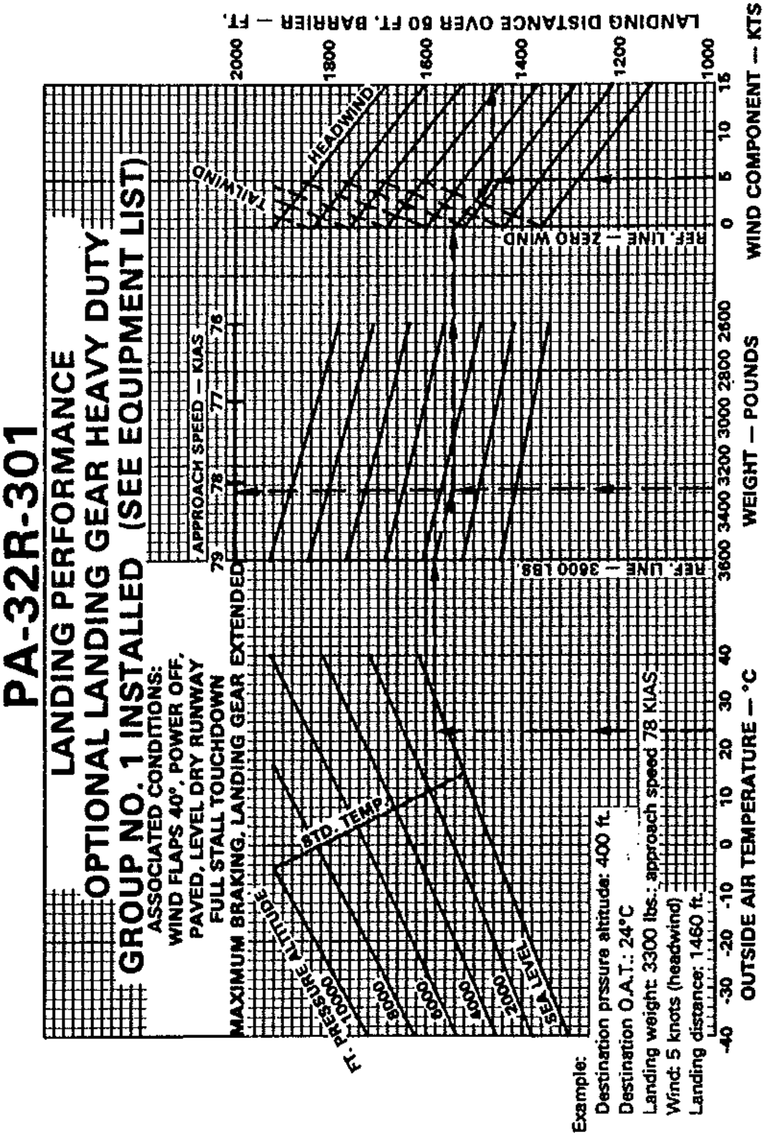
GLIDE RANGE
Figure 5-43



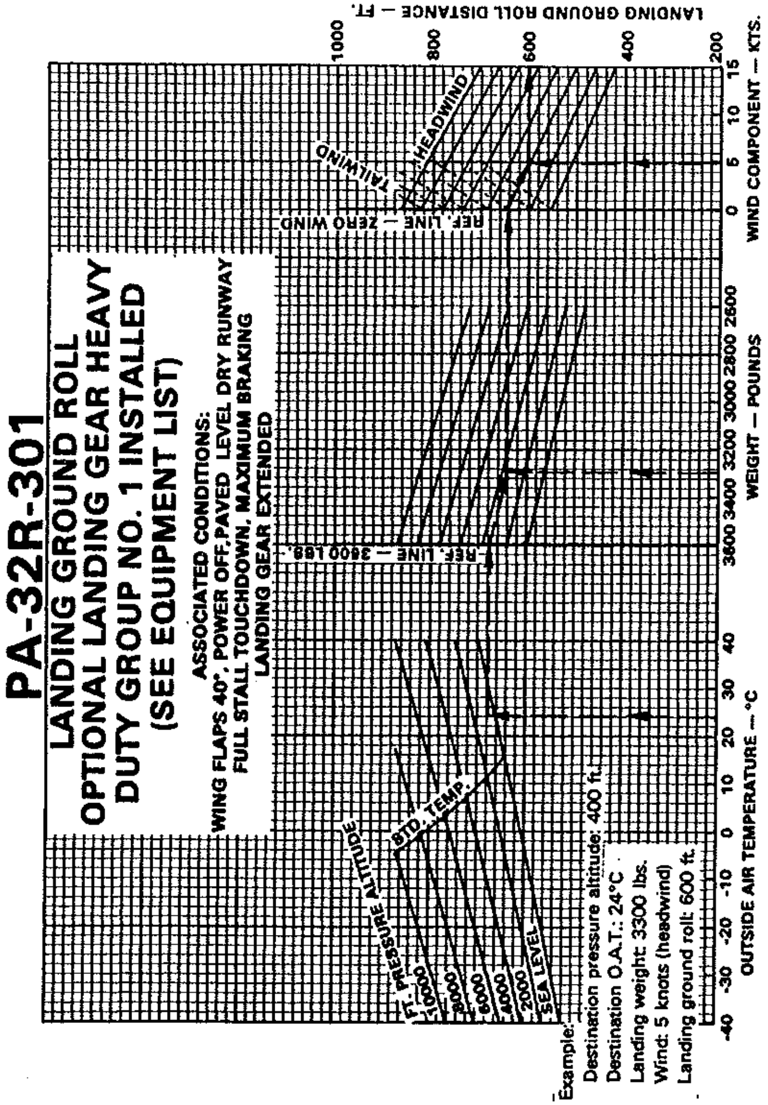
LANDING PERFORMANCE - STANDARD WHEELS, TIRES AND BRAKES
Figure 5-45



LANDING GROUND ROLL - STANDARD WHEELS, TIRES AND BRAKES
Figure 5-47



LANDING PERFORMANCE - OPTIONAL LANDING GEAR HEAVY DUTY GROUP NO. 1 INSTALLED
Figure 5-49



LANDING GROUND ROLL - OPTIONAL LANDING GEAR HEAVY DUTY GROUP NO. 1 INSTALLED
Figure 5-51

TABLE OF CONTENTS

SECTION 6

WEIGHT AND BALANCE

*For 1982 and preceding models only.
**For 1983 and subsequent models only.

SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance and 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 licensed, 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 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 licensing, 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 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 engine for a minimum of three minutes at 1000 RPM on each tank to insure that 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

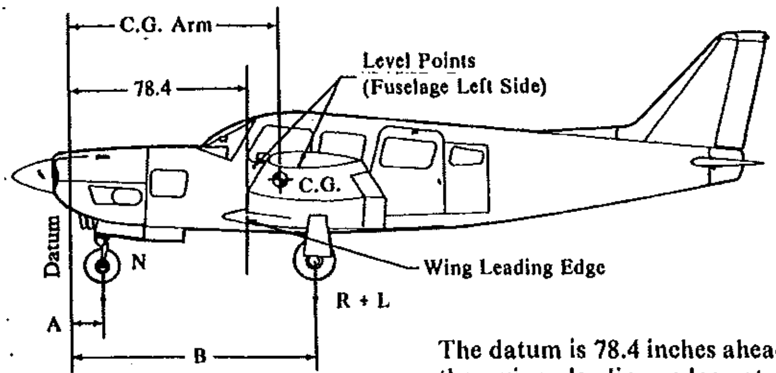
(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

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-32R-301 airplane when it is level. Refer to Leveling paragraph 6.3 (b).



A = 14.2

B = 109.7

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

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 licensed at the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane, as licensed at 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-32R-301 SARATOGA SP

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

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

(3615 lbs) - (lbs) =   lbs.

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

WEIGHT AND BALANCE DATA FORM
Figure 6-5

PA-32R-301		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
		As Licensed							

WEIGHT AND BALANCE RECORD
Figure 6-7

PA-32RT301	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 (cont)
Figure 6-7 (cont)

6.7 GENERAL LOADING RECOMMENDATIONS

The following general loading recommendation is intended only as a guide. The charts, graphs, instructions and plotter should be checked to assure that the airplane is within the allowable weight vs. center of gravity envelope.

(a) Pilot Only
Load rear baggage compartment to capacity first. Without aft baggage, fuel load may be limited by fwd. envelope for some combinations of optional equipment.

(b) 2 Occupants - Pilot and Passenger in Front
Load rear baggage compartment first. Without aft baggage, fuel load may be limited by fwd. envelope for some combinations of optional equipment.

(c) 3 Occupants - 2 in front, 1 in middle
Load rear baggage compartment to capacity first. Baggage in nose may be limited by fwd. envelope. Without aft baggage, fuel may be limited by fwd. envelope for some combinations of optional equipment.

(d) 4 Occupants - 2 in front, 2 in middle
Load rear baggage compartment to capacity first. Baggage in nose may be limited by fwd. envelope. Without aft baggage, fuel may be limited by fwd. envelope for some combinations of optional equipment.

(e) 5 Occupants - 2 in front, 2 in middle, 1 in rear
Investigation is required to determine optimum loading for baggage.

(f) 6 Occupants - 2 in front, 2 in middle, 2 in rear
With six occupants fuel and/or baggage may be limited by envelope. Load fwd. baggage compartment to capacity first.

(g) 7 Occupants - 2 in front, 3 in middle, 2 in rear
With seven occupants fuel and/or baggage may be limited by envelope.

For all airplane configurations, it is the responsibility of the pilot in command to make sure that the airplane always remains within the allowable weight vs. center of gravity while in flight.

6.9 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	2272	83.4	189485
Pilot and Front Passenger	340.0	85.5	29070
Passengers (Center Seats) (Forward Facing)		118.1	
Passengers (Center Seats) (Aft Facing) (Optional)		119.1	
Passengers (Rear Seats)	340.0	157.6	53584
Passenger (Jump Seat) (Opt.)		118.1	
Fuel (102 Gallon Maximum)	500	94.0	47000
Baggage (Forward) (100 Lb. Limit)	100	42.0	4200
Baggage (Aft) (100 Lb. Limit)	63	178.7	11258
Ramp Weight (3615 Lbs. Max.)	3615	92.6	334597
Fuel Allowance for Engine Start, Taxi & Runup	-15.0	94.0	-1410
Take-off Weight (3600 Lbs. Max.)	3600	92.6	333187

The center of gravity (C.G.) for the take-off weight of this sample loading problem is at 92.6 inches aft of the datum line. Locate this point (92.6) 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.

Take-off Weight	3600	92.6	333187
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lbs/Gal.	-360	94.0	-33840
Landing Weight	3240	92.4	299347

Locate the center of gravity of the landing weight on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, the loading may be assumed acceptable for landing.

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

SAMPLE LOADING PROBLEM
(NORMAL CATEGORY)
Figure 6-9

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		85.5	
Passengers (Center Seats) (Forward Facing)		118.1	
Passengers (Center Seats) (Aft Facing) (Optional)		119.1	
Passengers (Rear Seats)		157.6	
Passenger (Jump Seat) (Opt.)		118.1	
Fuel (102 Gallon Maximum)		94.0	
Baggage (Forward) (100 Lb. Limit)		42.0	
Baggage (Aft) (100 Lb. Limit)		178.7	
Ramp Weight (3615 Lbs. Max.)			
Fuel Allowance for Engine Start, Taxi & Runup	-15.0	94.0	-1410
Take-off Weight (3600 Lbs. Max.)			

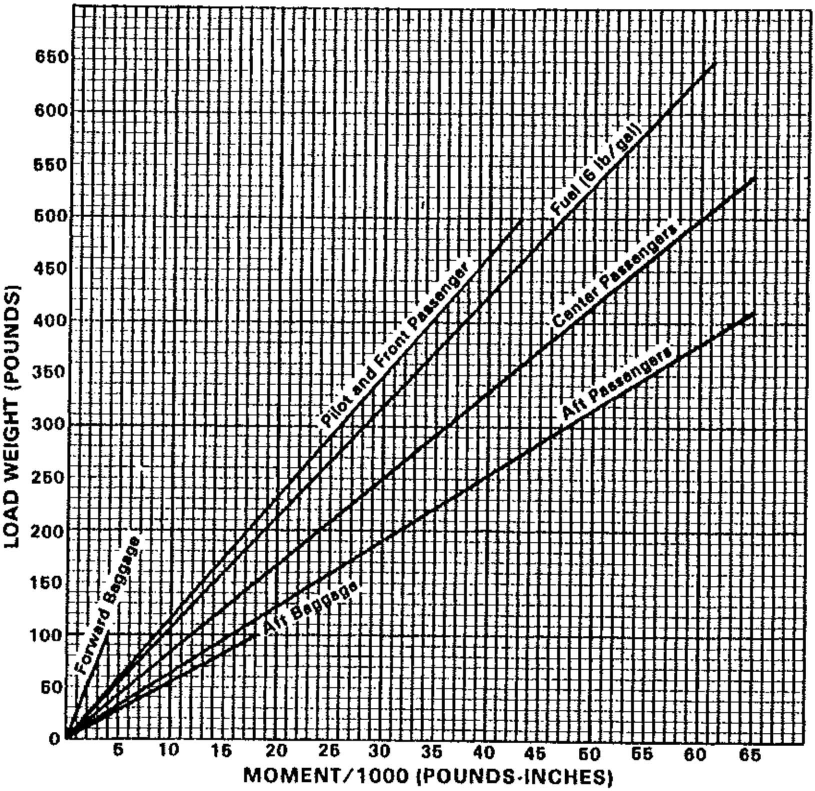
The center of gravity (C.G.) for the take-off weight of this loading problem is at inches aft of the datum line. Locate this point ( ) on the C.G. range and weight graph. If this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

Take-off Weight			
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lbs/Gal.		94.0	
Landing Weight			

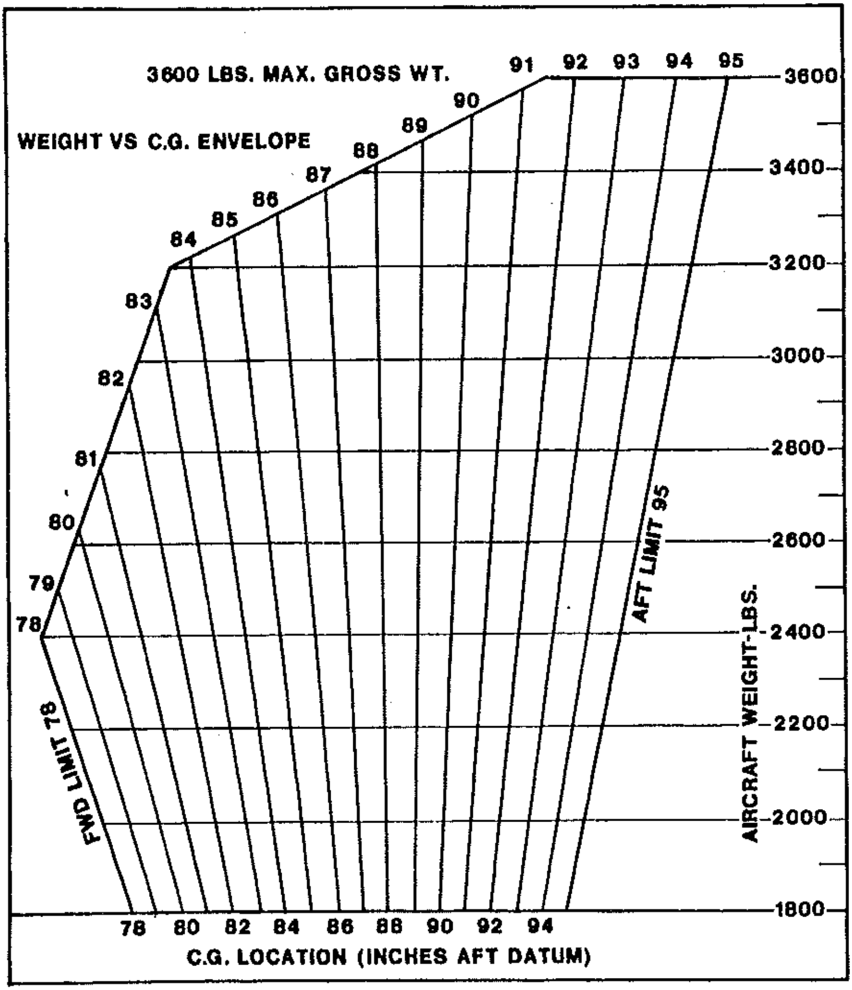
Locate the center of gravity of the landing weight on the C.G. range and weight graph. If this point falls within the weight - C.G. envelope, the loading may be assumed acceptable for landing.

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

WEIGHT AND BALANCE LOADING FORM
(NORMAL CATEGORY)
Figure 6-11



LOADING GRAPH
Figure 6-13



C.G. RANGE AND WEIGHT
Figure 6-15

6.11 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.

The "Basic Empty Weight and Center of Gravity" location is taken from the Weight and Balance Form (Figure 6-5), the Weight and Balance Record (Figure 6-7) or the latest FAA major repair or alteration form.

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 2150 pounds at 83.5 inches respectively. We wish to carry a pilot and 5 passengers. Two men weighing 180 and 200 pounds will occupy the front seats, two women weighing 115 and 135 pounds will occupy the middle seats and two children weighing 80 and 100 pounds will ride in the rear. Two 25 pound suitcases will be tied down in the front baggage compartment and 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?

(1) Place a dot on the plotter grid at 2150 pounds and 83.5 inches to represent the basic airplane. (See illustration.)

(2) Slide the slotted plastic into position so that the dot is under the slot for the forward seats, at zero weight.

(3) Draw a line up the slot to the 380 pound position (180 + 200) and put a dot.

(4) Move the slotted plastic again to get the zero end of the middle seat slot over this dot.

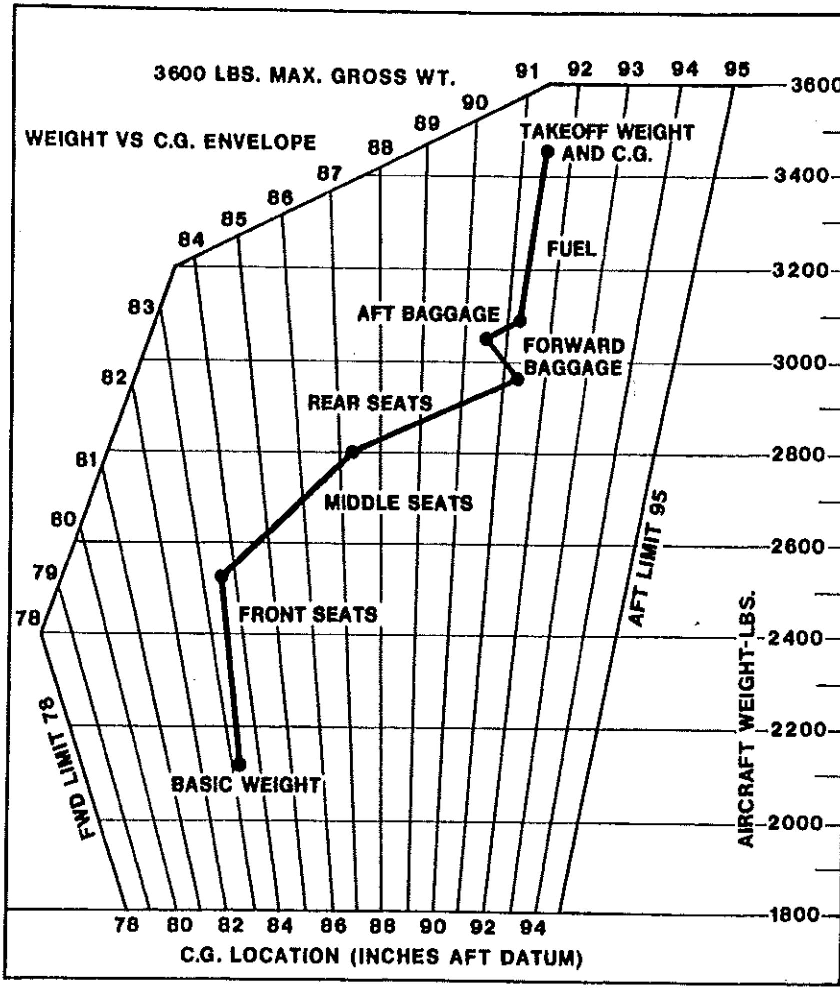
(5) Draw a line up this slot to the 250 pound position (115 + 135) and place the 3rd dot.

(6) Continue moving the plastic and plotting points to account for weight in the rear seats (80 + 100), forward baggage compartment (50), rear baggage compartment (45), and fuel tanks (360).

(7) As can be seen from the illustration, the final dot shows the total weight to be 3440 pounds with the C.G. at 91.6. This is well within the envelope.

(8) 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.



MOMENT CHANGE DUE TO RETRACTING LANDING GEAR = 819 IN.-LBS.

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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 Saratoga SP is a single engine, low wing, retractable landing gear airplane. It is all metal, seats up to seven occupants, and has two separate one hundred pound capacity baggage compartments.

7.3 AIRFRAME

With the exception of the steel engine mount, parts of 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 and a rear door on the left. A cargo door is installed aft of the rear passenger door. When both rear doors are open, large pieces of cargo can be loaded through the extra-wide opening. A door on the right side of the nose section gives access to the nose baggage compartment.

The wing is of a semi-tapered design and employs a laminar flow NACA 65_2-415 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 center 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. Each wing contains two interconnected fuel tanks. Both tanks on one side are filled through a single filler neck located in the outboard tank.

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

7.5 ENGINE AND PROPELLER

The Lycoming engine is rated at 300 horsepower at 2700 rpm. This engine has a compression ratio of 8.7 to 1 and requires 100 minimum grade fuel. The engine is equipped with a geared starter, a 60 ampere alternator, dual magnetos, vacuum pump drive, a diaphragm-type fuel pump, and fuel injection.

The exhaust system consists of individual exhaust pipes routed in pairs to three heavy gauge stainless steel mufflers. Exhaust gases are directed overboard at the underside of the engine cowling. The mufflers are surrounded by a shroud which provides heat for the cabin and for windshield defrosting.

The cowling is designed to cool the engine in all normal flight conditions, including protracted climb, without the use of cowl flaps or cooling flanges.

An induction scoop is located on the left side of the lower cowl. An intake air box is attached to the inside of the cowl adjacent to the air filter box. The air filter box is located at the aft end of the induction scoop. Access to the filter is gained through a detachable plate located on the outside of the lower cowl.

The intake air box incorporates a manually operated two-way valve designed to allow induction air either to pass through the filter or to bypass the filter and supply heated air directly to the engine. Alternate air selection insures induction air flow should the filter become blocked. Since the air is heated, the alternate air system offers protection against induction system blockage caused by snow or freezing rain, or by the freezing of moisture accumulated in the induction air filter. Alternate air is unfiltered; therefore, it should not be used during ground operation when dust or other contaminants might enter the system. The primary (through the filter) induction source should always be used for takeoffs.

The fuel injection system consists of a servo regulator which meters fuel flow in proportion to airflow to the engine, giving the proper fuel-air mixture at all engine speeds, and a fuel flow divider which receives the metered fuel and accurately divides the fuel flow among the individual cylinder fuel nozzles.

A combination fuel flow indicator and manifold pressure gauge is installed in the left side of the instrument panel. The fuel flow indicator is connected to the fuel flow divider and monitors fuel pressure. The instrument converts fuel pressure to an indication of fuel flow in gallons per hour and percentage of cruise power.

The constant speed propeller is controlled by a governor mounted at the left forward side of the crankcase. Control from the engine control quadrant is provided by a push-pull control.

7.7 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.

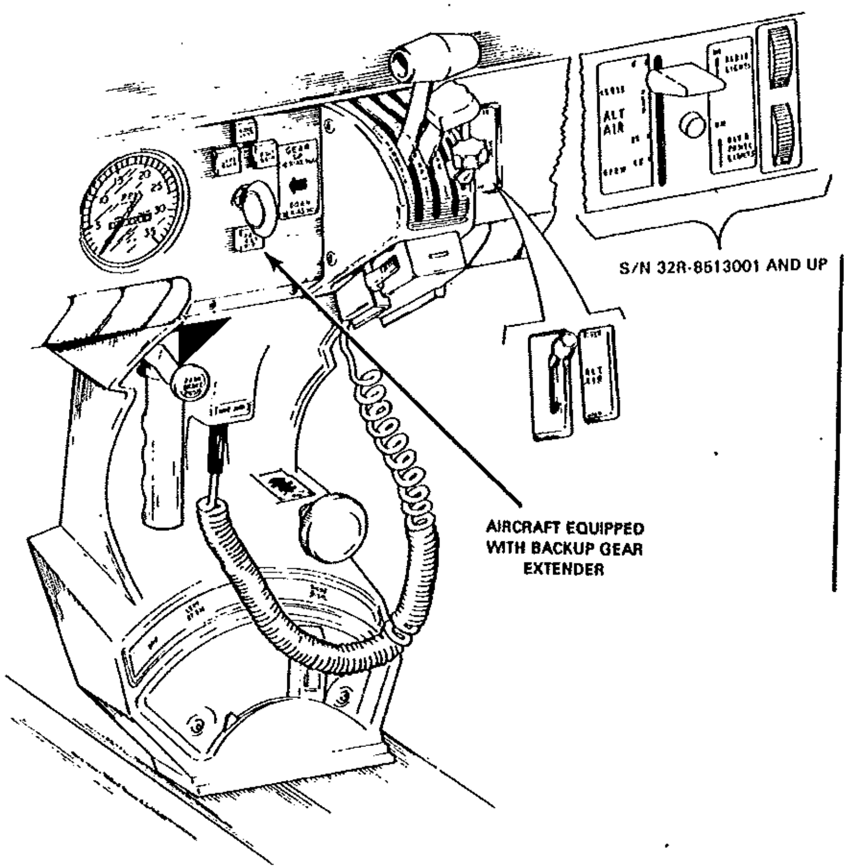
The throttle lever is used to adjust the manifold pressure. It incorporates a gear up warning horn switch which is activated during the last portion of travel of the throttle lever to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked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

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

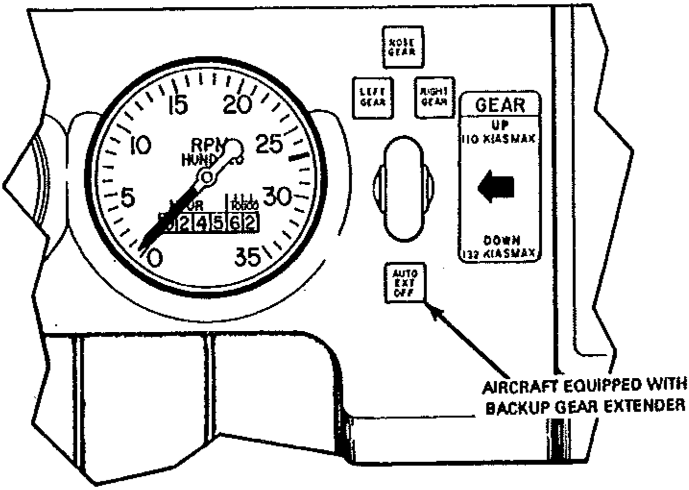
The mixture control lever is used to adjust the air to fuel ratio. The engine is shut down by the placing of the mixture control lever in the full lean position. In addition, the mixture control has a lock to prevent activation of the mixture control instead of the pitch control. For information on the leaning procedure, see the Avco-Lycoming Operator's Manual and the leaning procedure in Section 4 of this handbook.

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 or to lock the 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. The control is operated by pressing the knob to the left to clear the retaining gate and then moved in the desired direction (refer to Figure 7-1).



CONTROL QUADRANT AND CONSOLE
Figure 7-1



LANDING GEAR SELECTOR
Figure 7-3

7.9 LANDING GEAR

The airplane 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). The gear is designed to extend at airspeeds below approximately 103 KIAS with power off even if the selector is in the up position.

The extension speeds will vary from approximately 81 KTS to approximately 103 KIAS depending on power settings and altitude. The device also prevents the gear from retracting at airspeeds below approximately 81 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 right of the pitch trim wheel (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 switch 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 latching device which may be used to lock the override lever in the up position. The latch is located on the right side 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 latch down. 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 latch is spring-loaded to the off position to aid disengagement. To disengage the latch 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 latched in the raised (up) position when gear-up stalls are practiced.

Emergency extension of the landing gear is accomplished by releasing the hydraulic pressure which allows the gear to free-fall with spring assistance on the nose gear. Two types of release mechanisms have been installed and system operation depends on the system installed (Figure 7-9). On aircraft equipped with the lever release the control must be held in the downward position for emergency extension. On aircraft equipped with the cable release the retaining clip must be moved and the red knob pulled for emergency extension.

Gear down and locked positions are indicated by three green lights located above the selector, and a red "Warning Gear Unsafe" light 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 110 KIAS and should not be extended above a speed of 132 KIAS.

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

Two micro-switches in the throttle quadrant activate a warning horn and red "Warning Gear Unsafe" light under the following conditions:

(1) Gear up and power reduced below approximately 14 inches of manifold pressure.
(2) On aircraft equipped with the backup gear extender, if the system has extended the landing gear and the gear selector switch is UP, except at full power.
(3) Gear selector switch UP while on the ground.

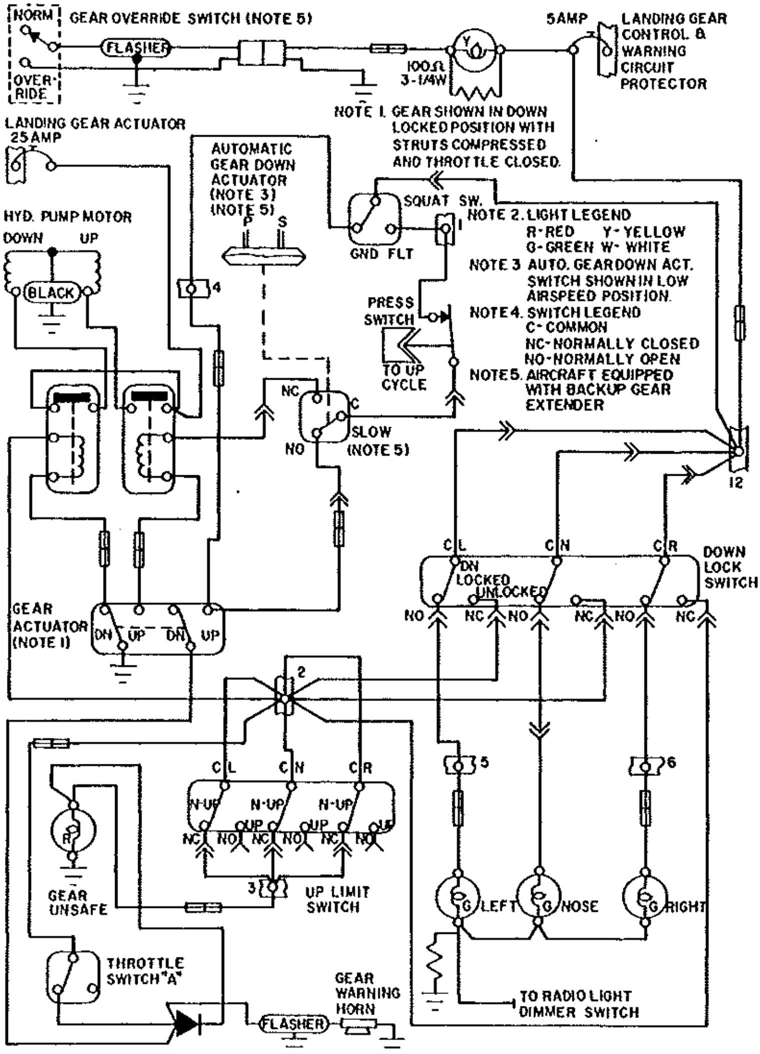
On aircraft which are NOT equipped with the backup gear extender an additional switch is installed which activates the warning horn and light whenever the flaps are extended beyond the approach position (10°) and the landing gear are not down and locked.

The gear warning horn emits a 90 cycle per minute beeping sound in contrast to the stall warning horn which emits a continuous sound.

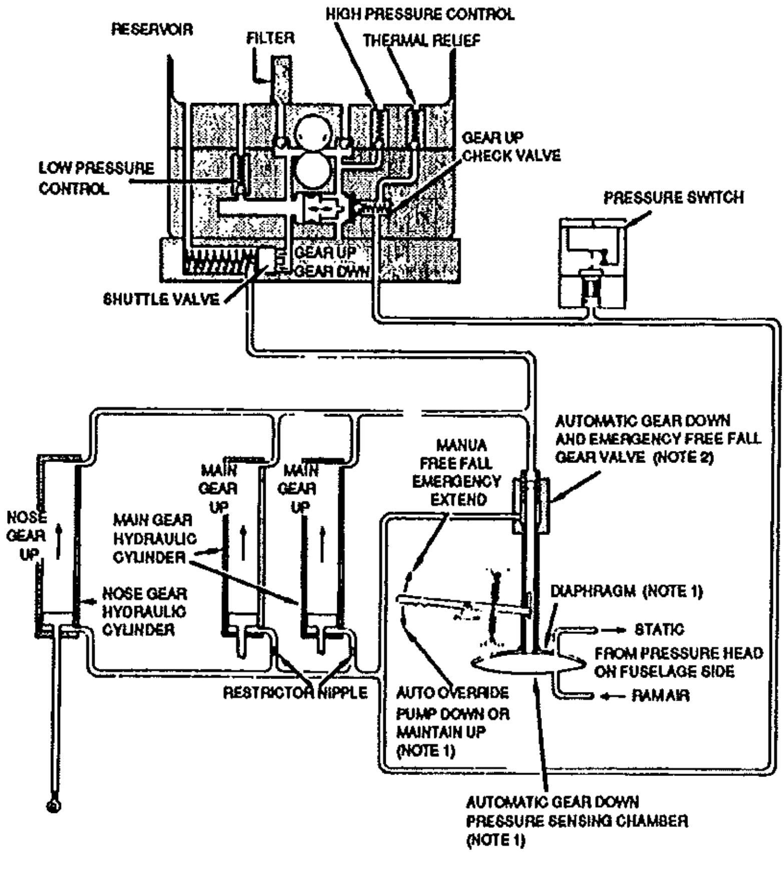
The nose gear is steerable through a 22.5 degree arc each side of center through the use of the rudder pedals. As the nose wheel retracts, the steering linkage disengages to reduce rudder pedal loads in flight. The nose wheel is equipped with a hydraulic shimmy dampener to reduce nose wheel shimmy.

The oleo struts are of the air-oil type, with normal extension being 3.25 ± .25 inches for the nose gear and 4.5 ± .5 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.



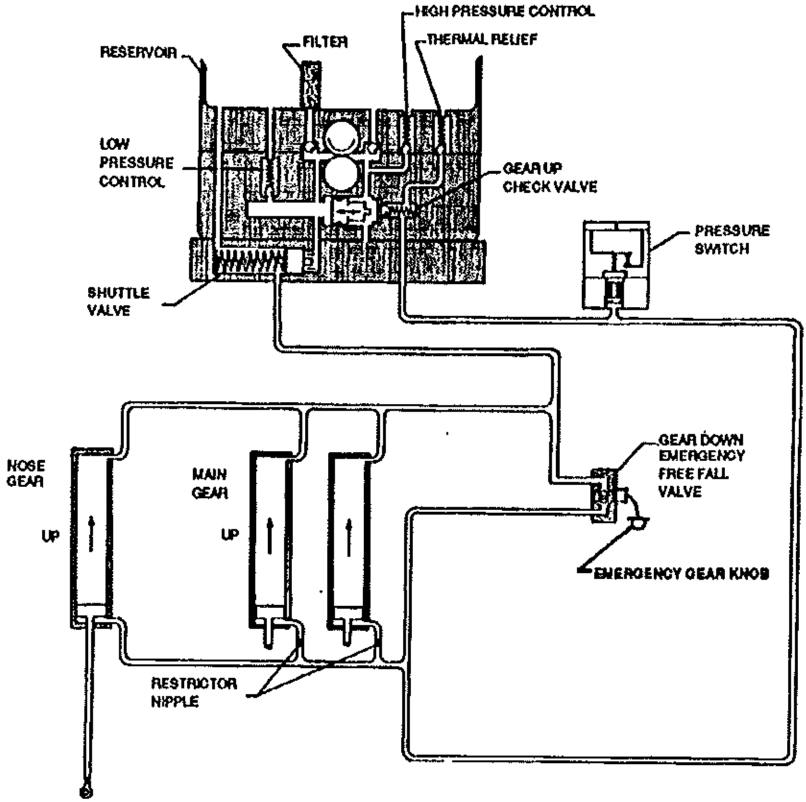
LANDING GEAR ELECTRICAL SCHEMATIC
Figure 7-5



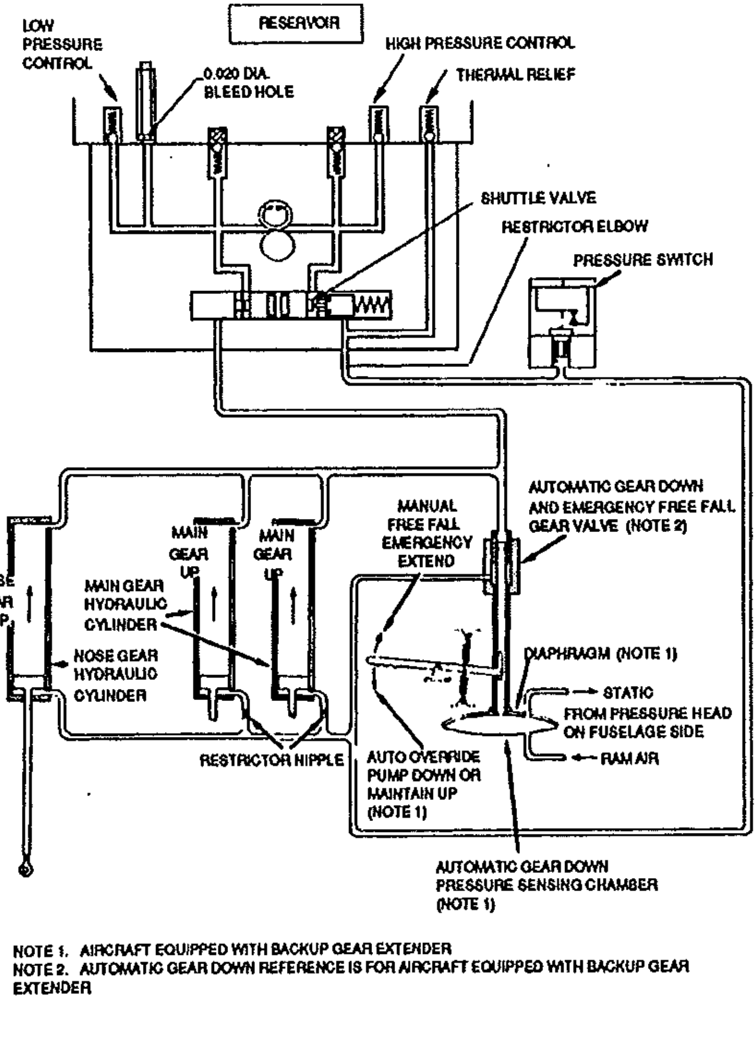
NOTE 1. AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER.

NOTE 2. AUTOMATIC GEAR DOWN REFERENCE IS FOR AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER.

LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Aircraft equipped with Prestolite pump and lever emergency gear release
Figure 7-7

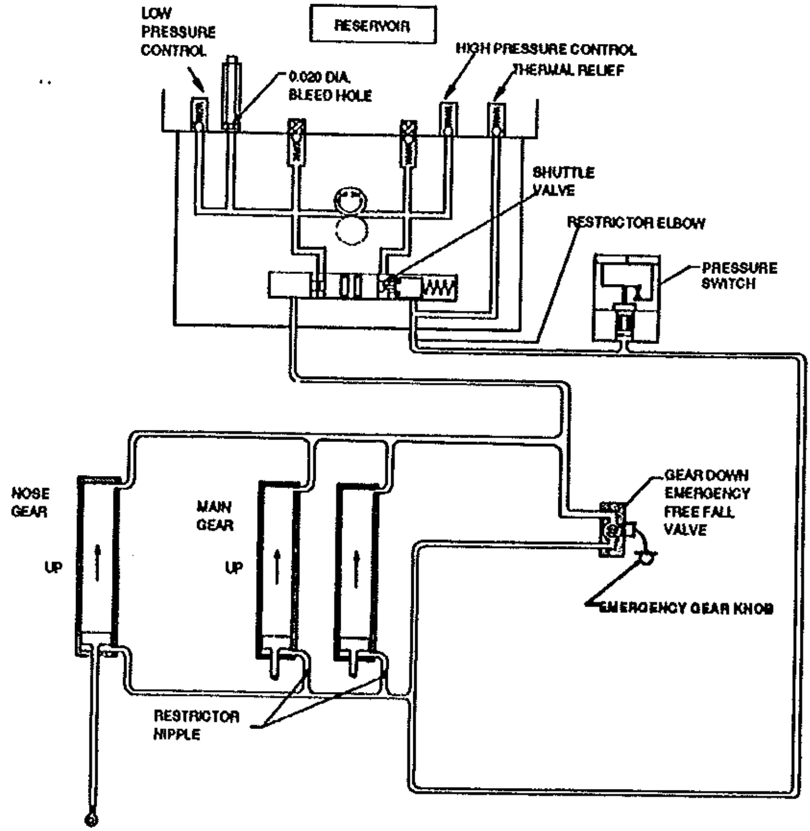


LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Aircraft equipped with Prestolite pump and cable emergency gear release
Figure 7-7a



NOTE 1. AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER
NOTE 2. AUTOMATIC GEAR DOWN REFERENCE IS FOR AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER

LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Aircraft equipped with Oildyne pump and lever emergency gear release
Figure 7-7b



LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Aircraft equipped with Oildyne pump and cable emergency gear release
Figure 7-7c

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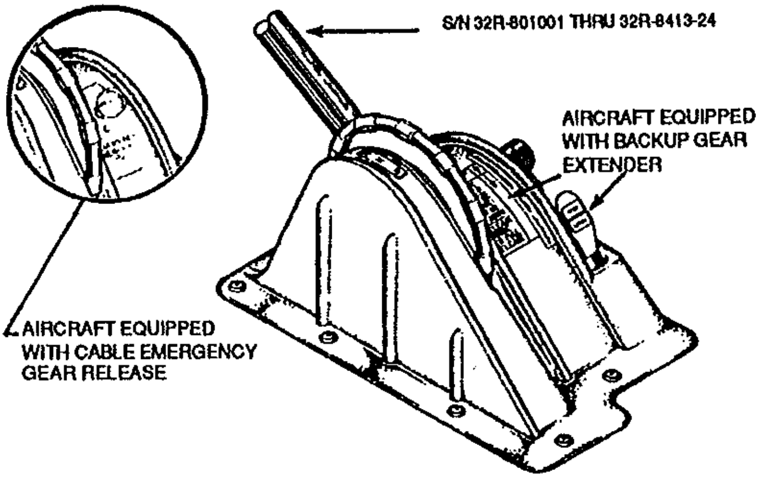

FLIGHT CONTROL CONSOLE
Figure 7-9

7.11 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) 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.

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When using less than the standard 107 gallon capcity of the tanks, fuel should be distributed equally between each side.

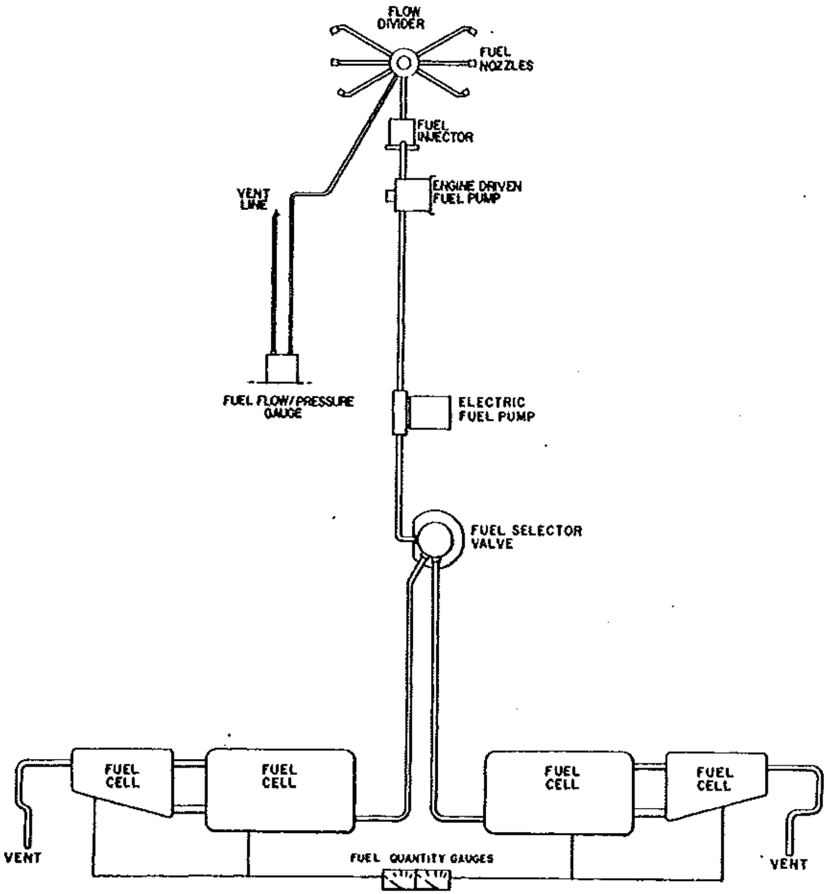
The fuel selector control is located below the center of the instrument panel on the sloping face of the control tunnel (refer to Figure 7-1). It has three positions, one position corresponding to each wing tank plus an OFF position.

To avoid the accumulation of water and sediment, the fuel tank sumps and strainer should be drained daily prior to first flight and after refueling. Each inboard tank is equipped with an individual quick drain located at the lower inboard rear corner of the tank. The fuel strainer and a system quick drain valve are located in the fuselage at the lowest point of the fuel system. It is important that the fuel system be drained in the following manner:

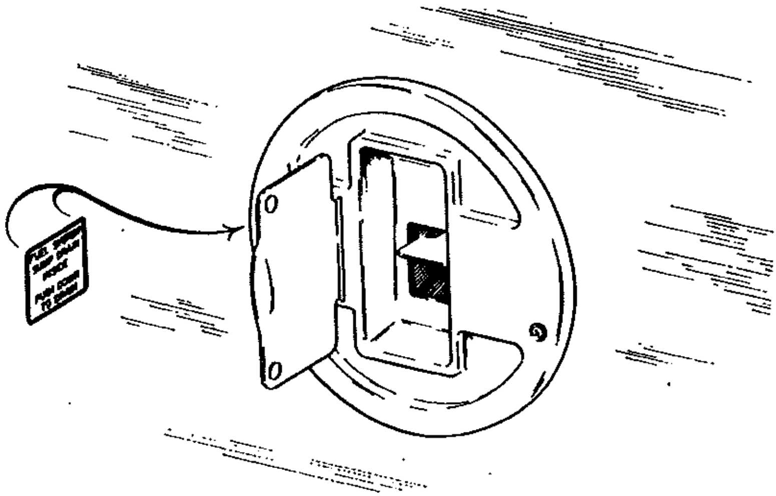
1. Drain each tank sump through its individual quick drain located at the lower inboard rear corner of the tank, making sure that enough fuel has flowed to ensure the removal of all water and sediment.
2. Place a container beneath the fuel strainer sump drain outlet located under the fuselage.
3. Drain the fuel strainer sump by pressing down on the lever located on the right side of the cabin on the forward edge of the wing spar housing (Figure 7-13). Move the selector through the following sequence: OFF position, left, right, while draining the strainer sump. Make sure that enough fuel has flowed to drain the fuel line between each tank outlet and the fuel strainer, as well as the strainer itself. With full fuel tanks, it will take approximately 6 seconds to drain all of the fuel from the line from either tank to the fuel strainer. When the tanks are less than full, it will take a few seconds longer.
4. Examine the contents of the container placed under the fuel sump drain outlet. When the fuel flow is free of water and sediment, close the drain and dispose of the contents of the bottle.

CAUTION

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



FUEL SYSTEM SCHEMATIC
Figure 7-11



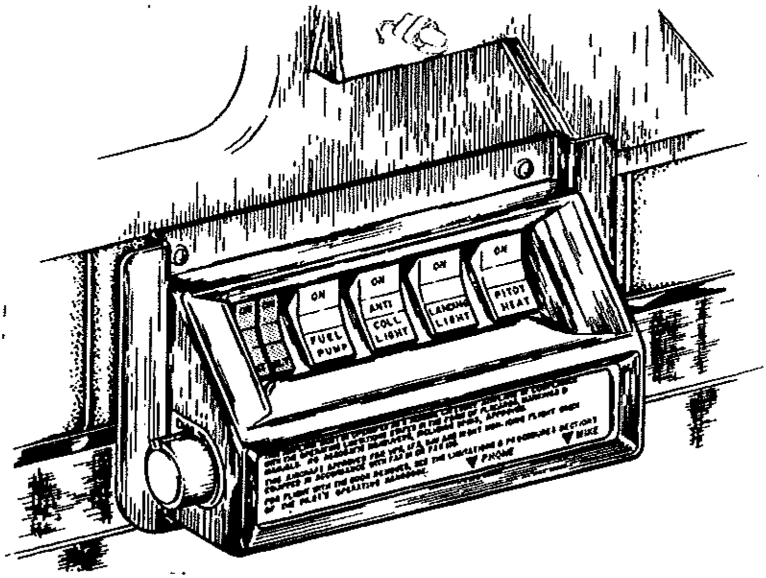
FUEL DRAIN LEVER
Figure 7-13

After using the underseat quick drain, check from the outside to make sure that it has closed completely and is not leaking.

Fuel quantity gauges for each of the tanks are located in the engine gauge cluster on the left side of the instrument panel.

A fuel quantity indicator to measure the fuel not visible through the filler neck in each wing is installed in the inboard fuel tank. This gauge indicates usable fuel quantities from 5 gallons to 35 gallons in the ground attitude. The sole purpose of this gauge is to assist the pilot in determining fuel quantities of less than 35 gallons during the preflight inspection.

An electric fuel pump is provided for use in case of failure of the engine driven pump. The electric pump operates from a single switch and independent circuit protector. It should be ON for all takeoffs and landings.



SWITCH PANEL
Figure 7-15

7.15 ELECTRICAL SYSTEM

The 14-volt electrical system includes a 12-volt battery for starting and to back up alternator output. Electrical power is supplied by a 60 ampere alternator. The battery, a master switch relay, a voltage regulator and an overvoltage relay are located beneath the floor of the forward baggage compartment. Access to these electrical components is gained by removing the compartment floor and access panel located on the left side of the forward fuselage.

Electrical switches are located on a panel to the pilot's left (Figure 7-15) and all circuit breakers are on the lower right instrument panel (refer to Figure 7-19). A switch panel light is available as optional equipment. The light is installed above the switch panel and is controlled by a rheostat switch mounted on the left side of the panel. Two thumb-wheel rheostat switches to the left of the circuit breakers control the navigation lights and the intensity of the instrument panel lights.

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

The annunciator panel includes alternator and low oil pressure indicator lights and provisions for optional baggage door ajar, air conditioner door open and low vacuum (gyro system) lights. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly, and that the applicable system gauge should be checked and monitored to determine when or if any corrective action is required.

Optional electrical accessories include the navigation lights, anti-collision strobe lights, instrument panel lighting and cabin courtesy lights. The cabin courtesy light installation consists of two light/switch panels, one mounted above each cabin entrance. Make sure the lights are off when leaving the aircraft. Leaving the lights on for an extended period of time could cause depletion of the battery.

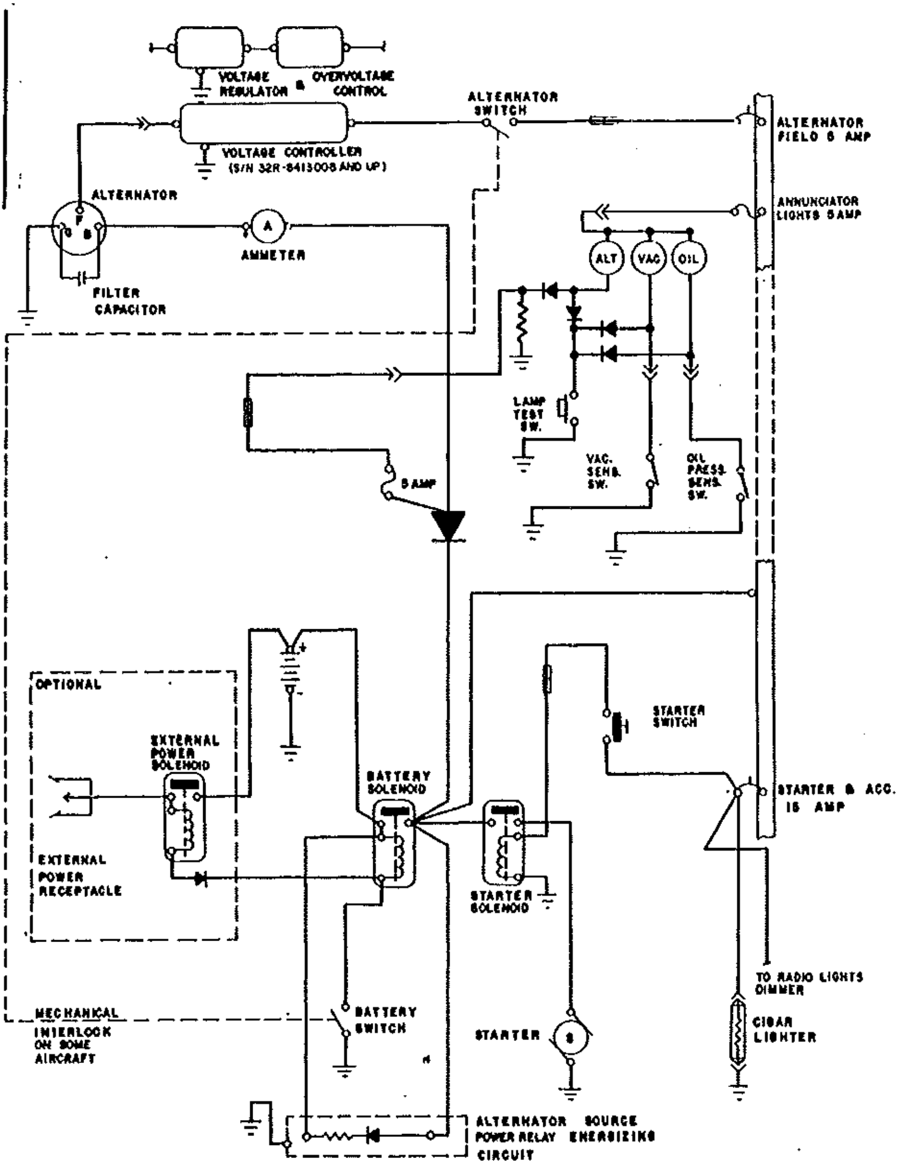
Two optional lights, mounted in the overhead panel, provide instrument and cockpit lighting for night flying. The lights are controlled by rheostat switches located adjacent to them. A map light window in each lens is actuated by an adjacent switch. An optional wing tip/recognition light system consists of 2 lights (one in each wing tip) and is operated by a split landing light/recognition light rocker type switch mounted on the pilot's switch panel.

Circuit provisions are made to handle the addition of communications and navigational equipment.

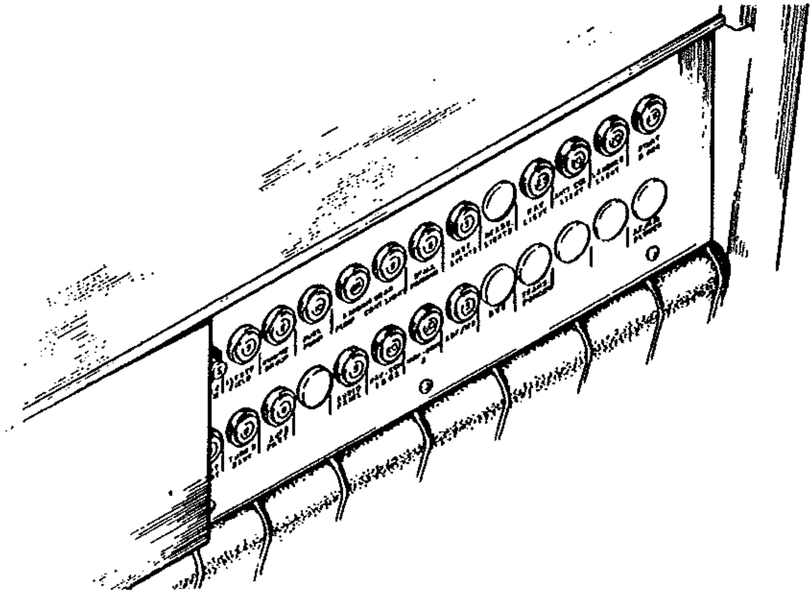
The ammeter in the alternator system displays in amperes the load placed on the alternator. It does not indicate battery discharge. With all electrical equipment off (except the master switch) the ammeter will be indicating the amount of charging current demanded by the battery. As each item of electrical equipment is turned on, the current will increase to a total appearing on the ammeter. This total includes the battery. The average continuous load for night flight, with radios on, is about 30 amperes. This 30 ampere value, plus approximately 2 amperes for a fully charged battery, will appear continuously under these flight conditions.

NOTE

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



ALTERNATOR AND STARTER SCHEMATIC
Figure 7-17



CIRCUIT BREAKER PANEL
Figure 7-19

For Abnormal and/or Emergency procedures, see Section 3.

WARNING

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

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.

CAUTION

Do not use cigar lighter receptacles as power sources for any devices other than the cigar lighters supplied with the airplane. Any other device plugged into these receptacles may be damaged.

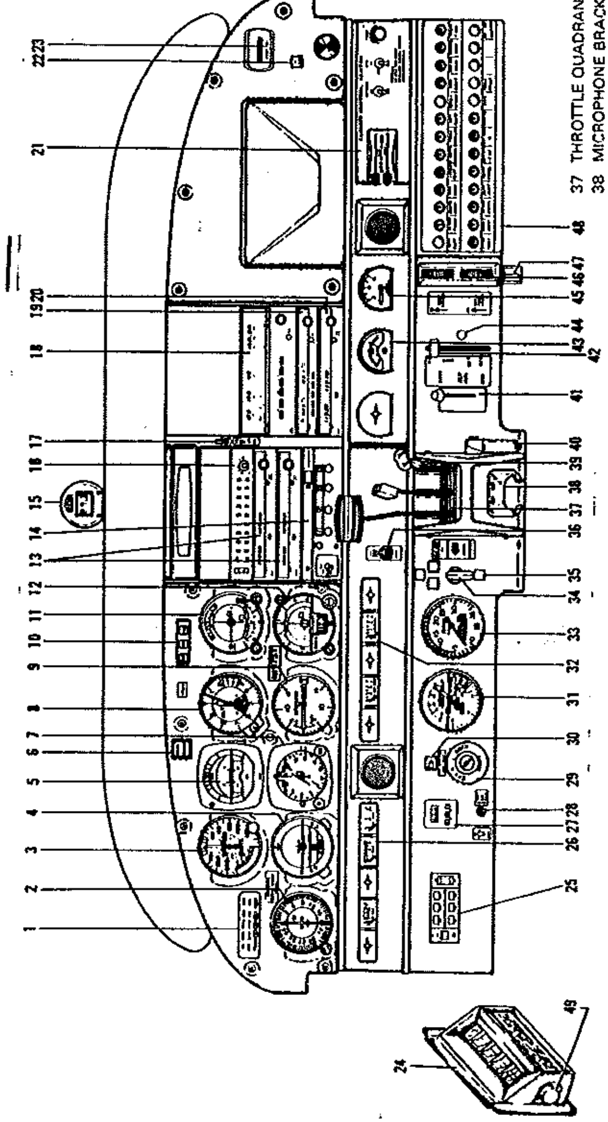
7.17 VACUUM SYSTEM

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 driven 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.



1. AUTOPILOT MODE ANNUNCIATOR
2. ADF INDICATOR
3. AIRSPEED INDICATOR
4. TURN AND BANK
5. FLIGHT COMMAND INDICATOR
6. GEAR UNSAFE LIGHT
7. HSI
8. ALTIMETER
9. VERTICAL SPEED INDICATOR
10. ANNUNCIATOR PANEL
11. GS/LOC/VOR INDICATOR
12. VOR INDICATOR
13. COM 1 AND COM 2
14. TRANSPONDER
15. COMPASS
16. AUDIO SELECTOR PANEL
17. RADIO MASTER SWITCH
18. RNAV/DME
19. ADF RADIO
20. NAV 1 RADIO
21. CLIMATE CONTROL CENTER
22. GROUND CLEARANCE SWITCH
23. ENGINE HOUR METER
24. MASTER AND ACCESSORY SWITCH PANEL
25. AUTOPILOT
26. ENGINE INSTRUMENT CLUSTER
27. SLAVEMETER
28. NAV SELECTOR SWITCH
29. MAGNETO AND STARTER SWITCH
30. PITCH TRIM SWITCH
31. MANIFOLD PRESSURE AND FUEL FLOW GAUGE
32. FUEL QUANTITY GAUGES
33. TACHOMETER
34. GEAR SELECTOR
35. "AUTO-EXT OFF" LIGHT *
36. AIR CONDITION DOOR LIGHT
37. THROTTLE QUADRANT
38. MICROPHONE BRACKET
39. MIXTURE CONTROL LOCK
40. FRICTION LOCK
41. ALTERNATE AIR CONTROL
42. WING FLAP SELECTOR (S/N 32R-8513001 AND UP)
43. EGT GAUGE
44. FLAP INTRANSIT LIGHT (S/N 32R-8513001 AND UP)
45. GYRO SUCTION GAUGE
46. NAV AND PANEL LIGHTS
47. EMERGENCY BUS SWITCH
48. CIRCUIT BREAKER PANEL
49. SWITCH PANEL LIGHT (OPTION)

* AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER

TYPICAL INSTRUMENT PANEL
Figure 7-21

7.19 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 switch. The radio power switch has an OFF, and ON position. An emergency bus switch is also provided to give AUXILIARY power to the avionics bus in the 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.

A ground clearance energy saver system is available to provide direct power to Comm #1 without turning on the master switch. An internally lit pushbutton switch, located on the instrument panel, provides annunciation for engagement of the system. When the button is engaged direct aircraft battery power is applied to Comm #1, audio amplifier (speaker) and radio accessories. The switch must be turned OFF or depletion of battery could result.

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 to the pilot's left. 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 valve is set in the alternate position, the altimeter, vertical speed indica 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

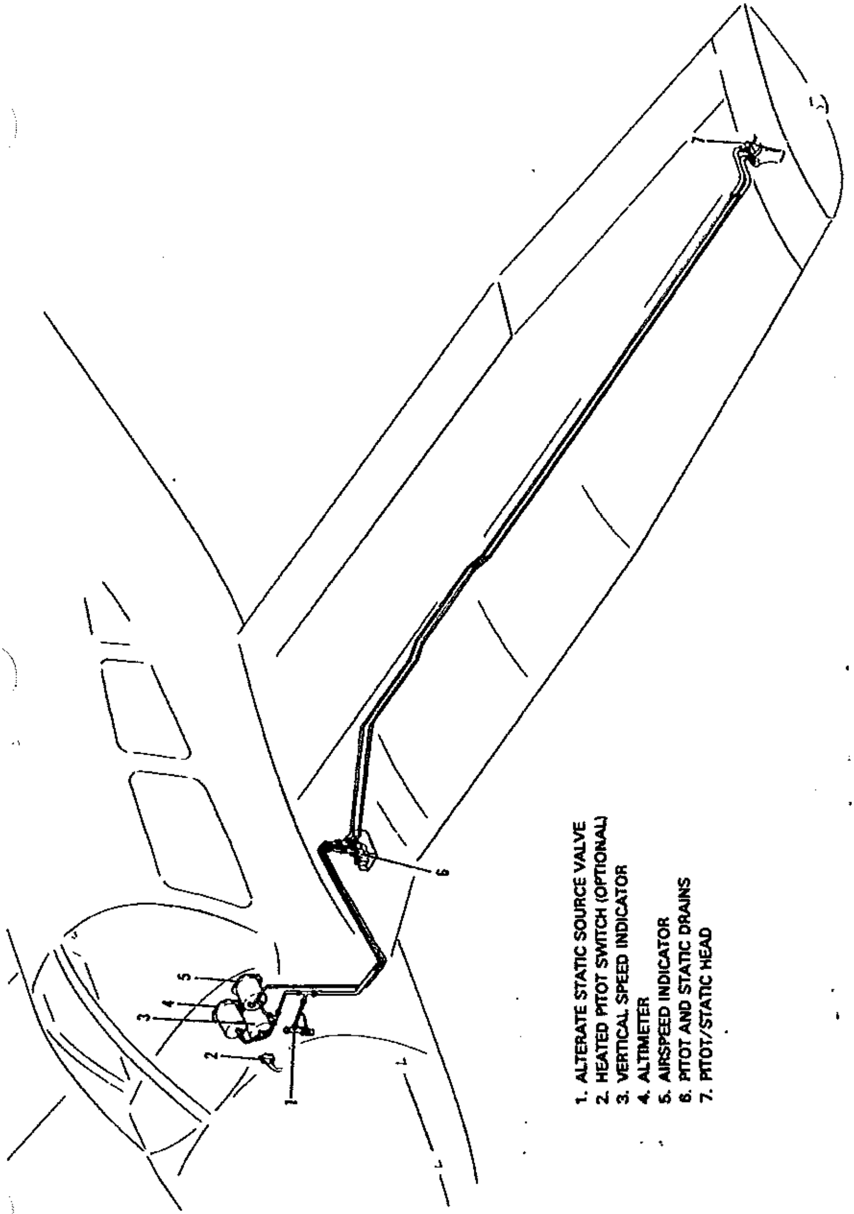
During preflight, check to make sure the pitot cover is removed.

7.23 CABIN FEATURES

For ease of entry and exit and for pilot and passenger comfort, the fr seats are adjustable fore and aft. All seats recline and have armrests and are available with optional headrests. The front seats can be equipped with optional vertical adjustment. The center and rear seats may be removed for additional cargo space.

NOTE

To remove the center seats, retainers securing the back legs of the seats must be unlocked. This is accomplished by depressing the plunger behind each rear leg. Any time the seats are installed in the airplane, the retainers should be in the locked position. To remove the rear seats, depress the plunger behind each front leg and slide seat to rear.



PITOT-STATIC SYSTEM
Figure 7-23

An optional jump seat can be installed between the two middle seats to give the airplane a seven-place capacity.

Shoulder harnesses with inertia reels are standard equipment for the front seats.

On aircraft serial numbers 32R-8013001 through 32R-8413024, shoulder harnesses with inertia reels are offered as optional equipment for the third, fourth, fifth and sixth seats, but not for the seventh seat.

The inertia reel should be checked by tugging sharply on the strap. The reel will lock in place under this test and prevent the strap from extending. Under normal movement, the strap will extend and retract as required.

On earlier aircraft provided with a single strap adjustable shoulder harness for each front seat the shoulder strap is routed over the shoulder adjacent to the windows and attached to the lap belt in the general area of the person's inboard hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint for the occupant.

Shoulder harnesses should be routinely worn during takeoff, land' and whenever an inflight emergency occurs.

An optional club seating interior is also available. In the club seating interior the center seats face aft. These seats are equipped with lap belts and adjustable shoulder harnesses* Removal of the seats is accomplished by removing the two bolts holding the aft attach points and sliding the seat aft.

*Earlier airplanes are equipped with lap belts only.

An optional refreshment console is located between the center seats. It is removed in an identical manner to the center seats.

An optional cabin work table, serving the two seats on the right side of the passenger cabin, is offered to the club seating arrangement. The table must be stowed during takeoff and landing. If the table is to be used, it should be set up after a level cruise is established.

To remove the cabin work table from the aft baggage compartment, unlock the stud located on the bottom of the close-out bulkhead. Loosen the white tie-down strap and remove the table from the mounting brackets by lifting the table two inches straight up until it clears the mounting brackets. Do not twist the table while it is in the brackets.

To install the cabin work table during flight, hold the table in place and tilt the free end of the table upward 30° until the lobed upper knobs on the table supports align with the top holes of the escutcheons located below the right cabin window trim. Hold the upper lobes in place and lower the free end of the table to the level work position. The retaining springs will click when secure.

To stow the cabin work table, remove the table by lifting the free end of the table upward to disengage the bottom lobes of the table supports. Lift until the top support lobes disengage at approximately 30° of tilt and remove the table. Position the table in the stowage area and, with the table work surface facing forward, place the slots in the table support into the receptacle clips mounted on the hat shelf. Make sure the white tie-down strap is not behind the table. With the table fully placed in the clips, bring the white tie-down strap across the face of the table and lock over the stud located on the bottom of the close-out bulkhead.

7.25 BAGGAGE AREA

The airplane has two separate baggage areas, each with a 100 pound capacity. A 7 cubic foot forward luggage compartment, located just aft of the fire wall, is accessible through a 16 x 22 inch door on the right side of the fuselage. A 17.3 cubic foot aft compartment is located behind the fifth and sixth seats and is accessible through the cargo door on the aft side of the fuselage and during flight from inside the cabin.

An automatic forward baggage compartment light feature is available which utilizes a magnetic reed switch and a magnet for activation. The switch and magnet are mounted just above the hinge line of the forward baggage door.

Opening the baggage door fully, activates the switch which turns on the baggage compartment light. The baggage compartment light is independent of the aircraft master switch; therefore, the light will illuminate regardless of the position of the master switch. The baggage door should not be left open for extended time periods, as battery depletion could result.

An optional forward baggage door ajar annunciation system is available which senses baggage door latch pin position. Failing to latch the forward baggage door will illuminate an amber light located on the pilot's annunciator panel. The annunciation, when illuminated, is "BAGGAGE DOOR" advising the pilot of this condition.

NOTE

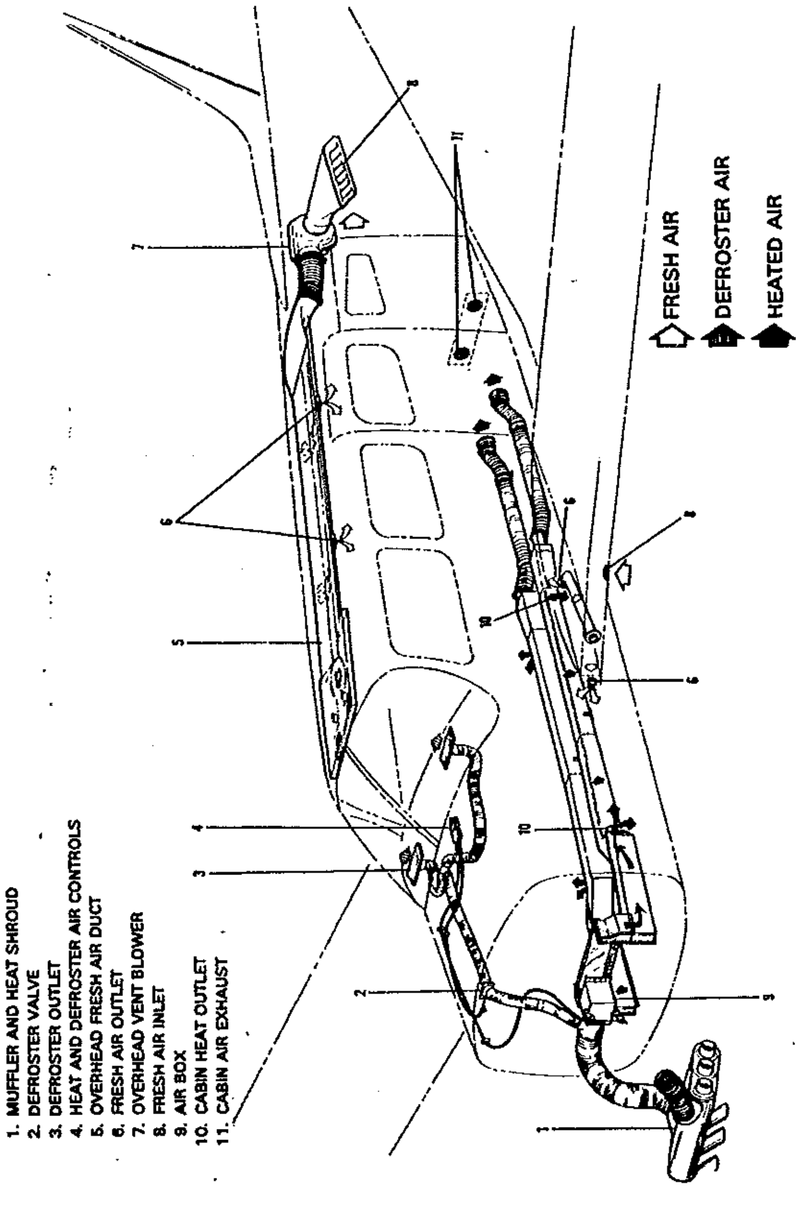
It is the pilot's responsibility to be sure when the baggage is loaded that the airplane's C.G. falls within the allowable C.G. range. (Refer to Weight and Balance Section.)

7.27 HEATING AND VENTILATING SYSTEM

Fresh air is ducted from the aft lower right engine baffle to the heater muff by a flexible hose. Hot air from the heater muff is routed through a flexible hose on the right side of the engine compartment, to the valve box mounted on the fire wall just above the tunnel cut out. It is then ducted down each side of the tunnel below the baggage floor to the cabin ducting and outlets (Figure 7-25).

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.



HEATING AND VENTILATING SYSTEM
Figure 7-25

Defrost heat is bled off from the main flow at the heater muff and routed through flexible hose to a shut-off valve located to the right of center at top of the fire wall. From this point, it is ducted to the defroster outl[illegible]

Fresh air inlets are located in the leading edge of each wing and in the left side of the tail cone. Two adjustable outlets are located on each side of the cabin, one forward and one aft of the front seat near the floor. There are also adjustable outlets above each seat. In airplanes without air conditioning, an optional blower may be added to the overhead vent system to aid in the circulation of cabin air.

7.29 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 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 90 cycle per minute beeping sound. The stall warning horn is activated by lift detectors installed on the leading edge of the left wing. During preflig[illegible] the stall warning system should be checked by turning the master switch [illegible] lifting the detectors and checking to determine if the horn is actuated.

7.31 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 enamel finish is available.

7.33 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 control.

The evaporator is located behind the rear baggage compartment. T[illegible] cools the air used for the air conditioning system.

*Optional equipment

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 forward right underside 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.

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 on the instrument panel 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 activates 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.

7.35 PIPER EXTERNAL POWER*

An optional starting installation known as Piper External Power (PEP) is accessible through a receptacle located on the left side of the nose section aft of the cowling. 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.

7.37 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT), when installed, is located in the aft portion of the fuselage just below the stabilator leading edge and is accessible through a plate on the right side of the fuselage. This plate attached with slotted-head nylon screws for ease of removal; these screws may be readily removed with a variety of common items, such as a dime, a key, a knife blade, etc. If there are no tools available in an emergency, the screw heads may be broken off by any means. The ELT is an emergency locator transmitter which meets the requirements of FAR 91.52.

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 the tests must be made at any other time, the tests should be coordinated with the nearest FAA tower or flight service station.

*Optional equipment

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.

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 ground 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 that the transmitter is silent.

NARCO ELT 910 OPERATION

On the ELT unit itself is a three position switch placarded ON, OFF 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.

A pilot's remote switch, placarded ON and ARM, is located on the left side panel to allow the transmitter to be armed or turned on from inside the cabin. The switch is normally in the ARM position. Moving the switch to ON will activate the transmitter. A warning light, located above the remote switch, will blink continuously whenever the ELT is activated.

NOTE

The warning light will not blink if the ELT is activated by an incident that also results in severance of the airplane's power supply lines.

Should the ELT be activated inadvertently it can be reset by ei positioning the remote switch to the ON position for two seconds, and relocating it to the ARM position, or by setting the switch on the ELT to OFF and then back to ARM.

In the event the transmitter is activated by an impact, it can be turned off by moving the ELT switch OFF. Normal operation can then be restored by resetting the switch to ARM. It may also be turned off and reset by positioning the remote switch to the ON position for two seconds, and then to the ARM position.

The transmitter can be activated manually at any time by placing either the remote switch or the ELT switch to the ON position.

The ELT should be checked during postflight to make certain the unit has not been activated. Check by selecting 121.50 MHz on an operating receiver. If a downward sweeping audio tone is heard, the ELT may have been activated. Set the remote switch to ON. If there is no change in the volume of the signal, your airplane is probably transmitting. Setting the remote switch to ARM will automatically reset the ELT and should silence the signal being receive 121.50 MHz.

7.39 RADAR*

A weather radar system can be installed in this airplane. The basic components of this installation are an R-T/Antenna and a cockpit indicator. The function of the weather radar system is to detect weather conditions along the flight path and to visually display a continuous weather outline on the cockpit indicator. Through interpretation of the advance warning given on the display, the pilot can make an early decision on the most desirable weather avoidance course.

NOTE

When operating weather avoidance radar systems inside of moderate to heavy precipitation, it is advisable to set the range scale of the radar to its lowest scale.

For detailed information on the weather radar system and for procedures to follow in operating and adjusting the system to its optimum efficiency, refer to the appropriate operating and service manuals provided by the radar system manufacturer.

WARNING

Heating and radiation effects of radar can cause serious damage to the eyes and tender organs of the body. Personnel should not be allowed within fifteen feet of the area being scanned by the antenna while the system is transmitting. Do not operate the radar during refueling or in the vicinity of trucks or containers accommodating explosives or flammables. Flashbulbs can be exploded by radar energy. Before operating the radar, direct the nose of the airplane so that the forward 120 degree sector is free of any metal objects such as other aircraft or hangars for a distance of at least 100 yards, and tilt the antenna upward 15 degrees. Do not operate the radar while the airplane is in a hangar or other enclosure.

*Optional equipment

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SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

SECTION 8

AIRPLANE HANDLING, SERVICING, AND MAINTENANCE

8.1 GENERAL

This section provides guidelines relating to the handling, servicing, and maintenance of the Saratoga SP. For complete maintenance instructions, refer to the PA-32R-301/301T Maintenance Manual.

Every owner should stay in close contact with an authorized Piper Service Center or Piper's Customer Services Department to obtain the latest information pertaining to their airplane, and to avail themselves of Piper Aircraft's support systems.

Piper Aircraft Corporation takes a continuing interest in having owners get the most efficient use from their airplane and keeping it in the best mechanical condition. Consequently, Piper Aircraft, from time to time, issues service releases including Service Bulletins, Service Letters, Service Spares Letters, and others relating to the airplane.

Piper Service Bulletins are of special importance and Piper considers compliance mandatory. These are sent directly to the latest FAA-registered owners in the United States (U.S.) and Piper Service Centers worldwide. Depending on the nature of the release, material and labor allowances may apply. This information is provided to all authorized Piper Service Centers.

Service Letters deal with product improvements and servicing techniques pertaining to the airplane. They are sent to Piper Service Centers and, if necessary, to the latest FAA-registered owners in the U.S. Owners should give careful attention to 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.

Piper Aircraft Corporation offers a subscription service for Service Bulletins, Service Letters, and Service Spares Letters. This service is availa[ble] to interested persons such as owners, pilots, and mechanics at a nominal fe[e] and may be obtained through an authorized Piper Service Center or Piper's Customer Services Department.

Maintenance manuals, parts catalogs, and revisions to both, are available from Piper Service Centers or Piper's Customer Services Department.

Any correspondence regarding the airplane should include the airplane model and serial number to ensure proper response.

8.3 AIRPLANE INSPECTION PERIODS

Piper Aircraft Corporation has developed inspection items and required inspection intervals for the PA-32R (see PA-32R Maintenance and Inspection Manuals). The PA-32R Inspection Manual contains appropriate forms, and all inspection procedures should be complied with by a properly trained, knowledgeable, and qualified mechanic at a Piper Autorized Service Center or a reputable repair shop. Piper Aircraft Corporation cannot accept responsibility for the continued airworthiness of any aircraft not maintain[ed] to these standards, and/or not brought into compliance with applica[ble] Service Bulletins issued by Piper Aircraft Corporation, instructions issued by the engine, propeller, or accessory manufacturers, or Airworthiness Directives issued by the FAA.

A programmed Inspection, approved by the Federal Aviation Administration (FAA), is also available to the owner. This involves routine and detailed inspections to allow maximum utilization of the airplane. Maintenance inspection costs are reduced, and the maximum standard of continued airworthiness is maintained. Complete details are available from Piper Aircraft Corporation.

In addition, but in conjunction with the above, the FAA requires periodic inspections on all aircraft to keep the Airworthiness Certificate in effect. The owner is responsible for assuring compliance with these inspection requirements and for maintaining proper documentation in logbooks and/or maintenance records.

A spectrographic analysis of the engine oil is available from several sources. This inspection, if performed properly, provides a good check of the internal condition of the engine. To be accurate, induction air filters must be cleaned or changed regularly, and oil samples must be taken and sent in at regular intervals.

8.5 PREVENTIVE MAINTENANCE

The holder of a pilot certificate issued under Federal Aviation Regulations (FAR) Part 61 may perform certain preventive maintenance as defined in the FARs. This maintenance may be performed only on an aircraft which the pilot owns and operates, and which is not used in air carrier or air taxi/commercial operations service.

All other aircraft maintenance must be accomplished by a person or facility appropriately certificated by the Federal Aviation Administration (FAA) to perform that work.

Anytime maintenance is accomplished, an entry must be made in the appropriate aircraft maintenance records. The entry shall include:

(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 F 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. Towing lugs are incorporated as part of the nose gear fork.

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 ring 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 access door on left side of lower cowl.
(2) Remove the wing nuts securing the filter. Remove the filter.

(b) Cleaning Engine Air Filter

The injector 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 i. unleaded gasoline. When the housing is clean and dry, install the filter.

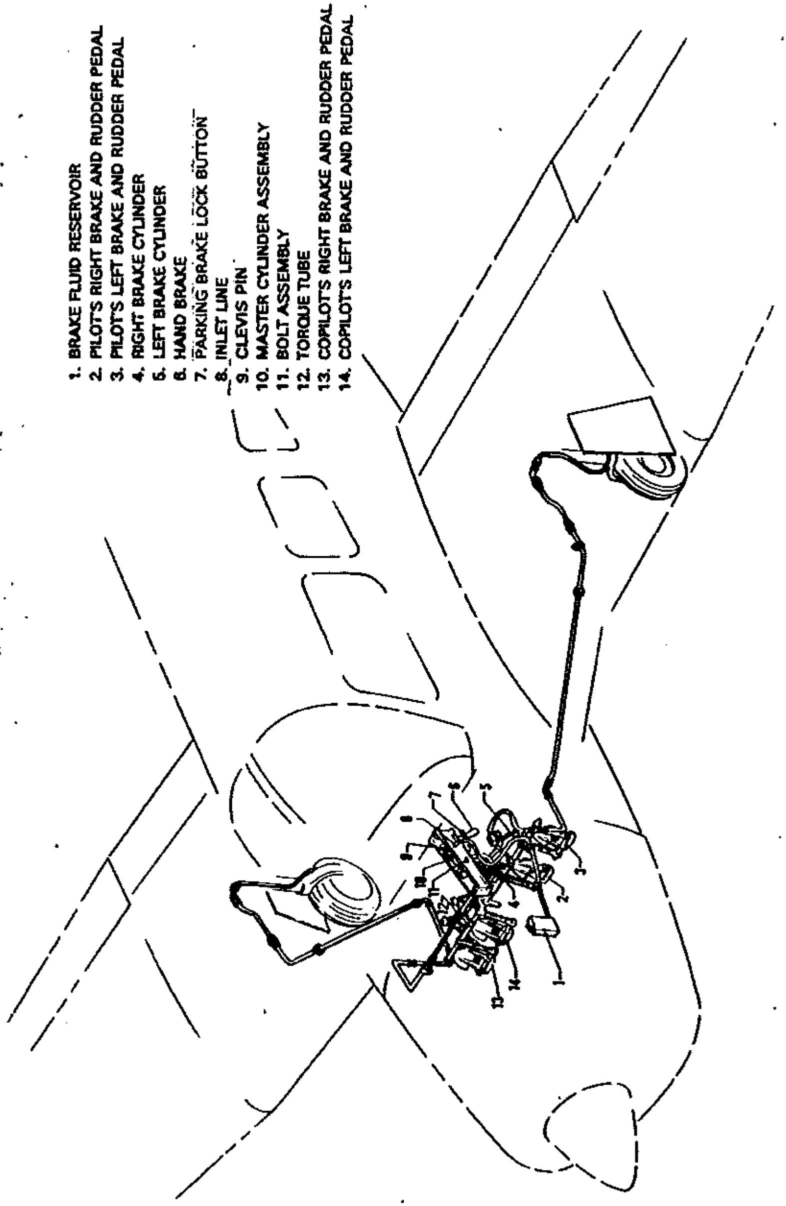
(c) Installation of Engine Air Filter

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 extende 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 Cleveland Aircraft Products 6.00 x 6 wheels with 6.00 x 6, eight-ply rating tires and tubes. The nose wheel uses a Cleveland Aircraft Products 5.00 x 5 wheel with a 5.00 x 5 six-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 should be serviced according to the instructions on the units. The main oleos should be extended under normal static load until 4.5 ± .5 inches of oleo piston tube is exposed, and the nose gear should show 3.25 ± .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 core 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 22.5° ±2° in either direction and is limited by stops at the rudder pedals.

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 TIO-540 series engine is 12 quarts, and the minimum safe quantity is 2-3/4 quarts. It is recommended that engine oil be drained and renewed every 50 hours, or sooner under unfavorable conditions. Full flow cartridge type oil filters should be replaced each 50 hours of operation. The interval between oil and oil filter change is not to exceed four (4) months. Lycoming Service Bulletin No. 446 should also be complied with each 50 hours. The following grades are required for temperatures:

Average Ambient Temperature All Temperatures	MIL-L-6082B SAE Grade --	MIL-L-22851 Ashless Dispersant SAE Grades 15W-50 or 20W-50
Above 80°F	60	60
Above 60°F	50	40 or 50
30°F to 90°F	40	40
0°F to 70°F	30	30, 40 or 20W-40
0°F to 90°F	20W50	20W50 or 15W50
Below 10°F	20	30 or 20W-30

When operating temperatures overlap indicated ranges, use the lighter grade oil.

NOTE

Refer to the latest issue of Lycoming Service Instruction 1014 (Lubricating Oil Recommendations) for further information.

8.21 FUEL SYSTEM

(a) Servicing Fuel System

At every 50 hour inspection, the fuel screens in the strainer and in the injector must be cleaned. The screen in the injector is located in the housing where the fuel line connects to the injector. The fuel strainer is located under the floor panel and is accessible for cleaning through an access plate on the underside of the fuselage. After cleaning, a small amount of grease applied to the gasket will facilitate reassembly.

(b) Fuel Requirements (AVGAS ONLY)

The minimum aviation grade fuel is 100. 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.

Whenever 100 or 100LL grade fuel is not available, commercial grade 100/130 should be used. (See Fuel Grade Comparison Chart.) Refer to the latest issue of Lycoming Service Instruction No. 1070 for additional information.

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. 3		
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 anit-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.

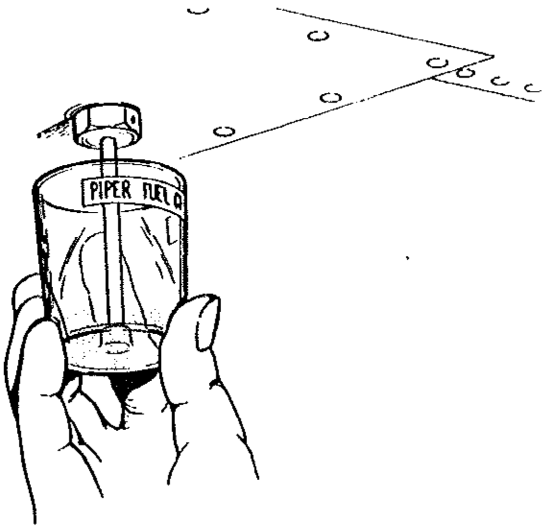
Fuel additive can not be used as a substitute for preflight draining of the fuel system drains.

(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 53.5 U.S. gallons. When using less than the standard 107 gallon capacity, fuel should be distributed equally between each side.

(d) Draining Fuel Strainer, Sumps and Lines

The fuel tank sumps and strainer should be drained before the first flight of the day and after refueling to avoid the accumulation of water and sediment. Each inboard fuel tank has an individual quick drain at the lower inboard corner. A fuel strainer with a fuel system quick drain is located at the lowest point in the system. Each tank sump should be drained through its individual quick drain until sufficient fuel has flowed to ensure the removal of any contaminants. The fuel strainer sump quick drain, operated by a lever inside the cabin on the right forward edge of the wing spar housing should be opened while the fuel selector valve is moved through the two tank positions. Enough fuel should flow at each position to allow the fuel lines and the strainer to ensure removal of contaminants. A quick drain fuel sampler is provided for the checking of the fuel clarity. (See Description-Airplane and Systems Section for more detailed instructions.)



FUEL TANK DRAIN
Figure 8-3

CAUTION

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

After using the fuel system quick drain, check from outside the airplane to be sure that it has closed completely and is not leaking.

(e) Draining Fuel System

The bulk of the fuel may be drained by opening the individual drain on each tank. The remaining fuel may be drained through the fuel strainer.

CAUTION

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

8.23 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressures - 35 psi for the nose gear and 38 psi for the main gear. All wheels and tires are balanced before original installation, and the relationship of tire, tube, and wheel should be maintained upon reinstallation. Unbalanced wheels can cause extreme vibration in the landing gear; therefore, in the installation of new components, it may be necessary to rebalance the wheels with the tires mounted. When checking tire pressure, examine the tires for wear, cuts, bruises, and slippage.

8.25 BATTERY SERVICE

Access to the 12-volt battery is through an access panel in the left side of the fuselage and by removing the floor of the forward baggage compartment. The battery box has a plastic tube which is normally closed off with a cap and which should be opened occasionally to drain off any accumulation of liquid. The battery should be checked for proper fluid level. DO NOT fill the battery above the baffle plates. DO NOT fill the battery with acid - use water only. A hydrometer check will determine the percent of charge in the battery.

If the battery is not up to charge, recharge starting at a 4 amp rate and finishing with a 2 amp rate. Quick charges are not recommended.

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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 in the applicable Service Manual.

(b) Cleaning Landing Gear

Before cleaning the landing gear, place a plastic cover or simi 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 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.

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 reduc 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. 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.

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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 inflight 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 55 nautical miles for the 102 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 full throttle position is selected. When 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. 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 has 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

(a) In case of malfunction, ACTIVATE disconnect switch located above the ignition switch, to OFF position.
(b) In case of malfunction, overpower the electric trim at either control wheel.
(c) Maximum altitude change with a 4 second delay in recovery initiation is 500 feet and occurs in the cruise configuration. Maximum altitude change in the approach configuration with a 4 second recovery delay is 100 feet.

SECTION 4 - NORMAL PROCEDURES

The electric trim system may be turned ON or OFF by a switch loca 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 must be used in conjunction with the FAA Approved Airplane Flight Manual, dated November 8, 1979 when Piper Autoflite II Autopilot, Model AK531 is installed in accordance with STC SA3054SW-D. The information contained herein supplements the information of the basic Airplane Flight Manual; for limitations, procedures and performance information not contained in this supplement, consult the basic Airplane Flight Manual.

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 (Autopilot V_{MO}).
(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 60° bank and a 400 foot altitude loss.
(d) In approach configuration, coupled or uncoupled; a malfunction with a 1 second delay in recovery initiation may result in an 18° bank and a 60 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 1 (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 a 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 must be used in conjunction with the FAA Approved Airplane Flight Manual, dated November 8, 1979 when Piper Autocontrol IIIB Autopilot, Model AK530, is installed in accordance with STC SA3053SW-D. The information contained herein supplements the information of the basic Airplane Flight Manual; for limitations, procedures and performance information not contained in this supplement, consult the basic Airplane Flight Manual.

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 pushing the roll ON-OFF rocker switch - OFF.
(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 climb, cruise or descending flight, could result in a 60° bank and a 400 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 18 bank and a 60 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 installation 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 to 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 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 console 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 an 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. Selected 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 must be used in conjunction with FAA Approved Airplane Flight Manual dated November 8, 1979 when Edo-Aire Mitchell Piper Altimatic IIIC Autopilot Model AK529 is installed in accordance with STC SA3052SW-D. The information contained herein supplements the information of the basic Airplane Flight Manual; for limitations, procedures and performance information not contained in this supplement, consult the basic Airplane Flight Manual.

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 Altimatic IIIC Autopilot is installed.

SECTION 2 - LIMITATIONS

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

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 breakers 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 60° of bank and 500 foot of altitude loss.
   (2) An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 20° of bank and 80 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 makes 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 that 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 UP and DOWN and check that control yoke moves same direction. Check to see that servo can be overriden by hand at control wheel.

NOTE

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

(4) Hold control yoke 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 elevator 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 Emergency Procedures 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 control 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 operatio by activating autopilot pitch command UP then DN. Observ 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 control to check manual trim operation. Reset to takeoff position prior to takeoff.

IN-FLIGHT PROCEDURE

(a) Trim airplane (ball centered).

(b) Check air pressure or vacuum to ascertain that the directional gyr 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 90 KIAS lower flaps one or two notches.

(f) Radio coupling VOR-ILS with HSI type instrument display. (Optional)

(1) VOR Navigation

a. Tune and identify VOR Station. Select desired course by rotating OBS knob OBS. (OMNI Bearing selector)
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 on OBS.
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 on OBS.
  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 displays 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/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 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.

(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 90-95 KIAS and lower flaps as desired.
    b. Use HDG mode and Pitch or altitude hold modes as appropriate during procedure turn.

c. At the FAF 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 attitude with pitch comand 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 95 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 90-95 KIAS on final approach glide slope capture is indicated by lighting of the green glide slope engage annunciator 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) (1) 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

KFC 200 AUTOMATIC FLIGHT CONTROL SYSTEM

SECTION 1 - GENERAL

This supplement must be attached to the Pilot's Operating Handbook and FAA approved Airplane flight Manual when the King KFC 200 Automatic Flight Control System is installed in accordance with STC SA 1522CE-D. The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic airplane flight manual.

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

The KFC 200 is certified in this airplane with 2 axis autopilot control, pitch and roll.

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

ABBREVIATIONS

ALT	Altitude or Altitude Hold
AP	Autopilot
APPR	Approach
ARM	System Arm for Capture
BC	Back Course
CDI	Course Deviation Indicator or Control
CPLD	Coupled
CWS	Control Wheel Steering (Synchronization)
DISC	Disconnect
FCS	Flight Control System
GS	Glide Slope
HDG	Heading Select
LOC	Localizer
NAV	Navigation
PAH	Pitch Attitude Hold
PNI	Pictorial Navigation Indicator

SECTION 2 - LIMITATIONS

(a) During autopilot operation, the pilot must be seated at the controls with seat belt fastened. Operation is restricted to left side pilot position.

(b) Maximum speed for autopilot operation is 175 KIAS. Minimum speed for autopilot operation is 82 KIAS.

(c) Autopilot operation prohibited with more than 25° flaps.

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

(e) The autopilot must be disengaged during takeoff and landing.

(f) The maximum fuel imbalance must not exceed 12 gallons (approximately one half hour flight time) during autopilot operation. If the autopilot is disengaged with a large fuel imbalance, a roll mistrim will be present.

(g) Autopilot attitude command limits:

Pitch	+15°
Roll	+25°

(h) Placards:
Location - Pilot's control wheel, left horn:

AP DISC | TRIM INTERRUPT

CWS

TRIM UP/DN

NOTE

In accordance with FAA recommendation, use of "ALTITUDE HOLD" mode is not recommended during operation in severe turbulence.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT MALFUNCTION
AP DISC/TRIM INTERRUPT switch - Hold the Control Wheel firmly and press the AP DISC/TRIM INTERRUPT Switch.

(b) ELECTRIC TRIM MALFUNCTION (EITHER MANUAL ELECTRIC OR AUTOTRIM)
(1) AP DISC/TRIM INTERRUPT Switch - Press and hold down until recovery can be made.
(2) FCS MASTER - OFF
(3) Aircraft - Manually retrim.
(4) Pitch Trim circuit breaker - Pull.

CAUTION

When disconnecting the autopilot after a trim malfunction, hold the control wheel firmly (up to 45 pounds of force on the control wheel may be necessary to hold the aircraft level).

(c) AUTOPILOT DISENGAGEMENT - MANUAL
The autopilot can be manually disengaged by the following methods:
(1) Press the A/P DISC/TRIM INTERRUPT switch on the pilot's control wheel.
(2) Move the Autopilot ON-OFF handle to the OFF position.
(3) Turn off the FCS MASTER.
(4) Operate manual electric trim switch UP or DN.

(d) AUTOPILOT DISENGAGEMENT - AUTOMATIC
The following conditions will cause the Autopilot to automatically disengage:
(1) Power failure.
(2) Internal Flight Control Computer power supply failure.
(3) With the KCS 55A compass system, a loss of compass valid (displaying HDG flag) disengages the Autopilot when a mode using heading information is engaged. With the HDG flag present only vertical modes can be selected.

(e) MAXIMUM ALTITUDE LOSSES DUE TO AUTOPILOT MALFUNCTION

(1) Cruise, Climb, Descent	400 feet
(2) Maneuvering	80 feet
(3) APPR	110 feet

CAUTION

When the autopilot is engaged, manual application of a force to the pitch axis of the control wheel for a period of three seconds or more will result in the autotrim system operating in the direction to create a force opposing the pilot. This opposing mistrim force will continue to increase as long as the pilot applies a force to the control wheel, and will ultimately overpower the autopilot. If the autopilot is disengaged under these conditions, the pilot may be required to exert control forces in excess of 50 pounds to maintain the desired airplane attitude. The pilot will have to maintain this control force while he manually retrims the airplane.

SECTION 4 -NORMAL PROCEDURES

(a) The MASTER switch function is unchanged.
(b) The FCS MASTER switch supplies power to the AUTOPILOT and PITCH TRIM system.
(c) The KFC 200 is controlled by the following circuit breakers.

AUTOPILOT - This supplies power to the FCS KC 295 Computer, KC 292 Mode Controller, KA 285 Annunciator panel, AP Pitch and Roll servos.

COMPASS SYSTEM - This supplies power to the KCS 55A Compass System.

PITCH TRIM - This supplies power to the FCS autotrim and manual electric pitch trim systems.

(d) PILOT'S CONTROL WHEEL SWITCH FUNCTIONS

AP DISC/TRIM INTERRUPT - This emergency disconnect switch will disengage the AP, interrupt the power to the electric trim system. To resume AP control, the AP lever on the Mode Controller must be re-engaged. In the event of electric trim or autotrim failure, the switch can be held depressed, which removes all power from the trim system to allow the pilot time to turn off the FCS MASTER Switch and pull the (PITCH TRIM) circuit breaker.

CWS - This switch when depressed and held will allow the pilot to manually fly the airplane without disengaging the AP. When the switch is released, the AP will resume control (within the pitch and roll attitude limits). The CWS switch will resync pitch attitude hold, or ALT hold mode. When the CWS is held depressed Manual Electric Trim may be operated without disengaging the AP.

TRIM DOWN/UP - Manual Electric pitch trim is activated by a dual action type switch that requires both halves be moved simultaneously for actuating up or down trim commands. Operation of the manual electric pitch trim switch will disengage the AP lever switch on the Mode Controller (except when CWS switch is held depressed as previously noted).

(e) FCS WARNING FLAGS AND ANNUNCIATORS DESIGNATION AND OPERATION

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

TRIM - The TRIM warning light, located in the lower right corner of the annunciator panel, will flash and be accompanied by an audible warning whenever autotrim and/or manual electric pitch trim failures occur. The trim servo motor running without a command is monitored on autotrim and manual trim. The trim servo motor not running when commanded to run and the trim servo motor running in the wrong direction are monitored on Autotrim only. The TRIM warning light flashes 4 to 6 times and the audible warning sounds when the test switch on the Mode Controller is depressed.

GS - The Glideslope valid (GS pointer being in view on PNI) has to be present before GS may couple. If, after GS coupled, the valid is lost, the system will flash the GS Annunciator and transfer from GS to pitch attitude hold with the FDI pitch steering bar providing pitch attitude steering information. If the GS valid returns the system will revert back to GS.

NAV - The NAV or APPR Modes (ARM or CPLD) may be selected and will function with or without a NAV warning flag present. The FDI bank steering will continue to provide steering information with or without a valid NAV signal.

AP (FLASHING) - Upon AP disengagement the AP light on the KA 285 Annunciator panel will flash at least 8 times and an aural alert will sound for 2 seconds.

(f) BEFORE ENGAGING FLIGHT CONTROL SYSTEM
(1) Check that all circuit breakers for the system are in.
(2) Allow sufficient time for gyros to come up to speed and system warm-up (3-4 minutes).

(g) PREFLIGHT CHECKS
Run Prior To Each Flight:

(1) With no modes engaged and power applied to all systems, depress the Test Button on the Mode Controller. All annunciators will be illuminated on the annunciator panel except FD and GA. The three marker lights will illuminate if the airplane uses the KA 285 as a remote marker annunciator. Also, the red TRIM failure light will flash. At least four or more flashes must be observed to indicate proper operation of the autotrim/manual electric pitch trim feature and audible warning should sound

(2) With the AP disengaged, run the following manual electric pitch trim checks.

a. Verify that the PITCH TRIM circuit breaker is in.

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

c. Grasping the manual trim wheel, run the trim both up and down and check the overpower capability. (Check that the trim indicator moves with the wheel.)

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

(3) Engage the AP, depress the CWS switch, center the flight controls and then release the CWS switch. Apply force to the controls to determine if the AP can be overpowered.

(4) Disengage the AP and set trim for takeoff.

CAUTION

If autopilot or electric trim fails preflight test, the FCS master switch should be turned off. Neither the electric trim nor the autopilot should be used.

Daily Check (Run prior to first flight of the day)

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

(2) Engage the AP and put in a pitch (UP) command using the vertical trim switch on the Mode Controller. Hold the control column to keep it from moving and observe the autotrim runs in the nose-up direction after approximately three seconds delay. Momentarily depress the CWS button and then use the vertical trim switch to input a pitch (DN) command. Hold the control column and observe that the autotrim runs in the nose-down direction after approximately three seconds.

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

NOTE

If the autopilot circuit breaker is tripped, the red "TRIM" failure light on the annunciator panel will be disabled and the audible warning will continuously sound indicating that the failure light is disabled. In this event the "PITCH TRIM" circuit breaker should be pulled and inflight trim accomplished by using the manual pitch trim wheel.

CAUTION

Operation of the autopilot on the ground may cause the autotrim to run because of system or pilot induced forces. Therefore, disengage the AP and check that the airplane manual pitch trim is in the takeoff position prior to takeoff.

(h) IN-FLIGHT OPERATION

(1) Engage Procedure:
After takeoff, clean up airplane and establish climb. Engage the AP. The pitch attitude will lock on any attitude up to 15° pitch attitude.

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

(2) Disengage Procedure:
While holding the control wheel firmly, disengage the system by one of the following methods: depressing the pilot's AP DISC/TRIM INTERRUPT switch by operation of the manual electric pitch trim switch; or by the operation of the engage lever on the Mode Controller. The AP light on the annunciator panel will flash at least four times and remain off to indicate that the AP is disengaged.

(3) AP Mode:
The AP must be engaged before any other mode can be engaged. The AP alone indicates PAH and wings level. The AP will automatically follow any other modes engaged. Disengaging the AP disengages all other modes.

NOTE

The "VERTICAL TRIM" switch, located on the mode controller, may be used to change the pitch attitude at a rate of one degree per second.

(4) Altitude Hold Mode (ALT):
When the ALT switch on the Mode Controller is pressed, the airplane will maintain the pressure altitude existing at the time the switch is depressed. For smooth operation, engage the ALT at no greater than 500 ft. per minute climb or descent. The ALT will automatically disengage when glideslope couples. ALT hold may be turned off at any time by depressing the ALT switch. ALT engagement is displayed on the annunciator panel.

NOTE

The "VERTICAL TRIM" switch, located on the mode controller, may be used to change altitude up or down at 500 to 700 FPM without disengaging the mode. The new pressure altitude that exists when the switch is released will then be held.

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

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

CAUTION

The "NAV" mode of operation will continue to provide airplane commands and/or control without a valid VOR/LOC signal (NAV flag in view). Also erroneous navigation information may result from comm radio interference with the NAV radio. This erroneous information may cause premature NAV captures as well as erroneous steering information. Should this occur re-select HDG mode and then re-select NAV mode.

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

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

CAUTION

The "APPR" mode of operation will continue to provide airplane commands and/or control without a valid VOR/LOC signal (NAV flag in view). Also erroneous navigation information may result from comm radio interference with the NAV radio. This erroneous information may cause premature APPR captures as well as erroneous steering information. Should this occur re-select HDG mode and then re-select APPR mode.

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

(9) Vertical Trim Switch (TRIM UP/DN):
Operation of the vertical trim switch on the Mode Controller provides a convenient means of changing the altitude when in ALT hold mode or pitch attitude when in pitch attitude hold mode without disengaging the mode.

(i) VOR PROCEDURES

(1) Tune NAV receiver to appropriate frequency.
(2) Set a desired Heading with the HDG bug to intercept the radial and engage AP and HDG (maximum recommended intercept angle is 90°).
(3) Select the desired radial and engage NAV. The FCS will rema on HDG as indicated on the annunciator panel and in ARM the NAV mode. When the airplane intercepts the beam, th system will automatically couple and track in NAV mode and indicate CPLD on the annunciator panel.
(4) A new course may be selected over the VOR station when operating in the NAV mode, by selecting a new radial when the To-From indication changes.

NOTE

For large course changes (10° or more) recommended procedure is to revert from NAV CPLD to HDG mode. Then reselect NAV and intercept new radial after leaving the VOR cone area.

(5) For VOR approach, see approach procedures.

(j) APPROACH PROCEDURES
(1) Tune ILS or VOR.
(2) Set CDI to front course.
(3) Set Heading Bug and engage HDG to intercept selected CDI course at any angle (maximum recommended intercept angle is 90°).
(4) Engage APPR and note APPR ARM on the annunciator panel.
(5) When airplane approaches the selected CDI course, APPR will couple, HDG will decouple, the AP will give commands to track LOC or VOR, and CPLD will illuminate on the annunciator panel.
(6) When the glideslope beam is intercepted, the glideslope will couple automatically and indicate GS on the annunciator panel. If ALT was engaged prior to intercepting the glideslope, it will automatically disengage when GS couples. The AP will now provide commands to track LOC and GS. Adjust throttle to control speed on descent. Set HDG bug for missed approach but do not engage HDG.

NOTE

Operation of the marker test function after approach coupled will reduce the flight control system gains. If this should occur, the approach mode should be recycled.

(k) BACK COURSE PROCEDURE
Same as front course except that BC is engaged after APPR is engaged and the airplane must be set for descent manually by holding the vertical trim switch DN on the mode controller if in Alt Hold or by establishing the desired PAH using CWS or vertical trim switch.

SECTION 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 7

KFC 200 AUTOMATIC FLIGHT CONTROL SYSTEM WITH FLIGHT DIRECTOR

SECTION 1 - GENERAL

This supplement must be attached to the Pilot's Operating Handbook and FAA approved Airplane Flight Manual when the King KFC 200 Automatic Flight Control System is installed in accordance with STC SA 1522CE-D. The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic airplane flight manual.

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

The KFC 200 is certified in this airplane with 2 axis autopilot control, pitch and roll. The system may be operated as a flight director alone with the pilot steering the airplane to the flight director command presentation or the autopilot can be engaged to automatically steer the airplane to the flight director command presentation.

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

ABBREVIATIONS

ALT	Altitude or Altitude Hold
AP	Autopilot
APPR	Approach
ARM	System Arm for Capture
BC	Back Course
CDI	Course Deviation Indicator or Control
CPLD	Coupled
CWS	Control Wheel Steering (Synchronization)
DISC	Disconnect
FCS	Flight Control System
FD	Flight Director
FDI	Flight Director Indicator
GA	Go Around
GS	Glide Slope
HDG	Heading Select
LOC	Localizer
NAV	Navigation
PAH	Pitch Attitude Hold
PNI	Pictorial Navigation Indicator

SECTION 2 - LIMITATIONS

(a) During autopilot operation, the pilot must be seated at the controls with seat belt fastened. Operation is restricted to left side pilot position.

(b) Maximum speed for autopilot operation is 175 KIAS. Minimum speed for autopilot operation is 82 KIAS.

(c) Autopilot operation prohibited with more than 25° flaps.

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

(e) The autopilot must be disengaged during takeoff and landing.

(f) The maximum fuel imbalance must not exceed 12 gallons (approximately one half hour flight time) during autopilot operation. If the autopilot is disengaged with a large fuel imbalance, a roll mistrim will be present.

(g) Autopilot attitude commands limits:

Pitch	±15°
Roll	±25°

(h) Placards:
Location - Pilot's control wheel, left horn:

AP DISC   TRIM INTERRUPT

CWS

TRIM UP/DN

NOTE

In accordance with FAA recommendation, use of "ALTITUDE HOLD" mode is not recommended during operation in severe turbulence.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT MALFUNCTION
AP DISC/TRIM INTERRUPT switch - Hold the Control Wheel firmly and press the AP DISC/TRIM INTERRUPT Switch.

(b) ELECTRIC TRIM MALFUNCTION (EITHER MANUAL ELECTRIC OR AUTOTRIM)
   (1) AP DISC/TRIM INTERRUPT Switch - Press and hold down until recovery can be made.
   (2) FCS MASTER - OFF
   (3) Aircraft - Manually retrim.
   (4) Pitch Trim circuit breaker - Pull.

CAUTION

When disconnecting the autopilot after a trim malfunction, hold the control wheel firmly (up to 45 pounds of force on the control wheel may be necessary to hold the aircraft level).

(c) AUTOPILOT DISENGAGEMENT - MANUAL
The autopilot can be manually disengaged by the followi
methods:
(1) Press the A/P DISC/TRIM INTERRUPT switch on the pilot's control wheel.
(2) Move the Autopilot ON-OFF handle to the OFF position.
(3) Engage the Go-Around mode.
(4) Turn off the FCS MASTER.
(5) Operate manual electric trim switch UP or DN.

(d) AUTOPILOT DISENGAGEMENT - AUTOMATIC
The following conditions will cause the Autopilot to automatically disengage:
(1) Power failure.
(2) Internal Flight Computer Power supply failure.
(3) With the KCS 55A compass system, a loss of compass valid (displaying HDG flag) disengages the Autopilot and Flight Director when a mode using heading information is engaged. With the HDG flag present only vertical modes can be selected for FD or Autopilot operation.

(e) MAXIMUM ALTITUDE LOSSES DUE TO AUTOPIL
MALFUNCTION

(1) Cruise, Climb, Descent	400 feet
(2) Maneuvering	80 feet
(3) APPR	110 feet

CAUTION

When the autopilot is engaged, manual application of a force to the pitch axis of the control wheel for a period of three seconds or more will result in the autotrim system operating in the direction to create a force opposing the pilot. This opposing mistrim force will continue to increase as long as the pilot applies a force to the control wheel, and will ultimately overpower the autopilot. If the autopilot is disengaged under these conditions, the pilot may be required to exert control forces in excess of 50 pounds to maintain the desired airplane attitude The pilot will have to maintain this control force while he manually retrims the airplane.

SECTION 4 -NORMAL PROCEDURES

System Operations:

(a) The MASTER switch function is unchanged.

(b) The FCS MASTER switch supplies power to the AUTOPILOT and PITCH TRIM system.

(c) The KFC 200 is controlled by the following circuit breakers.

AUTOPILOT - This supplies power to the FCS KC 295 Computer, KC 290 Mode Controller, KA 285 Annunciator panel, AP Pitch and Roll servos and KI 256.

COMPASS SYSTEM - This supplies power to the KCS 55A Compass System.

PITCH TRIM - This supplies power to the FCS autotrim and manual electric pitch trim systems.

(d) PILOT'S CONTROL WHEEL SWITCH FUNCTIONS

AP DISC/TRIM INTERRUPT - This emergency disconnect switch will disengage the AP, interrupt the power to the electric trim system and disconnect all FD Modes. To resume AP control, a FD Mode and the AP lever on the Mode Controller must be re-engaged. In the event of electric trim or autotrim failure, the switch can be held depressed, which removes all power from the trim system to allow the pilot time to turn off the FCS MASTER Switch and pull the (PITCH TRIM) circuit breaker.

CWS - This switch when depressed and held will allow the pilot to manually fly the airplane without disengaging the AP. When the switch is released, the AP will resume control (within the pitch and roll attitude limits). The CWS switch will resync the FD in PAH, or ALT hold mode and will transfer the GA mode to PAH. When the CWS is held depressed Manual Electric Trim may be operated without disengaging the AP.

TRIM DOWN/UP - Manual Electric pitch trim is activated by a dual action type switch that requires both halves be moved simultaneously for actuating up or down trim commands. Operation of the manual electric pitch trim switch will disengage the AP lever switch on the Mode Controller (except when CWS switch is held depressed as previously noted).

GA - The GA switch is located on the throttle and the operation of the switch will indicate a fixed angle of climb of 10° on the FDI. Selection of the GA Mode when in the APPR or NAV CPLD M will disengage the mode and revert to the FD Mode (wings level) lateral steering. The AP, if engaged, will disengage. However, the AP may be engaged/re-engaged with the GA Mode selected and will follow the FDI pitch command to climb at the fixed angle.

(e) FCS WARNING FLAGS AND ANNUNCIATORS DESIGNATION AND OPERATION

FD - The KI 256 Flight Director Indicator command bars will be biased out of view whenever the system is invalid or a FD mode is not engaged.

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

TRIM - The TRIM warning light, located in the lower right co of the annunciator panel, will flash and be accompanied by an audible warning whenever autotrim and/or manual electric pitch trim failures occur. The trim servo motor running without a command is monitored on autotrim and manual trim. The trim servo motor not running when commanded to run and the trim servo motor running in the wrong direction are monitored on Autotrim only. The TRIM warning light flashes 4 times and the audible warning sounds when the test switch on the Mode Controller is depressed.

GS - The Glideslope valid (GS pointer being in view on PNI) has to be present before GS may couple. If, after GS coupled, the valid is lost, the system will flash the GS Annunciator and transfer from GS to pitch attitude hold with the FDI pitch steering bar providing pitch attitude steering information. If the GS valid returns the system will revert back to GS.

NAV - The NAV or APPR Modes (ARM or CPLD) may be selected and will function with or without a NAV warning flag present. The FDI bank steering will continue to provide steering information with or without a valid NAV signal.

AP (FLASHING) - Upon AP disengagement the AP light on the KA 285 Annunciator panel will flash at least 8 times and an aural alert will sound for 2 seconds.

(f) BEFORE ENGAGING FLIGHT CONTROL SYSTEM
   (1) Check that all circuit breakers for the system are in.
   (2) Allow sufficient time for gyros to come up to speed and system warm-up (3-4 minutes).

(g) PREFLIGHT CHECKS
   Run Prior To Each Flight:
   (1) With no modes engaged and power applied to all systems, depress the Test Button on the Mode Controller. All annunciators will be illuminated on the annunciator panel, including the three marker lights, if the airplane uses the KA 285 as a remote marker annunciator. Also, the red TRIM failure light will flash. At least four or more flashes must be observed to indicate proper operation of the autotrim/manual electric pitch trim feature and audible warning should sound.
   (2) With the AP disengaged, run the following manual electric pitch trim checks.
      a. Verify that the PITCH TRIM circuit breaker is in.
      b. Actuate the left-side switch to the fore and aft positions. The trim solenoid should engage, but the trim should not run.
         Actuate the right-side switch to the fore and aft positions. The trim solenoid should not engage and the trim should not run.
      c. Grasping the manual trim wheel, run the trim both up and down and check the overpower capability. (Check that the trim indicator moves with the wheel.)
      d. Press the AP DISC/TRIM INTERRUPT switch down and hold. The manual electric pitch trim will not operate either up or down.
   (3) Engage the FD. Then engage the AP, depress the CWS switch, center the flight controls and then release the CWS switch. Apply force to the controls to determine if the AP can be overpowered.

(4) Disengage the AP and set trim for takeoff.

CAUTION

If autopilot or electric trim fails preflight test, the FCS master switch should be turned off. Neither the electric trim nor the autopilot should be used.

Daily Check (Run prior to first flight of the day)

(1) Check the operation of the pilot's control wheel switch functions.
(2) Engage the FD and AP and put in a pitch (UP) command using the vertical trim switch on the Mode Controller. Hold the control column to keep it from moving and observe the autotrim runs in the nose-up direction after approximately three seconds delay. Momentarily depress the CWS button and then use the vertical trim switch to input a pitch (DN) command. Hold the control column and observe that the autotrim runs in the nose-down direction after approximately three seconds.
(3) Engage the HDG mode and the AP. Set the HDG bug to command a right turn. The control wheel will rotate clockwise. Set the HDG bug to command a left turn. The control wheel will rotate counterclockwise.

NOTE

If the autopilot circuit breaker is tripped, the red "TRIM" failure light on the annunciator panel will be disabled and the audible warning will continuously sound indicating that the failure light is disabled. In this event the "PITCH TRIM" circuit breaker should be pulled and inflight trim accomplished by using the manual pitch trim wheel.

CAUTION

Operation of the autopilot on the ground may cause the autotrim to run because of system or pilot induced forces. Therefore, disengage the AP and check that the airplane manual pitch trim is in the takeoff position prior to takeoff.

(h) IN-FLIGHT OPERATION

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

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

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

(3) Flight Director Mode (FD):
The FD mode must be engaged before the AP can be engaged. The FD mode alone indicates Pitch Attitude Hold and wings level. The pilot may choose to fly the FDI commands manually, without the AP engaged, by depressing the FD mode switch on the Mode Controller and selecting any of the other modes he wishes to follow. When the AP is engaged, the airplane will automatically follow the FDI commands. The FD may be disengaged by depressing the FD mode switch on the Mode Controller at any time the AP is not engaged or by pressing the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel with or without the AP engaged. FD mode engagement is displayed on the annunciator.

NOTE

The "VERTICAL TRIM" switch, located on the mode controller, may be used to change the pitch attitude at a rate of one degree per second (the pitch attitude degrees legend on the airplane attitude indicator will not serve to indicate accurate FDI pitch steering bar pitch attitudes in degrees).

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

— NOTE —

The "VERTICAL TRIM" switch, located on the mode controller, may be used to change the altitude up or down at 500 to 700 FPM without disengaging the mode. The new pressure altitude that exists when the switch is released will then be held.

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

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

CAUTION

The "NAV" mode of operation will continue to provide airplane commands and/or control without a valid VOR/LOC signal (NAV flag in view). Also erroneous navigation information may result from comm radio interference with the NAV radio. This erroneous information may cause premature NAV captures as well as erroneous steering information. Should this occur re-select HDG mode and then re-select NAV mode.

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

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

CAUTION

The "APPR" mode of operation will continue to provide airplane commands and/or control without a valid VOR/LOC signal (NAV flag in view). Also erroneous navigation information may result from comm radio interference with the NAV radio. This erroneous information may cause premature APPR captures as well as erroneous steering information. Should this occur re-select HDG mode and then re-select APPR mode.

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

(9) Vertical Trim Switch (TRIM UP/DN):
Operation of the vertical trim switch on the Mode Controller provides a convenient means of changing the altitude when in ALT hold mode or pitch attitude when in pitch attitude hold mode without disengaging the mode.

(10) Go-Around Mode (GA):
The GA mode may be engaged at any time by depressing the GA switch on the engine throttle. GA will illuminate on the annunciator panel indicating mode status. The GA mo provides a fixed pitch up angle indication on the FDI. The A if engaged, will disengage. GA will cancel all other vertical modes as wll as APPR or NAV CPLD.

(i) VOR PROCEDURES
- (1) Tune NAV receiver to appropriate frequency.
- (2) Set a desired Heading with the HDG bug to intercept the radial and engage HDG and AP (maximum recommended intercept angle is 90°).
- (3) Select the desired radial and engage NAV. The FCS will remain on HDG as indicated on the annunciator panel and in ARM on the NAV mode. When the airplane intercepts the beam, the system will automatically couple and track in NAV mode and indicate CPLD on the annunciator panel.
- (4) A new course may be selected over the VOR station when operating in the NAV mode, by selecting a new radial when the To-From indication changes.

NOTE

For large course changes (10° or more) recommended procedure is to revert from NAV CPLD to HDG mode. Then reselect NAV and intercept new radial after leaving the VOR cone area.

- (5) For VOR approach, see approach procedure.

(j) APPROACH PROCEDURES
- (1) Tune ILS or VOR.
- (2) Set CDI to front course.
- (3) Set Heading Bug and engage HDG to intercept selected CDI course at any angle (maximum recommended intercept angle is 90°).
- (4) Engage APPR and note APPR ARM on the annunciator panel.
- (5) When airplane approaches the selected CDI course, APPR will couple, HDG will decouple, the FDI and/or AP will give commands to track LOC or VOR, and CPLD will illuminate on the annunciator panel.
- (6) When the glideslope beam is intercepted, the glideslope will couple automatically and indicate GS on the annunciator panel. If ALT was engaged prior to intercepting the glideslope, it will automatically disengage when GS couples. FDI and/or AP will now provide commands to track LOC and GS. Adjust throttle to control speed on descent. Set HDG bug for missed approach but do not engage HDG.

NOTE

Should the "GA" mode be inadvertently selected during "APPR" mode operation, cancel the "GA" mode (press CWS) prior to re-selection of the "APPR" mode. It may be necessary to use some combination of vertical trim and power to re-center the glideslope for "GS" coupling. Failure to follow this procedure will result in the "GS" mode being inhibited.

NOTE

Operation of the marker test function after approach coupled will reduce the flight control system gains. If this should occur, the approach mode should be recycled.

(k) GO AROUND PROCEDURE
Depress the Go Around (GA) switch and perform missed approach procedure as per Airplane Flight Manual. The AP will disengage and the FDI will command a 10° climb attitude. When established in climb attitude, the AP may be re-engaged and the APPR MODE may be selected for a straight away missed approach or HDG may be selected to turn to the missed approach heading.

(l) BACK COURSE PROCEDURE
Same as front course except that BC is engaged after APPR is engaged and the airplane must be set for descent manually by holding the vertical trim switch DN on the mode controller if in Alt Hold or by establishing the desired PAH using CWS or vertical trim switch.

SECTION 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 3362SW-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 desc with a 3 second delay in recovery initiation could result as much as 60° 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 18° bank and 60′ 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 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 recommeneded 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 HI 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

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 AK865 or Century 41 Flight Director Autopilot Mode AK865FD is installed in accordance with STC 3361SW. 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 programm
   c. Depressing master disconnect switch on pilot's contr 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 the failed system has been identified, pull the 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 60° bank and 450' 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 18° bank and 80' altitude loss. Maximum altitude lo measured in approach configuration, gear down, a 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 car(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" messsage 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 activa(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 conducting the following preflight check before the first flight each day. If the trim system fails any portion of this test, turn the autotrim 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 w 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 takeoff.

(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' 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 magentic compass HDG.
(3) Perform standard VOR receiver check.
(4) NAV-APPR - Engage NAV or APPR mode switch and observe steering bar indicates turn torward 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 mode) (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 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 reselect 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

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 the 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 one of 3 basic modes: (a) VOR, (b) RNAV, or (c) ILS. To change from one mode to another, the appropriate push button 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 enroute (RNV ENR) modes, the KNS 80 has a constant course width or parallel VOR mode (VOR PAR) and an RNAV approach mode (RNV APR). To place the unit in either of these secondary modes the VOR pushbutton or the RNAV pushbutton, as the case may be, is pushed a second time. Repetitive pushing of the VOR button will cause the system to alternate between the VOR and VOR PAR modes, while repetitive pushing of 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 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 units to tens position.
Rollover occurs from 117 to 108, or vice versa.
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 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 the Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 11

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 this 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.

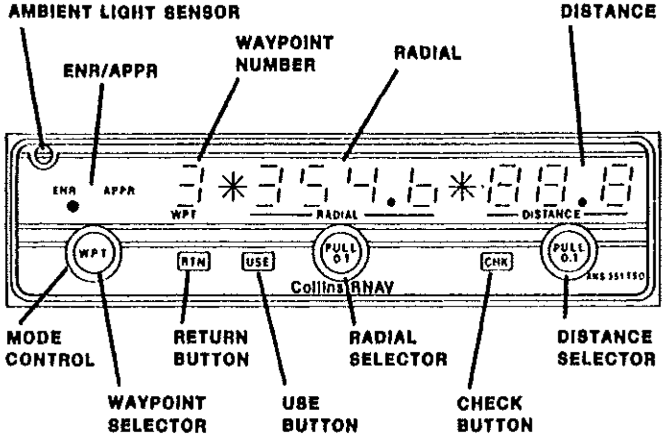
SECTION 2 - LIMITATIONS

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 the 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	Sequence 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 in 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 in 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 remains 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) Presetting of Waypoint On Ground

Waypoints are entered after engine start, since the waypo information will probably be lost during the low-voltag condition occurring during 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 th Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 12

RCA WEATHERSCOUT WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional RCA WeatherScout Weather Radar 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 RCA WeatherScout Weather Radar System is installed.

SECTION 2 - LIMITATIONS

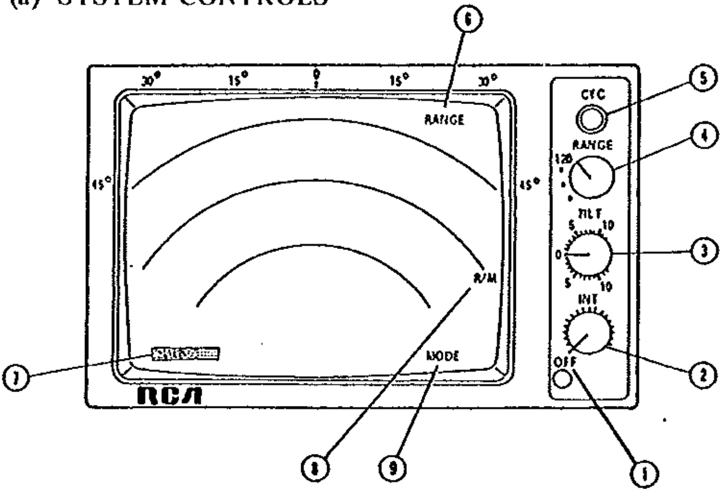
No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

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

SECTION 4 - NORMAL PROCEDURES

(a) SYSTEM CONTROLS



INDICATOR CONTROLS AND DISPLAY FEATURES

(1)	OFF	On/Off function: full CCW rotation of INTensity control places system in OFF condition.
(2)	INT	Rotary control used to regulate brightness (INTensity) of display.
(3)	TILT	Rotary control used to adjust antenna elevation position. Control indexes increments of tilt from 0 to 12 degrees up down.
(4)	RANGE 12/30/60/90 or 12/30/60/120	Rotary switch used to select one of four ranges.

(5)	CYC	Pushbutton switch used to select cyclical contour mode. Data is presented alternately as normal for 0.5 seconds, then contoured for 0.5 seconds. Pressing switch a second time restores normal or WX mode.
(6)	Range Field	Maximum selected range is displayed. Maximum range is always displayed when indicator is in on-condition.
(7)	Test Field	Test block displays three illumination levels.
(8)	Range Mark Identifier	Individual label displayed for each range mark.
(9)	Mode Field	Operating mode is displayed as WX or CYC. When system is first turned on, WAIT is displayed until system times out (30-40 seconds).

(b) PRELIMINARY CONTROL SETTINGS
Place the Indicator controls in the following positions before applying power from the aircraft electrical system:

INTensity control .... Fully counterclockwise, in OFF
TILT control .... Fully upward
RANGE switch .... 12 nautical miles

(c) OPERATIONAL CONTROL SETTINGS
- (1) Rotate INTensity control clockwise to bring system into ON condition.
- (2) Note that WAIT is displayed during warm-up period of 30-40 seconds.
- (3) When WX is displayed, rotate INTensity control clockwise until display brightness is at desired level.
- (4) Set RANGE switch to desired range.
- (5) Adjust TILT control for desired forward scan area.

(d) PRECAUTIONS
If the radar is to be operated while the aircraft is on the grou
(1) Direct nose of aircraft such that antenna scan sector is fre large metallic objects (hangars, other aircraft) for a distance of 100 yards (90 meters), and tilt antenna fully upward.

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks of containers accommodating flammables or explosives; do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

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 13

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 month flashing. Pressing the ST-SP button will advance the mo 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 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 nor timekeeping mode without altering the minutes timing. This fea 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.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 14 FOR KING KAP/KFC 150 SERIES FLIGHT CONTROL SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the King KAP/KFC 150 Series Flight Control System is installed in accordance with STC SA1572CE-D. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED Ward Evans
WARD EVANS
D.O.A. NO. SO-1
PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

DATE OF APPROVAL OCTOBER 11, 1983

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of airplane when the optional King KAP/KFC 150 Series Flight Cont... System is installed. The Flight Control System must be operated within the limitations herein specified. 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 King KAP/KFC 150 Series Flight Control System is installed.

SECTION 2 - LIMITATIONS

(a) During autopilot operation, a pilot with seat belt fastened must be seated at the left pilot position.
(b) The autopilot must be OFF during takeoff and landing.
(c) The system is approved for Category I operation only (Approach mode selected).
(d) Autopilot airspeed limitation: Maximum 175 KIAS.
(e) Autopilot flap limitation: Maximum flap extension - 25°.
(f) Maximum fuel imbalance - 12 gallons.
(g) When equipped with a KAS 297B, altitude select captures below 800 feet AGL are prohibited.

NOTE

In accordance with FAA recommendation, use of "altitude hold" mode is not recommended during operation in severe turbulence.

SECTION 3 - EMERGENCY PROCEDURES

(a) In case of Autopilot malfunction: (accomplish items 1. and 2. simultaneously)

(1) Airplane Control Wheel - GRASP FIRMLY and regain aircraft control.
(2) AP DISC/TRIM INTER Switch - PRESS and HOLD.
(3) AP DISC/TRIM INTER Switch - RELEASE while observi... pitch trim wheel. If pitch trim wheel is in motion, follow the Electric Trim Malfunction Procedure.

(b) In case of Electric Trim Malfunction (either manual electric or autotrim):

(1) AP DISC/TRIM INTER Switch - PRESS and HOLD throughout recovery.
(2) PITCH TRIM Circuit Breaker - PULL.
(3) Aircraft - RETRIM manually.

CAUTION

When disconnecting the autopilot after a trim malfunction, hold the control wheel firmly; up to 45 pounds of force on the control wheel may be necessary to hold the aircraft level.

Maximum Altitude losses due to autopilot malfunction:

Configuration	Alt Loss
Cruise, Climb, Descent	300 '
Maneuvering	75 '
APPR	60 '

SECTION 4 - NORMAL PROCEDURES

(a) PREFLIGHT (PERFORM PRIOR TO EACH FLIGHT)

(1) GYROS - Allow 3-4 minutes for gyros to come up to speed.
(2) RADIO POWER Switch - ON.
(3) PREFLIGHT TEST BUTTON - PRESS momentarily and NOTE:
   a. All annunciator lights on (TRIM annunciator flashing).
   b. When equipped with KAS 297B, all legends and digits are displayed on the KAS 297B.
   c. After approximately 5 seconds, all annunciator lights off except AP which will flash approximately 12 times and then remain off.

NOTE

If trim warning light stays on then the autotrim did not pass preflight test. The autopilot circuit breakers should be pulled. Manual electric trim cannot be used.

(4) MANUAL ELECTRIC TRIM - TEST as follows:
   a. Actuate the left side of the split switch to the fore and aft positions. The trim wheel should not move on its own. Rotate the trim wheel manually against the engaged clutch, to check the pilot's overpower capability.
   b. Actuate right side of split switch unit to the fore and aft positions. The trim wheel should not move on its own and normal trim wheel force is required to move it manually.
   c. Press the AP DISC/TRIM INTER switch down and hold. Manual Electric Trim should not operate either nose up or nose down.
(5) FLIGHT DIRECTOR (KFC 150 ONLY) - ENGAGE by pressing FD or CWS button.
(6) AUTOPILOT - ENGAGE by pressing AP ENG button.
(7) CONTROL WHEEL - MOVE fore, aft, left and right to verify that the autopilot can be overpowered.
(8) AP DISC/TRIM INTER Switch - PRESS. Verify that the autopilot disconnects and all flight director modes are cancelled.
(9) TRIM - SET to take off position.

(b) AUTOPILOT OPERATION

(1) Before takeoff
AP DISC/TRIM INTER Switch - PRESS.

(2) Autopilot Engagement
   a. FD Mode Selector Button (KFC 150 Only) - PRESS.
   b. AP ENG Button - PRESS. Note AP annunciator on. If no other modes are selected the autopilot will operate in wings level and pitch attitude hold.

CAUTION

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

(3) Climb or Descent
a. Using CWS
1. CWS Button - PRESS and MOVE aircraft nose to the desired attitude.
2. CWS Button - RELEASE. Autopilot will maintain aircraft pitch attitude up to the pitch limits of +15° or -10°.
b. Using Vertical Trim
1. VERTICAL TRIM Control - PRESS either up or down to modify aircraft attitude at a rate of .7 deg/sec. up to the pitch limits of +15° or -10°.
2. VERTICAL TRIM Control - RELEASE when desired aircraft attitude is reached. The autopilot will maintain the desired pitch attitude.

(4) Vertical Speed and Altitude Select, when equipped with KAS 297B
a. Vertical Speed Select
1. VERTICAL SPEED SELECT knob - PULL small knob to the OUT position.
2. VERTICAL SPEED SELECT knob - ROTATE until desired vertical speed is displayed.
3. VERTICAL SPEED MODE (ENG) button - PUSH to engage the vertical speed hold mode.

b. Changing Vertical Speed
1. Using CWS

CWS button - PRESS and HOLD, while establishing the desired vertical speed.

CWS button - RELEASE, when the desired vertical speed is obtained.

2. Using Vertical Trim Control

VERTICAL TRIM CONTROL - PRESS either up or down to increase or decrease the vertical speed. Displayed vertical speed changes 100 fpm for every second the control is held down.

CAUTIONS

When operating at or near the best rate of climb airspeed and using vertical speed hold, it is easy to decelerate to an airspeed on the back side of the power curve (a decrease in airspeed results in a reduced rate of climb). Continued operation on the back side of the power curve in vertical speed hold mode will result in a stall.

When operating at or near the maximum autopilot speed, it will be necessary to reduce power in order to maintain the desired rate of descent and not exceed the maximum autopilot speed.

c. Altitude Preselect
   1. ALTITUDE SELECT knob - PUSH small knob to the IN position.
   2. ALTITUDE SELECT knob - ROTATE until the desired altitude is displayed.
   3. ALTITUDE SELECT MODE (ARM) button PUSH to arm the altitude select mode.
   4. Airplane - ESTABLISH ATTITUDE necessary to intercept the selected altitude.

(5) Altitude Hold

a. ALT Mode Selector Button - PRESS. Note ALT mode annunciator ON. Autopilot will maintain the selected pressure altitude.

b. Change selected altitudes
   1. Using CWS (recommended for altitude changes greater than 100 ft.)
      CWS Button - PRESS and fly aircraft to desired pressure altitude.

      CWS Button - RELEASE when desired pressure altitude is reached. The autopilot will maintain the desired pressure altitude.

2. Using Vertical Trim (Recommended for altitude changes less than 100 ft.)
VERTICAL TRIM Control - PRESS either up or down. Vertical Trim will seek an altitude rate of change of 500 fpm.

VERTICAL TRIM Control - RELEASE when desired pressure altitude is reached. The autopilot will maintain the desired pressure altitude.

(6) Heading Changes
a. Manual Heading Changes
1. CWS Button - PRESS and MANEUVER aircraft to the desired heading.
2. CWS Button - RELEASE. Autopilot will maintain aircraft in wings level attitude.

NOTE

Aircraft heading may change in the wings level mode due to an aircraft out of trim condition.

b. Heading Hold
1. Heading Selector Knob - SET BUG to desired heading.
2. HDG Mode Selector Button - PRESS. Note HDG mode annunciator ON. Autopilot will automatically turn the aircraft to the selected heading.

c. Command Turns (Heading Hold mode ON)
HEADING Selector Knob - MOVE BUG to the desired heading. Autopilot will automatically turn the aircraft to the new selected heading.

(7) NAV Coupling
a. When equipped with HSI.
1. Course Bearing Pointer - SET to desired course.

NOTE

When equipped with NAV 1/NAV 2 switching and NAV 2 is selected, set OBS to the desired course.

2. HEADING Selector Knob - SET BUG to provi desired intercept angle.
3. NAV Mode Selector Button - PRESS.
If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if HDG not selected) with the NAV annunciator flashing; when the computed capture point is reached the HDG will disengage, the NAV annunciator will illuminate steady and the selected course will be automatically captured and tracked.

If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting NAV mode; the NAV annunciator will illuminate steady and the capture/ track sequence will automatically begin.

b. When equipped with DG
1. OBS Knob - SELECT desired course.
2. NAV Mode Selector Button - PRESS.
3. Heading Selector Knob - ROTATE BUG to agree with OBS course.

NOTE

When NAV is selected, the lateral operating mode will change from HDG (if selected) to wings level for 5 seconds. A 45° intercept angle will then be automatically established based on the position of the bug.

If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode (unless HDG not selected) and NAV flashing; when the computed capture point is reached the HDG annunciator will go out, the NAV annunciator will illuminate steady and the selected course will be automatically captured and tracked.

If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting NAV mode; the NAV annunciator will illuminate steady and the capture/tr sequence will automatically begin.

(8) Approach (APR) Coupling

a. When equipped with HSI

1. Course Bearing Pointer - SET to desired course.

NOTE

When equipped with NAV 1/NAV 2 switching and NAV 2 is selected, set OBS to the desired course.

2. HEADING Selector Knob - SET BUG to provide desired intercept angle.
3. APR Mode Selector Button - PRESS.
   If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if HDG not selected) with the APR annunciator flashing; when the computed capture point is reached the HDG will disengage, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

   If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting APR mode; the APR annunciator will illuminate steady and the capture/track sequence will automatically begin.

b. When equipped with DG

1. OBS Knob - SELECT desired approach course.
2. APR Mode Selector Button - PRESS.
3. Heading Selector Knob - ROTATE Bug to agree with OBS course.

NOTE

When APR is selected, the lateral operating mode will change from HDG (if selected) to wings level for 5 seconds. A 45° intercept angle will then be automatically established based on the position of the bug.

If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode (unless HDG not selec and APR flashing; when the computed capture p is reached the HDG annunciator will go out, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting APR mode; the APR annunciator will illuminate steady and the capture/track sequence will automatically begin.

(9) BC Approach Coupling
 a. When equipped with HSI
  1. Course Bearing Pointer - SET to the ILS front course inbound heading.

NOTE

When equipped with NAV 1/NAV 2 switching and NAV 2 is selected, set OBS to the ILS front course inbound heading.

  2. HEADING Selector Knob - SET BUG to provide desired intercept angle.

  3. BC Mode Selector Button - PRESS.
  If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if HDG not selected) with BC annunciated steady and APR annunciator flashing; when the computed capture point is reached the HDG will disengage, and the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

  If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting BC mode; the APR and BC annunciators will illuminate steady and the capture/track sequence will automatically begin.

 b. When equipped with DG
  1. OBS Knob - SELECT the ILS front course inbound heading.

2. BC Mode Selector Button - PRESS.
3. Heading Selector Knob - ROTATE Bug to the ILS front course inbound heading.

NOTE

When BC is selected, the lateral operating mode will change from HDG (if selected) to wings level for 5 seconds. A 45° intercept angle will then be established based on the position of the bug.

If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG (unless HDG not selected) and BC modes with APR flashing; when the computed capture point is reached the HDG annunciator will go out, the BC and the APR annunciators will illuminate steady and the selected course will be automatically captured and tracked.

If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting BC mode; the APR and BC annunciators will illuminate steady and the capture/track sequence will automatically begin.

(10) Glide Slope Coupling

NOTE

Glide slope coupling is inhibited when operating in NAV or APR BC modes. Glide slope coupling occurs automatically in the APR mode.

a. APR Mode - ENGAGED.
b. At glide slope centering - NOTE GS annunciator ON.

NOTE

Autopilot can capture glide slope from above or below the beam while operating in either pitch attitude hold or ALT hold modes.

(11) Missed Approach
- a. AP DISC/TRIM INTER Switch - PRESS to diseng AP.
- b. MISSED APPROACH - EXECUTE.
- c. CWS Button - PRESS (KFC 150 only) as desired to activate FD mode during go-around maneuver.
- d. AP ENG Button - PRESS (if AP operation is desired). Note AP annunciator ON.

NOTE

If it is desired to track the ILS course outbound as part of the missed approach procedure, use the NAV mode to prevent inadvertent GS coupling.

(12) Before Landing
AP DISC/TRIM INTER Switch - PRESS to disengage AP.

(c) FLIGHT DIRECTOR OPERATION (KFC 150 SYSTEMS ONLY)

NOTE

The flight director modes of operation are the same as those used for autopilot operations except the autopilot is not engaged and the pilot must maneuver the aircraft to satisfy the flight director commands.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the basic Pilot's Operating Handbook

SECTION 7 - DESCRIPTION AND OPERATION

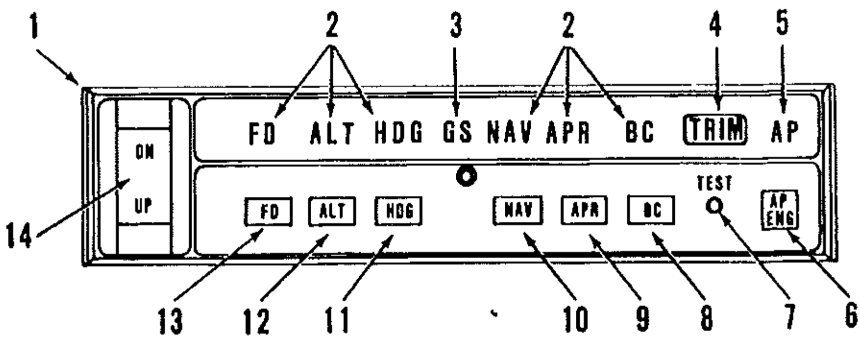
The 150 Series AFCS is certified in this airplane with 2 axis control, ...ch and roll. The various instruments and the controls for the operation of ...e 150 System are described in Figures 7-1 thru 7-17.

The 150 Series AFCS has an electric pitch trim system which provides autotrim during autopilot operation and manual electric trim for the pilot. The trim system is designed to withstand any single inflight malfunction. Trim faults are visually and aurally annunciated.

A lockout device prevents autopilot engagement until the system has been successfully preflight tested.

The following conditions will cause the Autopilot to automatically disengage:

(a) Power failure.
(b) Internal Flight Control System failure.
(c) With the KCS 55A Compass System, a loss of compass valid (displaying HDG flag) disengages the Autopilot when a mode using heading information is engaged. With the HDG flag present, the Autopilot may be re-engaged in the basic wings level mode along with any vertical mode.
(d) Roll rates in excess of 14° per second will cause the autopilot to disengage except when the CWS switch is held depressed.
(e) Pitch rates in excess of 8° per second will cause the autopilot to disengage except when the CWS switch is held depressed.



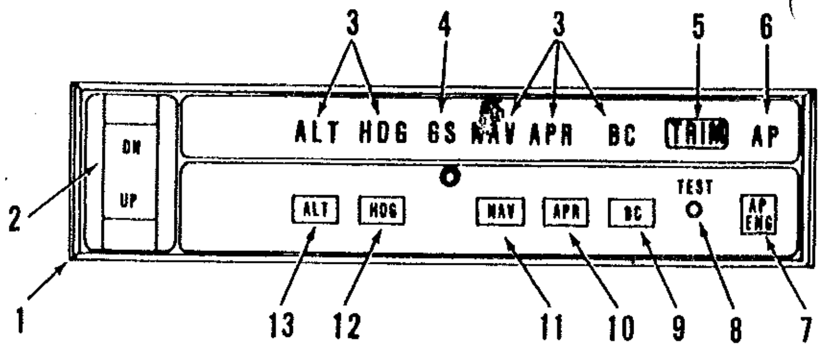
KC 192 AUTOPILOT & FLIGHT DIRECTOR COMPUTER
Figure 7-1

Figure 7-1 (cont)

1. KFC 150 SYSTEM KC 192 AUTOPILOT COMPUTER - Complete Flight Director and Autopilot computer to include system mode annunciators and system controls.
2. MODE ANNUNCIATORS - Illuminates when a mode is selected by the corresponding mode selector button (PUSH ON - PUSH OFF) or when the glide slope (GS) mode is automatically engaged.
3. GLIDE SLOPE (GS) ANNUNCIATOR - Illuminates continuously whenever the autopilot is coupled to the glide slope signal. The GS annunciator will flash if the glide slope signal is lost (GS flag in CDI or absence of glide slope pointers in KI 525A). The autopilot reverts to pitch attitude hold operation. If a valid glide slope signal returns within six seconds, the autopilot will automatically recouple in the GS mode. If the valid signal does not return within six seconds, the autopilot will remain in pitch attitude hold mode until such time that a valid glide slope returns and the aircraft passes thru the glide slope. At that point GS couple will re-occur.
4. TRIM WARNING LIGHT (TRIM) - Illuminates continuously whenever trim power is not on or the system has not been preflight tested. Flashes and is accompanied by an audible warning whenever a manual trim fault is detected. The TRIM warning light will illuminate steady and be accompanied by a steady audible tone whenever an autotrim failure occurs. The autotrim system is monitored for the following failures: trim servo running without a command; trim servo not running when commanded to run; trim servo running in the wrong direction. The trim power switch may be cycled off to silence the continuous tone but the trim fail light will remain on. The manual electric trim may be used but the autopilot should not be engaged.
5. AUTOPILOT ANNUNCIATOR (AP) - Illuminates continuously whenever the autopilot is engaged. Flashes approximately 12 times whenever the autopilot is disengaged (an aural alert will also sound for 2 seconds).
6. AUTOPILOT ENGAGE (AP ENG) BUTTON - When pushed, engages autopilot if all logic conditions are met.
7. PREFLIGHT TEST (TEST) BUTTON - When momentarily pushed, initiates preflight test sequence which automatically turns on all annunciator lights, tests the roll and pitch rate monitors, tests the autotrim fault monitor, checks the manual trim drive voltage and tests all autopilot valid and dump logic. If the preflight is successfully passed, the AP annunciator light will flash for approximately 6 seconds (an aural tone will also sound simultaneously with the annunciator flashes). The autopilot cannot be engaged until the preflight test is successfully passed.

Figure 7-1 (cont)

8. BACK COURSE APPROACH (BC) MODE SELECTOR BUTTON - When pushed, will select the Back Course Approach mode. This mode functions identically to the approach mode except that response to LOC signals is reversed. Glide slope coupling is inhibited in the Back Course Approach mode.
9. APPROACH (APR) MODE SELECTOR BUTTON - When pushed, will select the Approach mode. This mode provides all angle intercept (with HSI) or a fixed angle intercept of 45° (with DG), automatic beam capture and tracking of VOR, RNAV or LOC signals plus glide slope coupling in the case of an ILS. The tracking gain of the APR mode is greater than the gain in the NAV mode. The APR annunciator will flash until the automatic capture sequence is initiated.
10. NAVIGATION (NAV) MODE SELECTOR BUTTON - When pushed, will select the Navigation mode. The mode provides all angle intercept (with HSI) or a fixed angle intercept of 45° (with DG), automatic beam capture and tracking of VOR, RNAV or LOC signals. The NAV annunciator will flash until the automatic capture sequence is initiated.
11. HEADING (HDG) MODE SELECTOR BUTTON - When pushed, will select the Heading mode, which commands the airplane to turn to and maintain the heading selected by the heading bug on the DG or HSI. A new heading may be selected at any time and will result in the airplane turning to the new heading with a maximum bank angle of about 20°. Selecting HDG mode will cancel NAV, APR or BC track modes.
12. ALTITUDE HOLD (ALT) MODE SELECTOR BUTTON - When pushed, will select the Altitude Hold mode, which commands the airplane to maintain the pressure altitude existing at the moment of selection. Engagement may be accomplished in climb, descent, or level flight. In the APR mode, altitude hold will automatically disengage when the glide slope is captured.
13. FLIGHT DIRECTOR (FD) MODE SELECTOR BUTTON - When pushed, will select the Flight Director mode (with KC 292 Autopilot Computer only), bringing the Command Bar in view on the KI 256 and will command wings level and pitch attitude hold. The FD mode must be selected prior to Autopilot engagement.
14. VERTICAL TRIM CONTROL - A spring loaded to center rocker switch which will provide up or down pitch command changes: while in ALT will adjust altitude at rate of about 500 fpm; when not in ALT will adjust pitch attitude at a rate of .7 deg/sec. Will cancel GS couple. The aircraft must pass through the glide slope again to allow GS recouple.



KC 191 AUTOPILOT COMPUTER
Figure 7-3

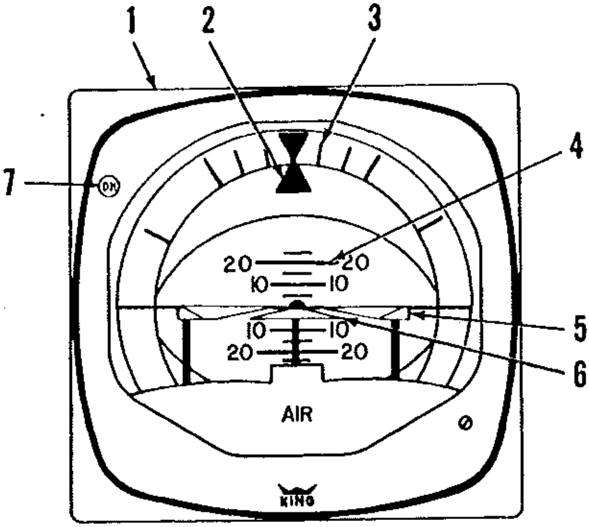
1. KFC 150 SYSTEM KC 191 AUTOPILOT COMPUTER Complete Flight Director and Autopilot computer to include system mode annunciators and system controls.
2. VERTICAL TRIM CONTROL - A spring loaded to center rocker switch which will provide up or down pitch command changes: while in ALT will adjust altitude at rate of about 500 fpm; when not in ALT will adjust pitch attitude at a rate of .7 deg/sec. Will cancel GS couple. The aircraft must pass through the glide slope again to allow GS recouple.
3. MODE ANNUNCIATORS - Illuminate when a mode is selected by the corresponding mode selector button (PUSH ON - PUSH OFF) or when the glide slope (GS) mode is automatically engaged.
4. GLIDE SLOPE (GS) ANNUNCIATOR - Illuminates continuously whenever the autopilot is coupled to the glide slope signal. The GS annunciator will flash if the glide slope signal is lost (GS flag in CDI or absence of glide slope pointers in KI 525A). The autopilot reverts to pitch attitude hold operation. If a valid glide slope signal returns within six seconds, the autopilot will automatically recouple in the GS mode. If the valid signal does not return within six seconds, the autopilot will remain in pitch attitude hold mode until such time that a valid glide slope returns and the aircraft passes thru the glide slope. At that point GS couple will re-occur.

Figure 7-3 (cont)

5. TRIM WARNING LIGHT (TRIM) - Illuminates continuously whenever trim power is not on or the system has not been preflight tested. The trim warning light flashes and is accompanied by an audible warning whenever a manual trim fault is detected. The TRIM warning light will illuminate steady and be accompanied by a steady audible tone whenever an autotrim failure occurs. The autotrim system is monitored for the following failures: trim servo running without a command; trim servo not running when commanded to run; trim servo running in the wrong direction. The pitch trim circuit breaker may be cycled off then on to silence the continuous tone but the trim fail light will remain on. The manual electric trim may be used but the autopilot should not be engaged.
6. AUTOPILOT ANNUNCIATOR (AP) - Illuminates continuously whenever the autopilot is engaged. Flashes approximately 12 times whenever the autopilot is disengaged (an aural alert will also sound for 2 seconds).
7. AUTOPILOT ENGAGE (AP ENG) BUTTON - When pushed, engages autopilot if all logic conditions are met.
8. PREFLIGHT TEST (TEST) BUTTON - When momentarily pushed, initiates preflight test sequence which automatically turns on all annunciator lights, tests the roll and pitch rate monitors, tests the autotrim fault monitor, checks the manual trim drive voltage and tests all autopilot valid and dump logic. If the preflight is successfully passed, the AP annunciator light will flash for approximately 6 seconds (an aural tone will also sound simultaneously with the annunciator flashes). The autopilot cannot be engaged until the preflight test is successfully passed.
9. BACK COURSE APPROACH (BC) MODE SELECTOR BUTTON - When pushed, will select the Back Course Approach mode. This mode functions identically to the approach mode except that response to LOC signals is reversed. Glide slope coupling is inhibited in the Back Course Approach mode.
10. APPROACH (APR) MODE SELECTOR BUTTON - When pushed, will select the Approach mode. This mode provides all angle intercept (with HSI) or a fixed angle intercept of 45° (with DG), automatic beam capture and tracking of VOR, RNAV or LOC signals plus glide slope coupling in the case of an ILS. The tracking gain of the APR mode is greater than the gain in the NAV mode. The APR annunciator will flash until the automatic capture sequence is initiated.

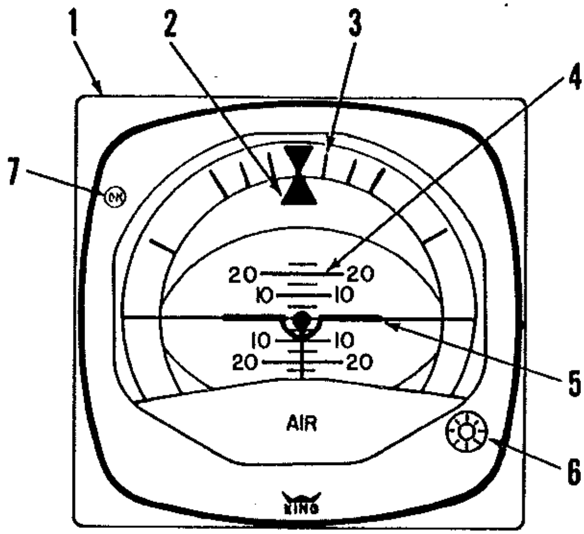
Figure 7-3 (cont)

11. NAVIGATION (NAV) MODE SELECTOR BUTTON - W pushed, will select the Navigation mode. The mode provid angle intercept (with HSI) or a fixed angle intercept of 45° (with DG), automatic beam capture and tracking of VOR, RNAV or LOC signals. The NAV annunciator will flash until the automatic capture sequence is initiated.
12. HEADING (HDG) MODE SELECTOR BUTTON - When pushed, will select the Heading mode, which commands the airplane to turn to and maintain the heading selected by the heading bug on the DG or HSI. A new heading may be selected at any time and will result in the airplane turning to the new heading with a maximum bank angle of about 20°. Selecting HDG mode will cancel NAV, APR or BC track modes.
13. ALTITUDE HOLD (ALT) MODE SELECTOR BUTTON - When pushed, will select the Altitude Hold mode, which commands the airplane to maintain the pressure altitude existing at the moment of selection. Engagement may be accomplished in climb, descent, or level flight. In the APR mode, altitude hold will automatically disengage when the glide slope is captured.



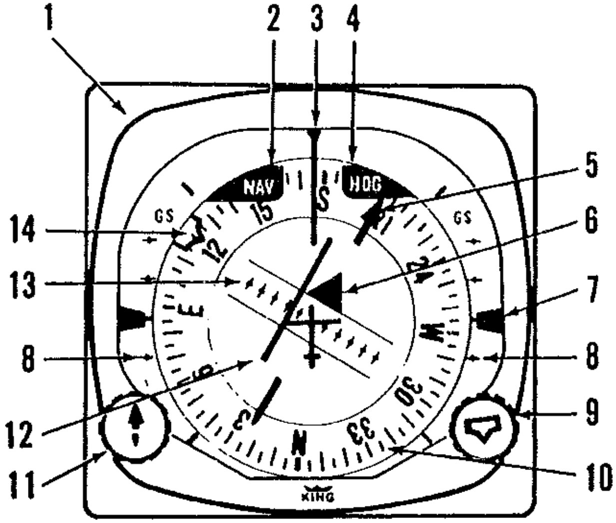
KI 256 FLIGHT COMMAND INDICATOR
Figure 7-5

1. KI 256 FLIGHT COMMAND INDICATOR (FCI) - Displays airplane attitude as a conventional attitude gyro and displays commands for flight director operation. The gyro is air driven.
2. ROLL ATTITUDE INDEX - Displays airplane roll attitude with respect to the roll attitude scale.
3. ROLL ATTITUDE SCALE - Scale marked at 0, ±10, ±20, ±30, ±60 and ±90 degrees.
4. PITCH ATTITUDE SCALE - Moves with respect to the symbolic airplane to present pitch attitude. Scale graduated at 0, ±5, ±10, ±15, ±20 and ±25 degrees.
5. COMMAND BAR - Displays computed steering commands referenced to the symbolic airplane. The command bar is visible only when FD mode is selected. The command bar will be biased out of view whenever the system is invalid or a Flight Director mode is not engaged.
6. FCI SYMBOLIC AIRPLANE - Airplane pitch and roll attitude is displayed by the relationship between the fixed symbolic airplane and the movable background. During flight director operation, the symbolic airplane is flown to align it with the command bar to satisfy the flight director commands.
7. DECISION HEIGHT (DH) ANNUNCIATOR LIGHT - Optional light for use with the aircraft's optional radar altimeter.



KG 258 VERTICAL GYRO
Figure 7-7

1. KG 258 VERTICAL GYRO - Displays airplane attitude as a conventional attitude gyro. The gyro is air driven.
2. ROLL ATTITUDE INDEX - Displays airplane roll attitude with respect to the roll attitude scale.
3. ROLL ATTITUDE SCALE - Scale marked at 0, ±10, ±20, ±30, ±60 and ±90 degrees.
4. PITCH ATTITUDE SCALE - Moves with respect to the symbolic airplane to present pitch attitude. Scale graduated at 0, ±5, ±10, ±15, ±20 and ±25 degrees.
5. SYMBOLIC AIRPLANE - Serves as a stationary symbol of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed symbolic aircraft and the movable background.
6. SYMBOLIC AIRCRAFT ALIGNMENT KNOB - Provides manual positioning of the symbolic aircraft for level flight under various load conditions.
7. DECISION HEIGHT (DH) ANNUNCIATOR LIGHT - Optional light for use with the aircraft's optional radar altimeter.

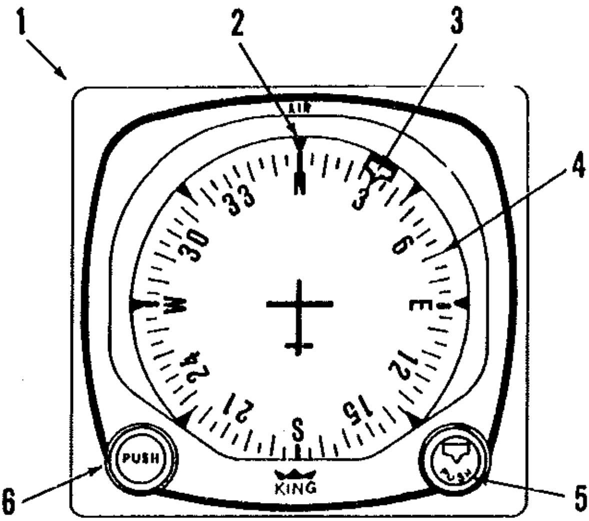


KI 525A HORIZONTAL SITUATION INDICATOR
Figure 7-9

1. KI 525A HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials or localizer beams. It also displays glide slope deviations and gives heading reference with respect to magnetic north.
2. NAV FLAG - Flag is in view when the NAV receiver signal is inadequate. When a NAV flag is present in the navigation indicator (CDI or KI 525A) the autopilot operation is not affected. The pilot must monitor the navigation indicators for NAV flags to insure that the Autopilot and/or Flight Director are tracking valid navigation information.
3. LUBBER LINE - Indicates aircraft magnetic heading on compass card (10).
4. HEADING WARNING FLAG (HDG) - When flag is in view, the heading display is invalid. If a HDG flag appears and a lateral mode (HDG, NAV, APR or APR BC) is selected, the Autopilot will be disengaged. The Autopilot may be re-engaged in the basic wings level mode along with any vertical mode. The CWS switch would be used to maneuver the aircraft laterally.

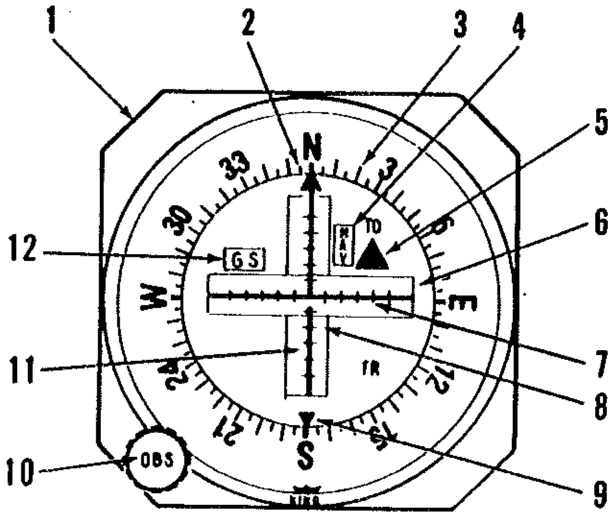
Figure 7-9 (cont)

5. COURSE BEARING POINTER - Indicates selected VOR co or localizer course on compass card (10). The selected VOR ra or localizer heading remains set on the compass card when the compass card (10) rotates.
6. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.
7. DUAL GLIDE SLOPE POINTERS - Indicate on glide slope scale (8) aircraft displacement from glide slope beam center. Glide slope pointers in view indicate a usable glide slope signal is being received.
8. GLIDE SLOPE SCALES - Indicate displacement from glide slope beam center. A glide slope deviation bar displacement of 2 dots, represents full scale (0.7°) deviation above or below glide slope beam centerline.
9. HEADING SELECTOR KNOB ( ) - Positions heading bug (14) on compass card (10) by rotating the heading selector knob. The Bug rotates with the compass card.
10. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (3) on HSI.
11. COURSE SELECTOR KNOB - Positions course bearing pointer (5) on the compass card (10) by rotating the course selector kn
12. COURSE DEVIATION BAR (D-BAR) - The center portio omni bearing pointer moves laterally to pictorially indicate the relationship of aircraft to the selected course. It indicates degrees of angular displacement from VOR radials and localizer beams, or displacement in nautical miles from RNAV courses.
13. COURSE DEVIATION SCALE - A course deviation bar displacement of 5 dots represents full scale (VOR = ±10°, LOC = ±2 1/2°, RNAV =±5NM, RNAV APR =±1 1/4NM) deviation from beam centerline.
14. HEADING BUG - Moved by ( ) knob (9) to select desired heading.



KG 107 NON-SLAVED DIRECTIONAL GYRO
Figure 7-11

1. KG 107 NON-SLAVED DIRECTIONAL GYRO (DG) - Provides a stable visual indication of aircraft heading to the pilot. The gyro is air driven.
2. LUBBER LINE - Indicates aircraft magnetic heading on compass card (4).
3. HEADING BUG - Moved by ( ) knob (5) to select desired heading.
4. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (2) on DG.
5. HEADING SELECTOR KNOB ( ) - Positions heading bug (3) on compass card (4) by rotating the heading selector knob. The Bug rotates with the compass card.
6. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (4) to correspond with the magnetic heading indicated by the magnetic compass. The unslaved compass card must be manually reset periodically to compensate for precessional errors in the gyro.

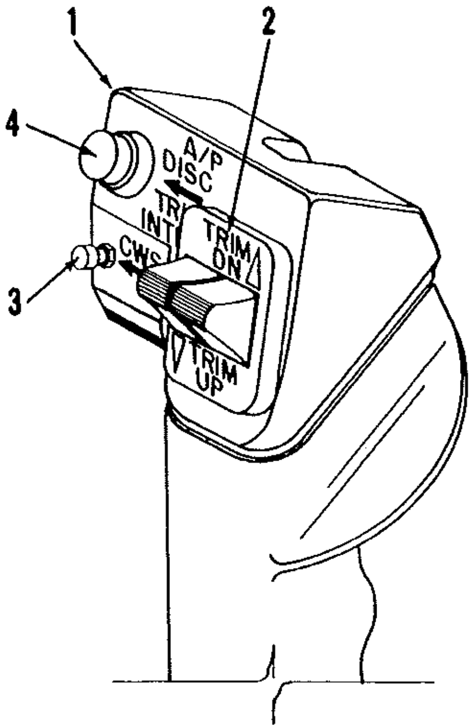


KI 204/206 VOR/LOC/
GLIDE SLOPE INDICATOR (TYPICAL)
Figure 7-13

1. VOR/LOC/GLIDE SLOPE INDICATOR - Provides rectilinear display of VOR/LOC and glide slope deviation.
2. COURSE INDEX - Indicates selected VOR course.
3. COURSE CARD - Indicates selected VOR course under course index.
4. NAV FLAG - Flag is in view when the NAV receiver signal is inadequate. When a NAV flag is present in the navigation indicator (CDI or KI 525A), the autopilot operation is not affected. The pilot must monitor the navigation indicators for NAV flags to insure that the Autopilot and/or Flight Director are tracking valid navigation information.
5. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.
6. GLIDE SLOPE DEVIATION NEEDLE - Indicates deviation from ILS glide slope.
7. COURSE DEVIATION SCALE - A course deviation bar displacement of 5 dots represents full scale (VOR = ±10°, LOC = ±2 1/2, RNAV =±5NM, RNAV APR =±1 1/4NM) deviation from beam centerline.

Figure 7-13 (cont)

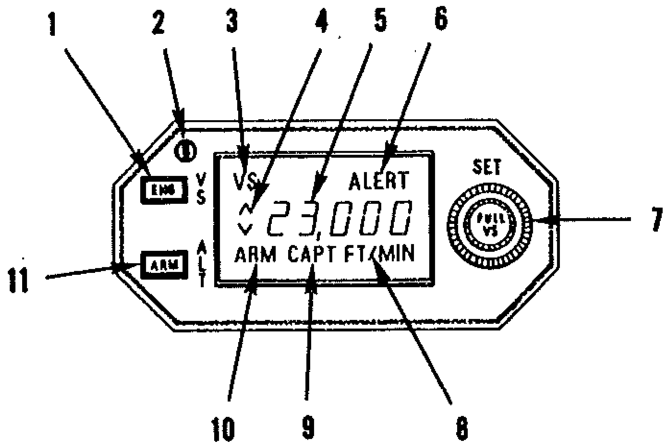
8. GLIDE SLOPE SCALE - Indicates displacement from glide slope beam center. A glide slope deviation needle displacement of 5 dots, represents full scale (0.7°) deviation above or below glide slope beam centerline.
9. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
10. OMNI BEARING SELECTOR (OBS) KNOB - Rotates course card to selected course.
11. COURSE DEVIATION NEEDLE - Indicates course deviation from selected omni course or localizer centerline.
12. GLIDE SLOPE (GS) FLAG - Flag is in view when the GS receiver signal is inadequate.



AUTOPILOT CONTROL WHEEL SWITCH CAP
Figure 7-15

Figure 7-15 (cont)

1. AUTOPILOT CONTROL WHEEL SWITCH CAP - Molded plastic unit mounted on the left horn of the pilot's control w which provides mounting for three switch units associated with autopilot and manual electric trim systems.
2. MANUAL ELECTRIC TRIM CONTROL SWITCHES - A split switch unit in which the left half provides power to engage the trim servo clutch and the right half to control the direction of motion of the trim servo motor. Both halves of the split trim switch must be actuated in order for the manual trim to operate in the desired direction. When the autopilot is engaged, operation of the manual electric trim will automatically disconnect the autopilot.
3. CONTROL WHEEL STEERING (CWS) BUTTON - When depressed, allows pilot to manually control the aircraft (disengages the servos) without cancellation of any of the selected modes. Will engage the Flight Director mode if not previously engaged. (KFC 150 only) Automatically synchronizes the Flight Director/Autopilot to the pitch attitude present when the CWS switch is released, or to the present pressure altitude when operating in the ALT hold mode. Will cancel GS couple. The aircraft must pass through the glide slope to allow GS recouple.
4. AUTOPILOT DISCONNECT/TRIM INTERRUPT (AP DIS TRIM INTER) Switch - When depressed and released disengage the autopilot and cancel all operating Flight Director modes. When depressed and held will interrupt all electric trim power (stop trim motion), disengage the autopilot, and cancel all operating Flight Director modes.



KAS 297B VERTICAL SPEED AND ALTITUDE SELECTOR
Figure 7-17

1. VERTICAL SPEED MODE (ENG) BUTTON - When pressed will engage the vertical speed hold mode. When pressed a second time will disengage the vertical speed hold mode. When pressed with altitude displayed, will engage the vertical speed hold mode and re-sync the vertical speed hold mode to the current vertical speed of the airplane.
2. PHOTOCELL - Automatically dims display according to the cockpit ambient light.
3. VERTICAL SPEED (VS) ANNUNCIATOR - Illuminates when the vertical speed hold mode is engaged.
4. VERTICAL SPEED UP/DOWN CARETS (◊) - Indicates whether the selected vertical speed is up or down.
5. GAS DISCHARGE DISPLAY - Displays selected altitude from 100 to 35,000 feet or the selected vertical speed from 0 to 3,000 feet per minute up or down.

Figure 7-17 (cont)

6. ALTITUDE ALERT (ALERT) ANNUNCIATOR - The ALERT annunciator is illuminated 1000 feet prior to the selected alti[illegible] goes out 300 feet prior to the selected altitude and illumin[illegible] momentarily when the selected altitude is reached. Once the selected altitude is reached the light signifies that the 300 feet "safe band" has been exceeded and will remain on until 1000 feet from the selected altitude. The alert light is accompanied by a 2 second aural tone anytime the light initially comes on or the selected altitude is reached.
7. VERTICAL SPEED/ALTITUDE SELECT KNOB - Concentric knobs which allow easy setting of altitude or vertical speed. The small knob (inner) has an in and out position.

   Altitude is displayed and selected when the small knob is in the IN position. When rotated the small knob selects altitude in 100 foot increments with roll over into the 1000 digits. The larger knob (outer) selects altitude in 1000 foot increments with roll over into the 10,000 digits.

   Vertical speed is displayed and selected when the small knob is in the OUT position. When rotated the small knob selects vertical spe[illegible] 100 fpm increments. The larger knob selects vertical speed in [illegible] fpm increments up to a maximum of 3000 fpm.
8. MODE (FT or FT/MIN) ANNUNCIATOR - Indicates FT/MIN when in the vertical speed hold mode and FT when in the altitude select mode.
9. ALTITUDE CAPTURE (CAPT) ANNUNCIATOR - Indicates the KAS 297B has switched the autopilot from pitch attitude hold or vertical speed hold mode into the pitch roundout mode (CAPT). The point, just prior to transfer into altitude hold, at which the CAPT mode becomes active varies with the vertical speed, i.e.

   The higher the rate of climb, the sooner the CAPT mode becomes active; at low rates of climb the activation of the CAPT mode and transfer to altitude hold occur almost simultaneously.
10. ALTITUDE SELECT ARM (ARM) ANNUNCIATOR - Indicates that the altitude select mode is armed to capture the selected altitude.

Figure 7-17 (cont)

11. ALTITUDE SELECT MODE (ARM) BUTTON - When pressed and the selected altitude is displayed, will arm the altitude select mode. The altitude select (ARM) mode will cancel altitude hold (ALT) if ALT is already engaged. If altitude select (ARM) mode is present when GS couple occurs, the GS mode will cancel altitude select (ARM) mode. The engagement of ALT by the pilot's use of the ALT switch will cancel the altitude select (ARM) mode. Reselection of a new altitude will also cycle the altitude select (ARM) mode off.
12. CONTROL WHEEL STEERING (CWS) BUTTON (Figure 7-15) - When pressed, in addition to the normal autopilot functions the CWS also interfaces with the KAS 297B. When operating in the vertical speed hold mode, the CWS will re-sync the vertical speed hold mode to the current vertical speed of the airplane. If altitude is displayed when the CWS is pressed, the display will automatically display vertical speed as long as the CWS is depressed. CWS does not affect the altitude select mode.
13. VERTICAL TRIM CONTROL (Figure 7-15) - When in the vertical speed hold mode this control can be used to slew the vertical speed up or down at 100 fpm for every second the rocker switch is held. If altitude is being displayed at the time the rocker switch is depressed, vertical speed will be displayed for 1 to 2 seconds after the rocker switch is released.

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

The RADIO POWER/AVIONICS MASTER switch supplies power to the avionics bus bar of the radio circuit breakers and the autopilot circuit breaker.

The following circuit breakers are used to protect the following elements of the King 150 Series Autopilot:

AUTOPILOT - Supplies power to the KC 192 or the KC 191 Computer, the autopilot pitch and roll servos, and the Pitch Trim Circuit Breaker.

PITCH TRIM - Supplies power to the autotrim and manual electric pitch trim systems.

COMP-SYSTEM - Supplies power to the optional KCS 55A Compass System.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 15 FOR SPERRY WEATHERSCOUT WEATHER RADAR SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Sperry Weather-Scout Weather Radar System is installed per Piper Drawing 87425-5. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED Ward Evans
WARD EVANS
D.O.A. NO. SO.-1
PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

DATE OF APPROVAL SEPTEMBER 17, 1984

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation o airplane when the optional Sperry WeatherScout Weather Radar Sy is installed.

SECTION 2 - LIMITATIONS

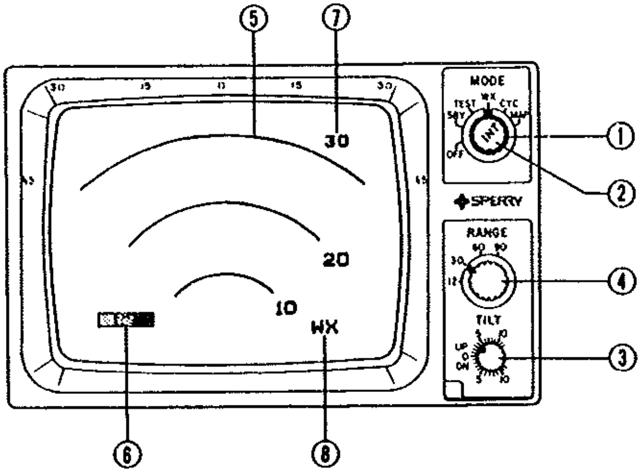
Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

(a) SYSTEM CONTROLS



INDICATOR CONTROLS AND DISPLAY FEATURES

(1) MODE Selector

a. OFF	All power is off.
b. SBY	Standby mode is used for system warmup. The antenna is not radiating energy in SBY.
c. TEST	Weather colors are displayed for preflight test.
d. WX	Normal weather detection mode.
e. CYC	Cyclic contour mode activated alternate flashing of red, intense storm cells, with a black background color for added warming emphasis.
f. MAP	Activates groundmapping for identification of prominent terrain features.

(2) INT — Rotary control used to regulate brightness (INTensity) of display.

(3)	TILT	Rotary control used to adjust ante[illegible] elevation position. Control indexes in[illegible] ments of tilt from 0 to 12 degrees up or down.
(4)	RANGE 12/30/60/90	Rotary switch used to select one of four ranges.
(5)	Range Field	Maximum selected range is displayed. Maximum range is always displayed when indicator is in on-condition.
(6)	Test Field	Test block displays three illumination levels.
(7)	Range Mark Identifier	Individual label displayed for each range mark.
(8)	Mode Field	Operating mode is displayed as WX or CYC. When system is first turned on, WAI[illegible] displayed until system times out (30-4[illegible] seconds).

(b) PRELIMINARY CONTROL SETTINGS

Place the Indicator controls in the following positions before applying power from the aircraft electrical system:

MODE selector.. OFF
INTensity control.....................Fully counterclockwise
TILT control..........................Fully upward
RANGE switch..........................12 nautical miles

(c) OPERATIONAL CONTROL SETTINGS

(1) Rotate MODE selector clockwise to SBY to bring system into ON condition.
(2) Note that WAIT is displayed during warm-up period of 30-40 seconds.
(3) Rotate MODE selector to desired operating mode.
(4) Set RANGE switch to desired range.
(5) Adjust TILT control for desired forward scan area.

(d) PRECAUTIONS

(1) If the radar is to be operated while the aircraft is on the ground, direct nose of aircraft such that antenna scan sector is free of large metallic objects (hangars, other aircraft) for a distance of 100 yards (90 meters), and tilt antenna fully upward.

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives; do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(2) Flash bulbs can be exploded by radar energy.

(3) Since storm patterns are never stationary, the display is constantly changing. Continued observation is always advisable in stormy areas.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the basic Pilot's Operating Handbook.

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SUPPLEMENT NO. 16

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 17 FOR CENTURY 31 AUTOPILOT MODEL AK896

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Century 31 Autopilot System Model AK896 is installed in accordance with STC SA3405SW-D. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED Ward Evans
WARD EVANS
D.O.A. NO. SO-1
PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

DATE OF APPROVAL SEPTEMBER 17, 1984

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation o airplane when the optional Century 31 Autopilot Model AK896 is insta in accordance with "FAA Approved" Piper data.

SECTION 2 - LIMITATIONS

(a) Autopilot OFF during takeoff and landing.
(b) Maximum airspeed for autopilot operation is 180 KIAS.
(c) Autopilot operation prohibited with more than 25° flaps extended.
(d) Placard (P/N 13A990-1) - in full view of the pilot:

CONDUCT TRIM CHECK
PRIOR TO FIRST FLIGHT
OF DAY (SEE AFM).

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT
In the event of an autopilot malfunction, or anytime the autopil not performing as commanded, do not attempt to identify the problem system. Regain control of the aircraft by overpowering and immediately disconnecting the autopilot. Be prepared for any residual trim force and retrim, as necessary, using the aircraft's primary trim control.

CAUTION

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. Pressing "AP OFF" bar on pilot's trim switch.
   b. Pressing the AP ON-OFF switch on the programmer OFF.
   c. Depressing Master Disconnect switch.

(2) Autotrim may be disconnected by:
   a. Any action in (1) above, or
   b. Pushing the trim master switch OFF.
   After failed system has been identified, leave system circuit breaker open and do not operate until the system failure has been identified and corrected.

(3) 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 60° of bank and 250 foot altitude loss. Maximum altitude loss was recorded at 180 KIAS during descent.
   b. An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 22° bank and 100 foot altitude loss. Maximum altitude loss measured with 25° flaps extended, gear down, and operating either coupled or uncoupled.

(b) COMPASS SYSTEM

(1) Emergency Operation with Optional NSD 360A (HSI) Slaved and/or Non-Slaved:
   a. Appearance of HDG Flag:
      1. Check air supply gauge (vac or pressure) for adequate air supply (4.2 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

(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.

(1) AUTOPILOT/AUTOTRIM - To be performed before the first flight of each day.
   a. Trim system switch - on.
   b. Engage autopilot.
   c. Move the heading bug left and right of the lubber line. Observe that the control wheel moves in the direction of the heading bug displacement.
   d. Press the DN switch - verify that the control wheel moves in the down direction. Verify that after approximately a 3 second delay, the trim moves in the down direction.
   e. Press the UP switch - verify that the control wheel moves in the up direction. Verify that after approximately a 3 second delay, the trim moves in the up direction.
   f. Grasp control wheel and override roll and pitch servo actuators to assure override capability.
   g. Hold control yoke and disengage autopilot by activating the AP OFF switch on the control wheel.
   h. Check controls through full travel in roll and pitch to assure complete autopilot disengagement.
   i. Press and hold the TEST switch - all mode annunciators light with AP flashing.
   j. Release the TEST switch after all annunciator lights except HDG, ATT, and TEST turn off.
   k. Press the DN switch - HDG, ATT and TEST remain on.
   l. Press the UP switch - HDG, ATT and TEST remain on.
   m. Momentarily press the TEST switch - HDG and ATT remain on, TEST flashes.

n. Press the DN switch - the TEST light remains OFF as long as the DN switch is held.
o. Press the UP switch - the TEST light remains OFF as lo as the UP switch is held.
p. Momentarily press the TEST switch - HDG and ATT lights remain on and the TEST light turns off.

(2) COMMAND TRIM SYSTEM - To be performed before the first flight of each day.
a. Using the control wheel trim switch, verify normal trim up and down operation.
b. Press and hold the center bar on the control wheel trim switch. Observe that the trim system does not operate.
c. Release the center bar on the control wheel trim switch. Move the control wheel trim switch fore and aft. Observe that the trim system does not operate.

This completes the test sequences.

CAUTIONS

Any failure of the above procedures indicates that a failure exists in the system and the system shall not be operated until the failure has been located and corrected.

Check the elevator trim setting before takeoff.

(3) COMPASS SYSTEM (NSD 360A)
(For other compass systems, refer to appropriate manufacturer's instructions)
a. Check slaving switch in SLAVE or SLAVE No. 1 or No. 2 position, as appropriate. (Slaving systems with R.M.I. output provides only slave and free gyro positions.)
b. Rotate card to center slaving meter - check HDG displayed with magnetic compass heading.
c. Perform standard VOR receiver check.

(b) IN-FLIGHT PROCEDURE - AUTOPILOT
(1) Rotate heading bug to desired heading.
(2) Trim aircraft for existing flight condition (all axes). Enga autopilot.
(3) During maneuvering flight - control aircraft through use of the heading bug and the pitch modifier. (HDG-ATT modes)

(4) For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in Section 7.1. For specific instructions relating to coupled instrument approach operations, refer to Special Operations and Information.

(c) IN-FLIGHT PROCEDURE - COMMAND/AUTOTRIM SYSTEM

(1) Trim master 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.

(d) 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. For smooth control, changes in flap extension should be made one notch at a time allowing time between changes for airspeed to stabilize.

(2) Instrument Approach Operations
Initial and/or intermediate approach segments should be conducted between 100-106 KIAS with flaps positioned 0° to 25°. Upon intercepting the glide path or when passing the final approach fix (FAF) immediately lower the landing gear and reduce the power for approximately 80-90 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 final 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

The 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
   a. Disconnect the autopilot and manually control the aircr
   b. Add takeoff power, or power as desired.
   c. Check that correct attitude and a positive rate of climb is indicated, then raise gear and flaps.
   d. Set the heading bug to the desired missed approach heading.
   e. Re-engage the autopilot.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the basic Pilot's Operating Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

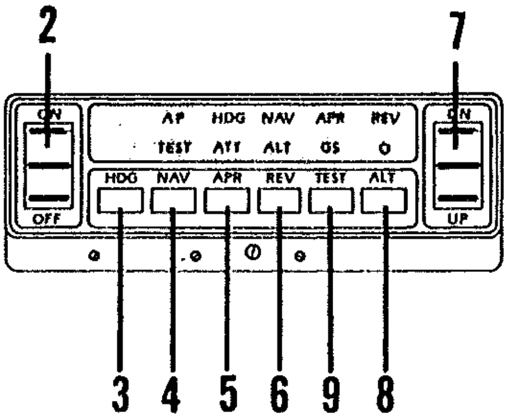
The Century 31 Autopilot is a light weight electronic autopilot system utilizing vertical and directional gyro signals and D.C. electric servos to provide three axis sensing and two surface control. The system includes lateral and vertical radio coupling, command and automatic elevator trim; and navigation and autopilot failure monitor and warning systems.

The Century 31 is activated with the aircraft master switch and operates in a low power state until the autopilot is engaged. Mode selection is made by pushing the desired mode switch on the mode programmer. The selected mode will illuminate on the annunciator panel.

The annunciator panel contains an ambient light level sensor which will automatically dim the annunciator light level during night operations. The programmer contains mode recognition lights and dimming is provided by the panel light dimmer switch.

The electric elevator trim system is a fully redundant type in both the manual and autotrim modes. The trim system is powered through a separate system master switch that must be "ON" during autopilot operations, and for the control wheel trim command switch to function when the autopilot is OFF.

7.1 COCKPIT CONTROLS AND FUNCTIONS



CONTROLLER/FLIGHT COMPUTER
Figure 7-1

1. Trim System Master Switch (Figure 7-3) - provides power for all autotrim and control wheel electric trim operations.
2. Autopilot ON - OFF Switch - Momentary rocker type switch which engages or disengages the autopilot roll, pitch and trim servos and lights or extinguishes autopilot (AP) annunciator, as appropriate.

NOTE

The autopilot will switch to HDG and ATT modes upon engagement or disengagement with automatic pitch attitude synchronization.

3. HDG Mode Selector Switch - provides turn control and heading hold through use of the heading index (bug) on the D.G. or H.S.I. heading instrument.

Figure 7-1 (cont)

4. NAV (Navigation) Mode Selector Switch - provides automatic 45° VOR-LOC intercept angle; tracking and crosswind correction. The autopilot utilizes the HDG bug as the VOR course reference and a separate VOR indicator instrument for left-right information when using a D.G. or the course indicator and left-right needle for reference inputs when using an H.S.I. type compass/VOR display. The NAV mode provides automatic gain and rate reductions and bank limiting to improve tracking performance. NAV mode should normally be used as an enroute function. Select APR mode for LOC and VOR approaches.

NOTES

The heading bug is disabled when using an H.S.I. and NAV, APR or REV is selected, except when using selected angle intercept feature (refer to Special Modes and Operations).

With a D.G., the heading bug must be set to the desired radio course when using NAV, APR or REV modes.

Select desired course on H.S.I. course selector (or OBS and D.G.) and select NAV mode for VOR tracking.

5. APR (Approach) Mode Selector Switch - provides automatic 45° VOR-LOC intercept angle, tracking and crosswind correction during instrument approach operations. D.G./H.S.I. operation and function are identical to NAV mode. Select the desired course on H.S.I. (or O.B.S. and D.G.) course selector and select APR mode.
6. REV (Back Course) Mode Selector Switch - for use in tracking the LOC front course outbound, or the LOC back course inbound, or the published VOR approach course outbound. When using an H.S.I. display always set the course selector on the inbound front localizer course or VOR inbound published approach course when using REV mode. When using a D.G. the heading bug must be set to the final approach course.
7. Pitch Modifier/Attitude Selector Switch
   The pitch data modifier is a momentary type switch that is used to select the ATT mode or modify the aircraft attitude. When the autopilot is engaged, automatic pitch synchronization is provided to the attitude existing at engagement. In ATT mode, actuation of the modifier UP or DN will cause a pitch attitude change at a rate of

Figure 7-1 (cont)

.7° per second. In ALT mode, actuation of the pitch modifier will cause the autopilot to enter the ATT mode with subsequent operation as described above.

8. ALT (Altitude) Mode Selector Switch
Selection of ALT mode will cause the autopilot to maintain the pressure level (altitude) at the point of engagement. Because of the pitch rate control provided by the autopilot, altitude mode may be engaged from any rate of climb or descent, however, for maximum passenger comfort, rate of climb or descent should be reduced to 1000 FPM or less prior to ALT mode engagement.

(a) SPECIAL MODES AND OPERATIONS

(1) Glide Slope (GS) Mode - The GS mode is fully automatic, therefore, no GS engage switch is used. The GS mode may be entered from either ATT mode or ALT mode, from above the GS centerline or below the centerline.

Activation of the GS mode depends upon satisfying two sets of conditions; completion of the ARMING sequence and satisfying of an equation relating to the aircraft's position relative to the GS centerline and the rate at which the aircraft is approaching or departing from the GS centerline.

For GS mode arming, the following conditions must exist simultaneously:

a. No. 1 NAV radio must be channeled to a localizer frequency.
b. Localizer deviation must be less than 80%.
c. Localizer flag not extended - valid LOC signal.
d. GS Flag not extended - valid GS signal.
e. System in APR mode.
f. System in either ATT or ALT mode.

When the GS mode arming conditions are met, the GS mode annunciator will illuminate in conjunction with the active pitch mode. Loss of any arming condition prior to GS capture will cause the GS annunciator to extinguish.

GS mode activation (GS capture) is indicated by the active pitch mode annunciator extinguishing, leaving only the GS annunciator lighted. Since GS mode activation results from a combination of position and rate information, GS capture will probably occur before the GS needle centers in such a manner that the transition on to the GS centerline will be anticipated and therefore, very smooth.

After GS capture, loss of valid GS signal will cause the GS annunciator to flash. Also selection of HDG, NAV or REV mode will cause GS to flash, indicating an inconsistent GS tracking condition. APR mode must be selected while tracking glide slope.

The GS mode may be deactivated by selection of any other pitch mode (ATT, ALT), however, automatic reactivation is possible from any pitch mode if APR mode is selected.

NOTE

If valid glide slope data is lost after coupling, the autopilot will NOT automatically decouple, however the GS light will flash. The pilot must monitor raw course guidance data during the approach to assure signal quality.

Since GS arm and capture are automatic when the arming and capture sequence is met, the GS must be locked out for holding operations on the localizer at the L.O.M. When localizer holding is desired, localizer tracking must be performed in NAV mode which will offer the same tracking dynamics as APR mode but will inhibit GS arm and capture. When APR clearance is received, select APR mode for completion of the approach.

(2) Selected Angle Intercepts - If an H.S.I. type heading system is installed, selected angle intercepts may be made during VOR or localizer intercept situations by selecting HDG and NAV, HDG and APR, or HDG and REV, simultaneously, as appropriate. During a selected angle intercept operation, the autopilot will follow the heading bug until reaching the computed On Course Turn Point at which time capture is indicated by extinguishing of the HDG mode annunciator. Selected angle intercepts of over 60° are not recommended.

NOTE

If radio information becomes invalid (Flag) after initiation of a selected angle intercept the applicable navigation mode annunciator will flash and the autopilot will remain in HDG mode. The automatic mode shift to the invalid radio mode will not occur.

(3) CWS Mode - The system is equipped with a control wheel steering switch on the pilot's control wheel. When depressed and held, this switch will disengage the autopilot roll and pitch servos to allow manual aircraft maneuvering. When released, the servos will re-engage with the lateral (roll) mode previously in use activated. The pitch mode previously engaged will remain programmed in the following condition:
   a. ALT Mode - If ALT mode had been in use, the ALT mode will synchronize at the new pressure altitude existing at release of the CWS switch.
   b. ATT Mode - If the ATT mode had been in use, the system will synchronize with the aircraft attitude existing at release of the switch.

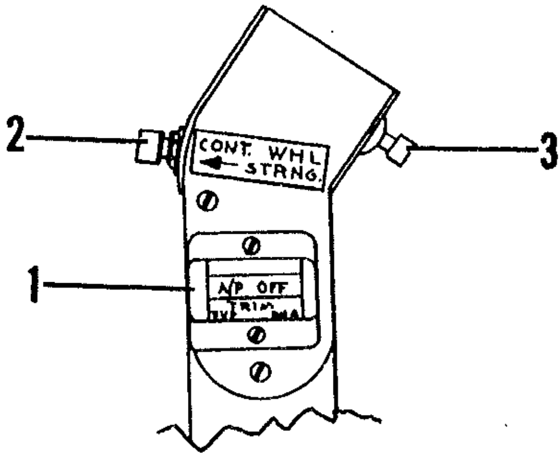
(4) System Test (Ground Operations Only) - The system is equipped with a comprehensive test circuit which, when activated, will test the failure monitor circuits and all the annunciator lamps. Activation of the TEST switch will initiate the system test only when the autopilot is NOT engaged. When autopilot is engaged, activation of the TEST switch will test the annunciator lamps. If the autopilot is engaged during the test sequence, the sequence will terminate immediately. Refer to Section 4 for tests required before the first flight of each day.

(5) Warning System and Interlocks - The Century 31 System includes a number of automatic interlocks that will prevent system operation or individual mode operation if the input information is not valid or if other prerequisite conditions do not exist. In addition to the interlocks, the system will annunciate various failure conditions as advisory information for the pilot. Following is a brief description of the interlocks and warnings provided.

a. Interlocks
   1. Autopilot engagement is inhibited unless an excitation signal is being provided to the attitude gyro.
   2. Selection of ALT mode is inhibited if the system altitude information is unreliable or if the entire system has not been powered for approximately 3 minutes to allow stabilization of the altitude source.
   3. During Dual Mode (selected angle) intercepts, if the navigation information becomes invalid the appropriate NAV/APR/REV annunciator will flash and automatic mode switching from HDG to the coupled navigation mode will be inhibited.

b. Warnings
   1. Low Voltage - When the aircraft bus voltage falls below the minimum required for reliable system function, any mode annunciator not already ON will flash.
   2. Attitude Gyro Excitation - Absence of valid gyro excitation will cause the autopilot to disengage and the AP annunciator to flash. The autopilot cannot be re-engaged until this condition is corrected.
   3. AP Disengagement - Anytime the autopilot is disengaged the AP annunciator will flash for approximately 5 seconds, then remain OFF.
   4. Navigation Information Invalid - The appropriate navigation mode annunciator will flash when selected and invalid navigation signals are present (NAV Flag in view). Additionally, the appropriate navigation mode annunciator (NAV/APR/REV) will flash during a dual mode intercept if invalid navigation information is present.
   5. GS Information Invalid - The GS annunciator will flash when GS information (GS Flag in view) is invalid after the GS mode is active or when HDG, NAV or REV mode is selected after GS capture. If valid GS information is not available during the arming sequence, the system will not arm and GS capture will not occur.

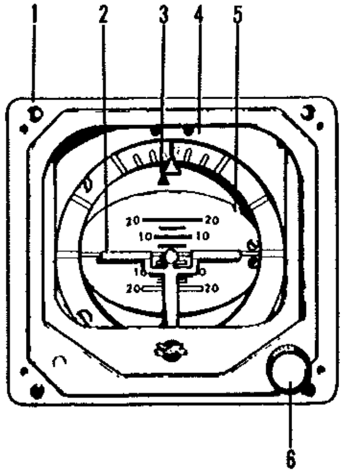
(b) REMOTE CONTROL SWITCHES



AUTOPILOT CONTROL WHEEL SWITCH CAP
Figure 7-3

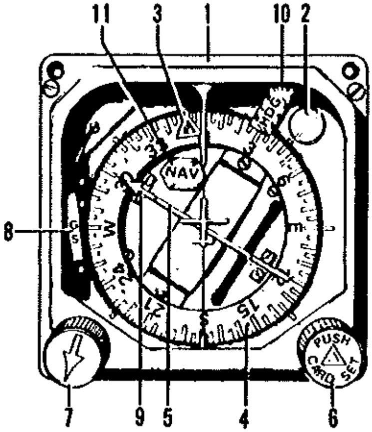
(1) Command Trim Switch - Dual action type switch requiring the top bar to be depressed and the rocker to be moved fore or aft to cause the electric trim to function from the control wheel switch. Depressing the center bar will disconnect the autopilot.
(2) Control Wheel Steering (CWS) Switch
See explanation in Special Modes and Operations Section.
(3) Master Disconnect Switch - Pressing this switch will disconnect autopilot and interrupt command/autotrim operation while depressed. Trim operation will resume when the switch is released.

7.3 INSTRUMENTS



ATTITUDE GYRO
Figure 7-5

1. Standard 3 Inch Air Driven Attitude Indicator Gyro.
2. Symbolic Airplane - Serves as a stationary symbol of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed symbolic aircraft and the movable background.
3. Roll Attitude Index - Displays airplane roll attitude with respect to the roll attitude scale.
4. Roll Attitude Scale - Scale marked at 0, ±10, ±20, ±30, ±60 and ±90 degrees.
5. Pitch Attitude Scale - Moves with respect to the symbolic airplane to present pitch attitude. Scale graduated at 0, ±5, ±10, ±15, ±20 degrees.
6. Symbolic Aircraft Alignment Knob - Provides manual positioning of the symbolic aircraft for level flight under various load conditions.



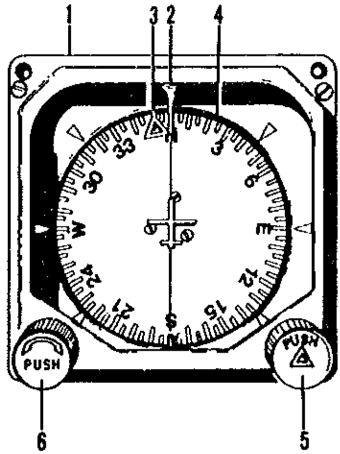
NSD-360A NAVIGATION SITUATION DISPLAY
Figure 7-7

1. NSD-360A Compass System - (For details of any other com system, refer to manufacturer's information.)
2. Slaving Meter - Oscillation of needle indicates that compass is slaved to magnetic flux detector. Needle maintained in either extreme position for more than 2 - 3 minutes indicates system failure.

NOTE

NSD-360A System includes a slaving selector switch allowing the selection of free gyro mode. Refer to emergency procedures for failure instructions.

3. HDG index (bug) for autopilot heading control.
4. Compass card.
5. Left-right portion of VOR-LOC Course Needle.
6. HDG Control Knob - push in for initial compass setting.
7. VOR Course Needle Set Knob (O.B.S.).
8. GS Indicator with Flag Alarm.
9. VOR-LOC Bearing Selector Course Needle and Omni Bear Indicator.
10. Heading Warning Flag.
11. Navigation Warning Flag.



DIRECTIONAL GYRO
Figure 7-9

1. Non-Slaved Directional Gyro - Provides a stable visual indication of aircraft heading to the pilot. The gyro is air driven.
2. Lubber Line - Indicates aircraft magnetic heading on compass card (4).
3. Heading Bug - Moved by (△) knob (5) to select desired heading.
4. Compass Card - Rotates to display heading of airplane with reference to lubber line (2) on DG.
5. Heading Selector Knob (△) - Positions heading bug (3) on compass card (4) by rotating the heading selector knob. The bug rotates with the compass card.
6. Gyro Adjustment Knob (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (4) to correspond with the magnetic heading indicated by the magnetic compass. The unslaved compass card must be manually reset periodically to compensate for precessional errors in the gyro.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT 18 FOR AUXILIARY VACUUM SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Piper Auxiliary Vacuum System is installed in accordance with Piper Drawing No. 87778-3. The information contained herein supplements or supersedes the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED ____________________
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VERO BEACH, FLORIDA

DATE OF APPROVAL Oct. 22, 1986

SECTION 1 - GENERAL

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

SECTION 2 - LIMITATIONS

(a) The auxiliary vacuum system is limited to standby function only, do not take off with the engine driven dry air pump inoperative.

(b) Discontinue flight in Instrument Meteorological Conditions (IMC) if vacuum pressure falls below 4.8 In. Hg.

(c) The auxiliary pump/motor assembly and elapsed time indicator must be removed from service after 500 hours accumulated operating time or 10 years whichever occurs first.

SECTION 3 - EMERGENCY PROCEDURES

(a) VAC OFF or Low VAC Warning - Auxiliary Vacuum Switch AUX ON.
(b) Verify vacuum system suction 4.8 to 5.2 In. Hg.

CAUTION

Compass error may exceed 10° when auxiliary vacuum system is in operation.

SECTION 3 - EMERGENCY PROCEDURES (cont)

(c) Monitor electrical load - verify alternator capacity is not being exceeded as indicated by the ammeter. If required turn off non-essential electrical equipment.
(d) Land at the earliest opportunity to have primary system repaired.

SECTION 4 - NORMAL PROCEDURES

(a) Preflight Check.
   (1) Turn on battery switch and verify VAC OFF light illuminated.

NOTE

Due to the electrical power requirement of the auxiliary vacuum pump it is suggested that the engine be operating while making the following checks.

   (2) Turn on auxiliary vacuum pump and verify AUX ON light is illuminated and electrical load (approximately 15 amps) on ammeter.
   (3) Turn off auxiliary vacuum pump and verify AUX ON light extinguished.

SECTION 4 - NORMAL PROCEDURES (cont)

(b) Inflight Check.
   (1) Turn off non-essential electrical equipment.
   (2) Turn on auxiliary vacuum pump and verify AUX ON light illuminated and electrical load (approximately 15 amps) on ammeter.
   (3) Turn off auxiliary vacuum pump and verify AUX ON light extinguished and return to normal flight.

NOTE

For maximum service life, avoid continuous non-emergency operation of the auxiliary vacuum pump.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT & BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the Basic Pilot's Operating Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

The auxiliary dry air pump system provides an independent back-up source of pneumatic power to operate the gyro flight instruments in the event the engine driven air pump fails. Neither the auxiliary nor the engine driven gyro vacuum systems provides air for deice boot inflation and hold-down. These functions are provided by a separate engine driven air pump system.

The control switch (labeled AUX VAC) for the auxiliary pump system is located on the right side of the instrument panel below the vacuum suction gage. The control switch operating modes are "push-for-on" and "push-for-off".

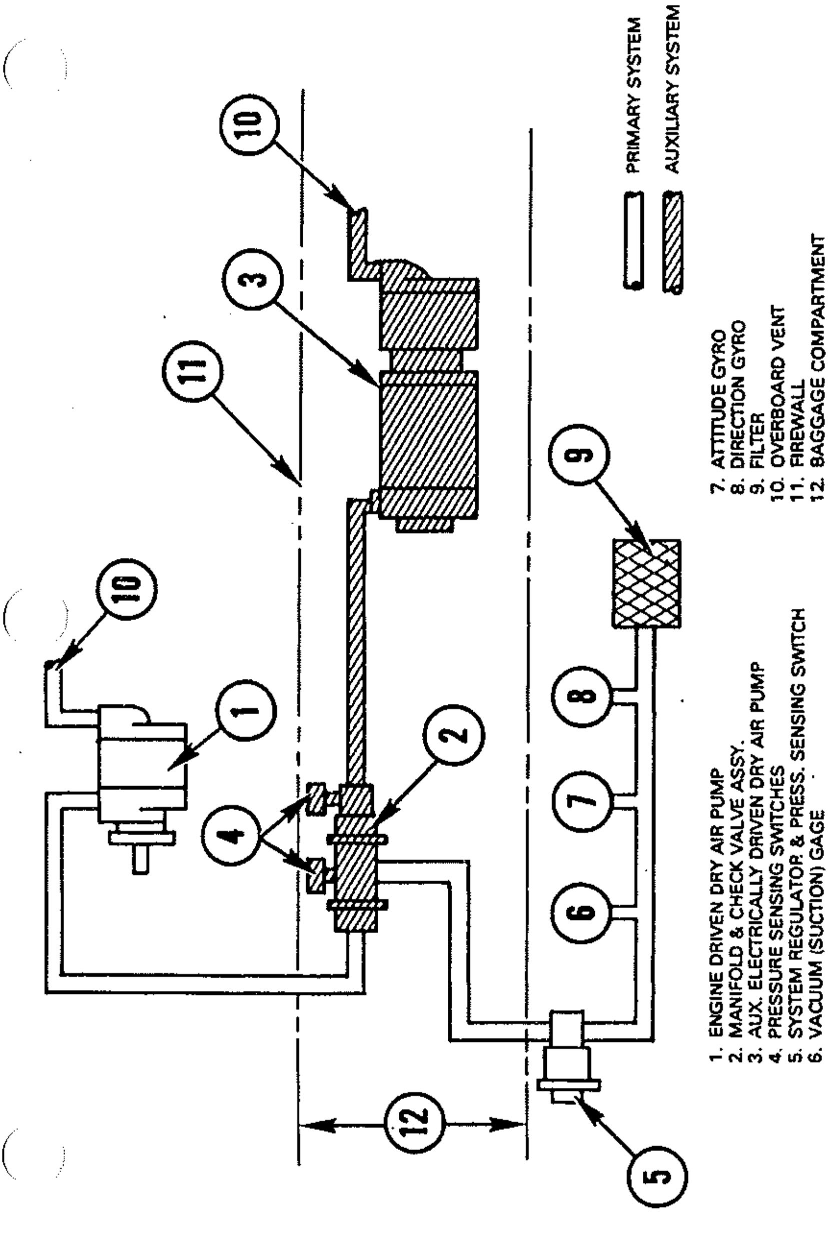
The switch button incorporates two annunciator light sections labeled VAC OFF and AUX ON. The VAC OFF section is controlled by a vacuum switch in the primary pneumatic system and illuminates an amber light when the engine driven pump is inoperative or when the system vacuum falls below the switch activation level. The AUX ON section is controlled by a vacuum switch in the auxiliary pneumatic system and illuminates a blue light when the auxiliary pump is operating and creating a vacuum in the system. When the auxiliary pump is activated at high altitude, or if the system has developed air leaks, the AUX ON light may fail to illuminate. This indicates that the system vacuum is still below the AUX ON switch activation level even though the auxiliary pump is operating and can be verified by observing the vacuum system indicator.

SECTION 7 - DESCRIPTION AND OPERATION (cont)

The annunciator lights do not incorporate a press-to-test feature. If the lights do not illuminate as expected, check for burned out lamps, replace with MS 25237-330 bulbs and retest the system.

System electrical protection is provided by a 20 amp circuit breaker in the pump motor circuit and a 5 amp in line fuse in the annunciator light circuit. The breaker is mounted on the circuit breaker panel.

The auxiliary pump is in the forward baggage compartment under the right side floor board. The auxiliary system connects to the primary system at a manifold downstream of the vacuum regulator. Isolation of the primary and auxiliary systems from each other is accomplished by check valves on each side of the manifold. The primary system vacuum switch is located in the center of the manifold and senses vacuum supplied to the gyros. The auxiliary system vacuum switch is located on the manifold between the check valve and the auxiliary pump and senses vacuum generated by the auxiliary pump. In order to assure high reliability of the auxiliary air pump system as a back-up power supply for gyro instruments, the pump/motor assembly must be removed and replaced after a time in service as specified in the limitations Section 2 of this handbook. An elapsed time indicator is incorporated into the auxiliary pump electrical system to show accumulated hours of operation.


PRIMARY SYSTEM
AUXILIARY SYSTEM
1. ENGINE DRIVEN DRY AIR PUMP
2. MANIFOLD & CHECK VALVE ASSY.
3. AUX. ELECTRICALLY DRIVEN DRY AIR PUMP
4. PRESSURE SENSING SWITCHES
5. SYSTEM REGULATOR & PRESS. SENSING SWITCH
6. VACUUM (SUCTION) GAGE
7. ATTITUDE GYRO
8. DIRECTION GYRO
9. FILTER
10. OVERBOARD VENT
11. FIREWALL
12. BAGGAGE COMPARTMENT

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT 19 FOR NORTHSTAR M1 LORAN C NAVIGATOR WITH KAP/KFC 150 AUTOPILOT SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Flight Manual when the optional Northstar M1 Loran C Navigator is installed per the Equipment List. The information contained herein supplements or supersedes the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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VERO BEACH, FLORIDA

DATE OF APPROVAL: March 26, 1990

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of airplane when the optional Northstar M1 Loran C Navigator system is installed. The navigator system must be operated within the limitations herein specified. 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 Northstar M1 Loran C Navigator System is installed.

SECTION 2 - LIMITATIONS

(a) Northstar M1 Loran C Navigator Reference Manual (latest revision) must be immediately available to the flight crew whenever navigation is predicated on the use of the Northstar M1.

(b) The Northstar M1 Loran C Navigator is approved for VFR only.

(c) During operation no flight operation shall be predicated upon Northstar M1 Loran C Navigator whenever a NAV flag is displayed by the Course Deviation Indicator (CDI).

(d) The following placard is located on the pilot's instrument panel in clear view of the pilot:

LORAN C APPROVED FOR VFR ONLY

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) OPERATION

Normal operating procedures are outlined in the Northstar M1 Loran C Navigator Reference Manual (latest revision).

(b) NAV-COUPLED MODE

When operating the KAP/KFC 150 flight control system in either the navigation (NAV) or approach (APR) mode, and the NAV/LORAN switch has been set to the Northstar M1 as the navigation source, all operational procedures which are applicable to these two modes, as described in the KAP/KFC 150 Operator's Manual and this Flight Manual Supplement, still apply, with the following notations or exceptions:

(1) Northstar is approved for VFR only.
(2) Course deviation data for the autopilot is derived from the Northstar M1.
(3) For course intercept or course tracking, set the HSI course needle to the Loran C course to be flown. This setting provides course datum to the autopilot.
(4) Switch position:

NAV/LORAN SW	SELECTIONS
NAV	NAV #1 coupled to A/P. Displayed on HSI.
LORAN	LORAN coupled to A/P. Displayed on HSI (blue indicator light illuminated).

NAV/LORAN SW	A/P NAV SW	SELECTIONS
NAV	A/P NAV 1	NAV #1 coupled to A/P. Displayed on HSI.
	A/P NAV 2	NAV #1 coupled to A/P. Displayed on #2 CDI.
LORAN	*	LORAN coupled to A/P. Displayed on HSI (blue indicator light illuminated).
*When the LORAN/NAV switch is in the Loran mode, the A/P NAV autopilot coupling switch is inactive.		

(c) NAVIGATION DISPLAYS

The Loran C System drives the pilot's HSI display when manually selected by the NAV/LORAN switch. This configuration is annunciated by a mode light. The HSI will only display left or ri course information, and a NAV flag indication, from the Norths M1. The course selector pointer must be manually set to the Loran C course. (Actual course cannot be determined on the HSI by rotating the course selector pointer.)

When Loran has been selected for display on the HSI, the bearing pointer will continue displaying the bearing to a previous selected VOR, RNAV waypoint, or NDB. Caution must be used in noting that the pointer will not indicate the bearing to the Loran waypoint.

(d) WAYPOINT ALERT ANNUNCIATOR

Becomes active within a one-minute radius of a waypoint.

(e) PARALLEL OFFSET ANNUNCIATOR

Becomes active whenever a parallel offset is in effect.

SECTION 5 - PERFORMANCE

Installation of the Northstar M1 Loran Navigator does not affect the basic performance information presented in Section 5 of this Pilot's Operating Handbook.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the Pilot's Operating Handbook.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SPECIAL SUPPLEMENT
FOR
KING,
KLN 88, LORAN C
NAVIGATION SYSTEM
WITH KAP/KFC 150 AUTOPILOT SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional King KLN 88, Loran C Navigator is installed per the Equipment List. The information contained herein supplements or supersedes the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED Wm. R. Moreu
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VERO BEACH, FLORIDA

DATE OF APPROVAL AUGUST 15, 1992

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional King KLN 88, Loran C Navigation System is installed. The navigation system must be operated within the limitations herein specified. 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 King KLN 88, Loran C Navigation System is installed.

SECTION 2 - LIMITATIONS

(a) King KLN 88, Loran C Navigation System, Pilot's Guide (P/N 006-08458-0000 dated August, 1989, or latest revision) must be immediately available to the flight crew whenever navigation is predicated on the use of the King KLN 88.

(b) The King KLN 88, Loran C Navigation System is not approved for IFR approaches.

(c) IFR RNAV operation is limited to the 48 contiguous states, the District of Columbia and coastal waters in accordance with AC 20-121A.

(d) IFR terminal navigation using the KLN 88 Loran C system is approved for use in the conterminous United States and coastal waters in accordance with AC 20-121A with the exception of an area bounded on the north by N36°00' Lat., on the east by W107°30' Long., on the south by N33°00' Lat., on the west by W111°00' Long. (See Figure 1).

(e) During RNAV operation of the King KLN 88, Loran C, additional navigation equipment required for the specific type of operation must be installed and operable.

(f) The King KLN 88 Loran C Navigation System must be checked for accuracy (reasonableness) prior to use as a means of navigation and under the following conditions:

(1) Prior to each compulsory reporting point during IFR operation when not under radar surveillance or control.

(2) Prior to requesting Off-Airway routing, and at hourly intervals thereafter during RNAV operation off approved RNAV routes.

(3) At or prior to arrival at each enroute waypoint during RNAV operation along approved RNAV routes.

(4) After acquisition of a new GRI, or reacquisition of the same GRI.

AREA RESTRICTION TO TERMINAL OPERATIONS
Figure 2-1

(g) No flight operation shall be predicated on the use of the King KLN 88, Loran C Navigation System whenever a NAV OFF flag is displayed by the CDI. In addition, no IFR flight shall be predicated on the use of the King KLN 88, Loran C Navigation System whenever the external LORAN WARN annunciator is lighted, or the accuracy reasonableness check has a consistently greater position error than 3.0 nautical miles or any failure observed during the system start-up test.

(h) The pilot must verify the coordinates of each waypoint to be used during an IFR flight.

(i) The following placard is located on the pilot's instrument panel adjacent to the HSI:

LORAN C NOT APPROVED FOR APPROACH

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.

If KLN 88, Loran C information is flagged, utilize remaining operational navigation equipment as required.

SECTION 4 - NORMAL PROCEDURES

(a) OPERATION

Normal operating procedures are outlined in the King KLN 88, Loran C Navigation System, Pilot's Guide (P/N 006-08458-0000 dated August, 1989, or latest revision).

(b) External Annunciators

(1) Waypoint (WPT)
Approximately 36 seconds prior to reaching a direct to waypoint or 20 seconds prior to the beginning of turn anticipation (turn anticipation function enabled) the waypoint alert annunciator will begin flashing. This is called "waypoint alerting".

(2) Message (MSG)
Will flash to alert the pilot of a situation that requires attention. Press the MSG button on the KLN 88, Loran C to view the message. (Appendix B of the KLN 88 Pilot's Guide contains a list of all of the message page messages and their meanings).

(3) Approach (APR)
Annunciates approach mode selection on the KLN 88, Loran C (Approaches NOT APPROVED).

(4) Warning (WRN)
Annunciates whenever the KLN 88 determines that its estimated position error is greater than 1.7 nautical miles.

SECTION 5 - PERFORMANCE

Installation of the King KLN 88, Loran C does not affect the basic performance information in Section 5 of this Pilot's Operating Handbook.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the Pilot's Operating Handbook.

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TABLE OF CONTENTS

SECTION 10

OPERATING TIPS

SECTION 10

OPERATING TIPS

10.1 GENERAL

This section provides operating tips of particular value in the operation of the Saratoga SP.

10.3 OPERATING 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 to 80 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 112 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 spacial 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.