OY-RPO

FAA APPROVED

AIRPLANE FLIGHT MANUAL

FOR

AZTEC "E"

Serial Numbers 27-4426, 27-4574 through 27-7554168

WARNING

EXTREME CARE MUST BE EXERCISED TO LIMIT THE USE OF THIS MANUAL TO APPLICABLE AIRCRAFT. THIS MANUAL REVISED AS INDICATED BELOW OR SUBSEQUENTLY REVISED IS VALID FOR USE WITH THE AIRPLANE IDENTIFIED BELOW WHEN OFFICIALLY APPROVED. SUBSEQUENT REVISIONS SUPPLIED BY PIPER AIRCRAFT CORPORATION MUST BE PROPERLY INSERTED.

MODEL PA-23-250 (6)

AIRCRAFT SERIAL NO. _____ REGISTRATION NO. _____

AIRPLANE FLIGHT MANUAL, REPORT 1630 PART I REVISION _____

PIPER AIRCRAFT CORPORATION
SIGNATURE AND STAMP _____

NOTE

THIS MANUAL MUST BE KEPT IN THE AIRPLANE AT ALL TIMES

FAA APPROVED BY: _____
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NORMAL CATEGORY

TABLE OF CONTENTS

SECTION I
Page
Log of Revisions 1

SECTION II
Limitations 3
A. Engine 3
B. Fuel 3
C. Propellers 3
D. Cowl Flaps 3
E. Wing Flaps 3
F. Instrument Markings (Power Plant) 3
G. Airspeed Limitations and Indicator Markings (Calibrated Airspeed) 4
H. Flight Load Factors 4
I. Maximum Weight 4
J. C.G. Range 4
K. Maneuvers 5
L. Placards 5

SECTION III
Procedures 7
A. Systems Operation and Checks 7
1. Voltage Regulating and Alternator System (For Aircraft up to and including Serial No. 27-4793) 7
2. Alternator Paralleling System (For Aircraft Serial No. 27-4794 and up) 8
3. Fuel Management 8
4. Landing Gear and Flap Extension - Emergency 9
5. Stall Warning Indicator 9

B. Emergency Procedures 11
1. Feathering Procedure 11
2. Unfeathering Procedure 11
3. Emergency Exit 11

SECTION IV
Performance 13

SECTION V
Supplements 15
1. Icing Equipment Installation 17

2. Oxygen System Installation 19
1. Limitations 19
2. Procedures 19
3. Placards 19
4. Emergency 19

3. Installation of Piper AutoControl III 21
1. Limitations 21
2. Operating Instructions 21
3. Normal Operation 21
4. Emergency Procedures 21

4. Installation of Lycoming Turbocharged Engines 23
1. Limitations 23
2. Normal Operating Procedures 24
3. Performance 24

5. Installation of Piper AltiMatic IIIB 25
1. Limitations 25
2. Operating Instructions 25
3. Normal Flight Operation 26
4. Emergency Procedures 27
5. Placards 27

6. Installation of Anti-Collision (Strobe) Lights 29
1. Operating Limitations 29

7. Installation of AltiMatic V F/D 31
1. Limitations 31
2. Normal Operating Procedures 31
3. Emergency Operating Procedure 34
4. Placards 35

8. Installation of AltiMatic V 37
1. Limitations 37
2. Normal Operating Procedures 37
3. Emergency Operating Procedure 40
4. Placards 40

9. Piper AltiMatic IIIB-1 (Includes Roll, Pitch AutoFlite II and Pitch Trim Sections) . . . 41
1. Limitations 41
2. Procedures 41
3. Performance 46

10. Installation of AltiMatic V F/D-1 47
1. Limitations 47
2. Normal Operating Procedures 47
3. Emergency Operating Procedure 51
4. Placards 51

11. Installation of AltiMatic V-1 53
1. Limitations 53
2. Normal Operating Procedures 53
3. Emergency Operating Procedure 56
4. Placards 56

12. Installation of Piper AutoControl IIIB 57
1. Limitations 57
2. Procedures 57
3. Emergency Operation 59
4. Performance 59

13. Installation of Piper AltiMatic IIIC (Includes Roll, Pitch and Pitch Trim Sections) . . . 61
1. Limitations 61
2. Procedures 61
3. Performance 66

14. Instruktionsbog AUTOPILOT —

SECTION I

LOG OF REVISIONS

Revision	Revised Pages	Description and Revision	FAA Approved Date
1.	15, 31 thru 35	Addition of Supplement 7 AltiMatic V F/D.	April 15, 1970
2.	i, 17, 19, 21, 23, 25, 29, 31, 35 ii, 15, 37 thru 40	Editorial revision - correction of typographical errors. Addition of Supplement 8 AltiMatic V and pertinent references.	Feb. 1, 1971
3.	7	Revised instructions for steps e. and g. under item 2.	Dec. 1, 1971
4.	i, 7, 8, 9 4 ii, 15, 41 thru 46 23, 24	Addition of Alternator Paralleling System and relocation of existing material. Deleted Red Line for Vmc. Addition of Supplement 9 AltiMatic IIIB-1 and pertinent references. Addition of revised C. G. Range and relocation of existing material.	Dec. 10, 1971
5.	45	Rearranged contents of page.	Aug. 16, 1972
6.	6	Revised placard (Power Chart); added Warning placard.	Aug. 20, 1972
7.	ii, 15, 47 thru 56	Addition of Supplement 10, AltiMatic V F/D-1 and Supplement 11, AltiMatic V-1 and pertinent references.	Nov. 7, 1972
8.	4	Added 0° Flaps to Item F. Revised Item G.	Nov. 12, 1973
9.	Title	Added PAC Approval Form (NOTE: AIRCRAFT DELIVERED WITH MANUALS PRIOR TO THIS REVISION DO NOT REQUIRE THIS REVISION.)	Sept. 3, 1974 Paul E. Everly
10.	i iii	Added Wing Flaps; rearranged contents to accommodate wing flaps. Added page to accommodate addition of Piper AutoControl IIIB and AltiMatic IIIC.	

LOG OF REVISIONS (cont)

Revision	Revised Pages	Description and Revision	FAA Approved Date
10. (cont)	iv	Added Intentionally Blank Page.	
	3	Revised Cowl Flaps info; added Wing Flaps; changed heading of Instrument Markings from E. to F.	
	4	Revised Headings.	
	5	Revised Headings.	
	6	Revised Headings.	
	11	Revised Emergency Procedures Item 2. h.	
	15	Added Items 12 and 13 to Supplements contents.	
	17	Added Deicing Equipment to Item 1; revised format.	
	18	Revised format; added Pneumatic Deicer info.	
	18a	Added page (Pneumatic Deicers).	
	18b	Added Intentionally Blank Page.	
	32	Revised Note.	
	57, 58, 59	Added pages (Installation of Piper AutoControl IIIB).	Oct. 1, 1974
	60	Added Intentionally Blank Page.	Bill D. Hurley
	61, 62, 63, 64, 65, 66	Added pages (Installation of Piper AltiMatic IIIC).	Bill D. Hurley
11.	17	Added Airborne Deicing Equipment to Item 1.a.; revised Item 2.c.; relocated Items 3. a. 2., 3. a. 3., 3. a. 4. to page 18.	
	18	Added Items 3. a. 2., 3. a, 3., 3. a. 4. from page 17.	
	33	Revised Item 1. (c).	Jan. 22, 1975
	48	Revised Note.	
	49	Revised Item 1. (c).	
	64	Revised Items (7), (7) (a), (7) (b), (7) (c) and Note.	Paul E. Everly PE Everly
12.	6	Revised Warning placard.	March 21, 1975 PE Everly Paul E. Everly
13.	17	Added Piper Dwg. No. to Airborne Deicing Equip. Item 1.a.	May 12, 1975 Paul E. Everly PE Everly

LOG OF REVISIONS (cont)

Revision	Revised Pages	Description and Revision	FAA Approved Date
14.	5 35, 40, 51, 56	Added Serial No. effectivity to "Inside rudder on tip rib" placard. Revised altitude loss figure in item 3. b. (2).	Feb. 23, 1976 Paul E. Everly P E Everly
15.	8 9	Revised emergency single engine crossfeed operation in item 3. b; relocated material to page 9. Added relocated material from page 8.	Nov. 23, 1976 Paul E. Everly P E Everly
16.	4 23 24	Revised item I. Maximum Weight (Added Zero Fuel Weight) Revised item 4. 1. f., E.G.T. Green Arc. Added item 4. 1. j., Maximum Weight.	March 21, 1977 R. L. Taylor
17.	29 62, 63, 64, 66 67	Revised item 6.1 b. (Added serial nos.) Added item 6.1 c. (Added new placard) Revised AltiMatic III C info. Added page to accommodate addition of AltiMatic III C NSD 360A info.	March 20, 1979 P E Everly Paul E. Everly

SECTION II

LIMITATIONS

The following limitations must be observed in the operation of this airplane:

A. ENGINE
Lycoming IO-540 Series — Two

ENGINE LIMITS
For all operation 2575 RPM, 250 BHP

B. FUEL
91/96 Octane Aviation Gasoline (Minimum)

C. PROPELLERS
Hartzell HC-E2YR-2 Series — Two
Constant Speed
Full Feathering; Blades 8465-7R
Pitch Settings at 30 in. Station
High 80°, Low 14.5°

D. COWL FLAPS
Cowl flaps are provided to allow manual control of engine temperatures. The cowl flaps should be open during ground operations and in climbs. In no case should the cylinder head temperatures be allowed to exceed 500°F. and the oil temperatures allowed to exceed 245°F. On airplanes equipped with 24 volt 70 amp alternators, the cowl flaps must be full open during climbs above 18,000 ft with an alternator loaded to 60 amps or more.

E. WING FLAPS

Takeoff	0°
Landing	0° to 50°

F. INSTRUMENT MARKINGS (POWER PLANT)

OIL TEMPERATURE

Green Arc (Normal Operating Range)	120° to 245°F
Yellow Arc (Caution)	60° to 120°F
Red Line (Maximum)	245°F

OIL PRESSURE

Green Arc (Normal Operating Range)	60 PSI to 90 PSI
Yellow Arc (Caution)	25 PSI to 60 PSI and 90 PSI to 100 PSI
Red Line (Minimum)	25 PSI
Red Line (Maximum)	100 PSI

TACHOMETER

Green Arc (Normal Operating Range)	500 RPM to 2575 RPM
Red Line (Maximum)	2575 RPM

FUEL FLOW

Green Arc (Normal Operating Range)	0 GPH to 26 GPH
Red Line (Maximum at Sea Level)	26 GPH (7.8 PSI)

CYLINDER HEAD TEMPERATURE	
Green Arc (Normal Range)	200° to 500° F
Red Line (Maximum)	500° F

G. AIRSPEED LIMITATIONS AND INDICATOR MARKINGS (Calibrated Airspeed) — Normal Category

NEVER EXCEED SPEED	249 MPH
MAXIMUM STRUCTURAL CRUISING SPEED	198 MPH
DESIGN MANEUVERING SPEED	149 MPH
FLAPS EXTENDED SPEEDS	70 MPH to 125 MPH
Full Flap	125 MPH
Half Flap	140 MPH
Quarter Flap	160 MPH
MAXIMUM GEAR EXTENDED SPEED	150 MPH
MINIMUM CONTROL SPEED (Single Engine, 0° Flaps)	80 MPH
STALL SPEED	
Gear and Flaps Up	76 MPH
Gear and Flaps Down	70 MPH
AIRSPEED INDICATOR MARKINGS	
Green Arc (Normal Operating Range)	76 MPH to 198 MPH
Yellow Arc (Caution Range - Smooth Air)	198 MPH to 249 MPH
White Arc (Flaps Extended Range)	70 MPH to 125 MPH
Radial Red Line (Never Exceed - Smooth Air)	249 MPH

H. FLIGHT LOAD FACTORS

Positive Load Factor (Maximum)	3.68 G
Negative Load Factor (Maximum)	No Inverted Maneuvers Approved

I. MAXIMUM WEIGHT

Maximum Takeoff Weight	5200 LBS
Maximum Landing Weight	4940 LBS
Maximum Zero Fuel Weight	4400 LBS

It is the responsibility of the airplane owner and the pilot to assure that the airplane is properly loaded. See "Weight and Balance Section" for proper loading instructions.

J. C. G. RANGE

Weight Pounds	Forward Limit Inches Aft of Datum	Aft Limit Inches Aft of Datum
5200	99.0	100.5
5000	97.0	100.5
3250	85.7	100.5

1. Straight line variation between the points given.
2. Datum is 80 inches ahead of the wing leading edge outboard of the tapered sections.

K. MANEUVERS

All intentional acrobatic maneuvers (including spins) are prohibited.

L. PLACARDS

On the instrument panel in full view of the pilot:

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE AIRPLANE FLIGHT MANUAL. ACROBATIC MANEUVERS (INCLUDING SPINS) PROHIBITED.

On the instrument panel:

"MINIMUM SINGLE ENGINE CONTROL SPEED 80 MPH"

Under both center windows:

"LATCH SEATS FOR TAKE-OFF AND LANDING"

On firing ring cover of emergency landing gear extender under left front seat:

"EMERGENCY GEAR EXTENDER PLACE GEAR SELECTOR TO DOWN POSITION LIFT COVER, PULL RING".

On forward baggage compartment door frame:

"BAGGAGE MAXIMUM 150 LBS. SEE LOADING SCHEDULE"

On rear baggage compartment door:

"MAXIMUM BAGGAGE 150 LBS. INCLUDES 20 LBS. ON SHELF. SEE LOADING SCHEDULE".

Inside rudder on tip rib (Ser. Nos. 27-4426, 27-4574 through 27-7305134):

"ANTI-COLLISION LIGHT REQUIRED FOR PROPER RUDDER MASS BALANCE. DO NOT REMOVE. SEE SERVICE MANUAL".

On emergency exit, middle window left side:

"EMERGENCY EXIT RELEASE: REMOVE COVER, TURN HANDLE, PUSH DOOR".

On right sun visor, (Power Chart) (required on normally aspirated models only):

DO NOT EXCEED 27" MANIFOLD PRESSURE BELOW 2300 RPM OR 25" BELOW 2000 RPM.

On instrument panel (ser. nos. 27-4426, 27-4574 thru 27-7405476):

WARNING – UNCOORDINATED MANEUVERS, INCLUDING SIDE SLIPS OF 30 SECONDS OR MORE, FOR ANY REASON, AND FAST TAXI TURNS JUST PRIOR TO TAKE-OFF CAN CAUSE LOSS OF POWER IF FUEL TANKS IN USE ARE LESS THAN 1/2 FULL

2. ALTERNATOR PARALLELING SYSTEM (FOR AIRCRAFT SER. NO. 27-4794 AND UP)

On aircraft equipped with the subject system, each alternator is controlled independently by its own voltage regulator. These regulators are interconnected electronically so as to provide paralleled outputs from their associated alternators under normal operating engine RPM ranges. An ammeter that can be switched into either alternator output lead is provided for system monitoring, along with alternator "INOP" warning lights that illuminate when their associated alternator is not producing a voltage.

In the event of an alternator "INOP" indication the following steps should be taken:

a. Reduce electrical load to minimum for continued safe flight.

b. Turn OFF one section of the Master Switch (L or R, as appropriate) to open the corresponding alternator field circuit. Reset all circuit breakers which may have tripped.

c. Turn ON the section of the Master Switch which had been previously turned OFF and if "INOP" light goes out - reinstate electrical load.

d. If, after turning ON the section of the Master Switch, the "INOP" light remains lit and/or the alternator circuit breaker switch has tripped, turn the same section of the Master Switch OFF and continue flight with reduced electrical load.

e. In the event that both alternator "INOP" lights come on simultaneously, repeat the above procedure for each alternator individually.

f. If both alternators fail to return to normal operation, turn ON Master Switch and turn OFF both alternator circuit breaker switches. Terminate flight as soon as possible.

CAUTION

The alternator circuit breaker switches should not be opened manually whenever the alternators are functioning normally.

3. FUEL MANAGEMENT

a. Normal Operation

(1) Take-off and landing
- (a) Main fuel valve "ON"
- (b) Pressure crossfeed "OFF"
- (c) Electric fuel pumps "ON"

(2) Cruise
- (a) Main fuel valves "ON"
- (b) Pressure crossfeed "OFF"
- (c) Electric fuel pumps "OFF"

b. Emergency Operation - Extended Cruise
Single Engine

(1) Cruise
- (a) A pressure crossfeed valve is provided to increase range during single engine operation. Fuel system management should be as follows:
  - (1) Pressure crossfeed "ON".
  - (2) Main fuel valve of inoperative engine "ON".
  - (3) Electric fuel pump of inoperative engine "ON".
  - (4) Main fuel valve of operating engine "OFF".
  - (5) Electric fuel pump of operating engine "OFF".

(b) When fuel from the cell of the inoperative engine is exhausted return to the operating engine fuel system as follows:
(1) Main valve operating engine "ON".
(2) Electric pump operating engine "ON".
(3) Electric pump inoperative engine "OFF".
(4) Pressure crossfeed "OFF".
(5) Main valve inoperative engine "OFF".
(6) Electric pump operating engine "OFF".

(2) Landing
(a) Main valve "ON" on operative engine.
(b) Pressure crossfeed "OFF".
(c) Electric fuel pump "ON" on operative engine.
(d) Inoperative engine fuel valve "OFF".
(e) Inoperative engine electric fuel pump "OFF".

4. LANDING GEAR AND FLAP EXTENSION - EMERGENCY

a. In case of hydraulic pump failure, landing gear and flap extension may be accomplished through the use of the emergency hand pump by placing the pertinent selector handle in the down position and operating the manual pump as follows:
(1) Pull emergency pump handle out as far as possible.
(2) Pump handle up and down until pressure is built up in the system and the selector handle automatically returns to neutral.
The hand pump is designed to be used for emergency only.

b. Gear Extension Only with CO_2:

USE ONLY IF THE ENGINE DRIVEN AND HAND HYDRAULIC PUMPS FAIL TO EXTEND THE LANDING GEAR.

In case the engine driven and emergency hand hydraulic pumps fail to lower the landing gear the emergency CO_2 system should be used as follows:
(1) Place the gear selector handle in the down position.
(2) Raise firing ring cover under the left front seat.
(3) Pull ring as far as possible.

NOTE

After operating the CO_2 system the landing gear (or flap) should NOT be operated and the selector handles should NOT be moved until repairs are made to the system. See Service Manual for repair procedure.

5. STALL WARNING INDICATOR

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

B. EMERGENCY PROCEDURES

1. FEATHERING PROCEDURE

Open operative engine throttle to maintain altitude and airspeed. MAINTAIN AT LEAST 102 MPH (BEST SINGLE RATE OF CLIMB).

Inoperative engine procedure is as follows:

a. "CLOSE" throttle.

b. Prop control "FEATHERED". PROPELLER CANNOT BE FEATHERED UNDER 1000 RPM.

c. Mixture control "IDLE CUT-OFF".

d. Ignition switches "OFF".

e. Electric fuel pump "OFF".

f. Main fuel valve "OFF" inoperative engine side.

2. UNFEATHERING PROCEDURE

The procedure to unfeather a propeller is as follows:

a. Turn main fuel valve "ON."

b. Turn ignition switches "ON."

c. Prime engine if necessary, then turn electric fuel pump off.

d. Open throttle 1/2 inch.

e. Advance propeller control to high RPM position.

f. Advance mixture control to full rich.

g. Engage starter.

h. As RPM passes 1000 coming out of feather, retard propeller control to maintain 1800-2000 RPM for warm-up. Adjust manifold pressure to 15" and maintain this low power until oil temperature begins to rise and oil pressure can be maintained within limits.

i. Re-synchronize engines.

3. EMERGENCY EXIT

Emergency Exit from the aircraft may be made through the Emergency Exit, middle window, on the left side of the cabin. The exit is operated by removing the plastic handle guard and twising the handle rearward. The window may then be pushed outward away from the fuselage.

SECTION V

SUPPLEMENTS

NOTE

A FLIGHT MANUAL SUPPLEMENT IS REQUIRED TO BE IN THE AIRPLANE FLIGHT MANUAL ONLY IF THE EQUIPMENT WHICH IS THE SUBJECT OF THE SUPPLEMENT IS INSTALLED.

1. Icing Equipment Installation

~~2. Oxygen System Installation~~

~~3. Installation of Piper AutoControl III~~

~~4. Installation of Lycoming Turbocharged Engines~~

~~5. Installation of Piper AltiMatic IIIB~~

6. Installation of Anti-Collision (Strobe) Lights

~~7. Installation of AltiMatic V F/D~~

~~8. Installation of AltiMatic V~~

~~9. Piper AltiMatic IIIB-1 (Includes Roll, Pitch, AutoFlite II and Pitch Trim Sections.)~~

~~10. Installation of AltiMatic V F/D-1~~

~~11. Installation of AltiMatic V-1~~

~~12. Installation of Piper AutoControl IIIB~~

13. Installation of Piper AltiMatic IIIC (Includes Roll, Pitch and Pitch Trim Sections)

1. ICING EQUIPMENT INSTALLATION

1. The following items of equipment must be installed and operable to effectively cope with normally encountered icing conditions:

a. B. F. Goodrich Wing and Tail Pneumatic Deicing Boots installed per B. F. Goodrich S.T.C. No. SA155EA, revised March 6, 1970, or FAA approved equivalent, or Piper Drawing No. 32735, or 32302. (Ref. Item 503 (b), or 503 (c), Aircraft Specification No. 1A10.)

or

B. F. Goodrich Wing and Tail Pneumatic Deicing Boots Installed per B. F. Goodrich S.T.C. No. SA155EA, revised September 30, 1974, and Piper Drawing No. 33435-3.

or

Airborne Mfg. Co. Wing and Tail Pneumatic Deicing Boots Installed per Airborne S.T.C. SA667CE, revised March 14, 1975 and Piper Drawing No. 15695-2.

b. B. F. Goodrich Electric Propeller Deicing Installed per B. F. Goodrich S.T.C. No. SA195EA, dated June 24, 1964, or FAA approved equivalent or Piper Drawing No. 32740. (Ref. Item 504 (b), Aircraft Specification No. 1A10.)

c. Piper Antennas Installed per P.A.C. Dwg. 31628. No special operating instructions required.

d. Piper Heated Glass Panel on Windshield Installed per P.A.C. Dwg. 31640. (Ref. Item 502 (b), Aircraft Specification No. 1A10.)

e. Heated Pitot Head per P.A.C. Dwg. 19024. No special operating instructions required. (Ref. Item 601, Aircraft Specification No. 1A10.)

2. PLACARDS

a. At switch:

W'SHIELD
HEAT

b. At circuit breaker:

W'SHIELD
HEAT

c. When any of the above icing equipment is not installed, the following placard must be on the instrument panel:
"Warning - This aircraft is not fully equipped for flight in icing condition."

NOTE
WHEN ALL ITEMS OF EQUIPMENT LISTED ABOVE ARE INSTALLED, PLACARD NO. c. IS NOT REQUIRED.

3. OPERATING INSTRUCTIONS

a. Heated Windshield

(1) Prior to flight in conditions where the possibility of encountering icing exists, the HEATED PANEL assembly should be attached to the aircraft and the lead wire plug firmly inserted in socket provided.

(2) An operational check should then be accomplished by turning the HEATED PANEL switch ON for a period not exceeding 30 SEC.
(3) Proper operation is indicated by the glass section being warm to the touch.
(4) If icing conditions are encountered the HEATED PANEL switch should be turned ON and remain ON until the icing conditions cease.
(5) When icing is not prevalent the unit should be turned OFF. UNDER NO CIRCUMSTANCE SHOULD THE UNIT BE TURNED ON FOR A PERIOD EXCEEDING 30 SEC. UNLESS:
  (a) The aircraft is in flight, or
  (b) Ice exists on the HEATED PANEL.

CAUTION

This equipment cannot be expected to cope with heavy or very prolonged moderate icing conditions. The latter can be expected to tax the equipment beyond its capacity.

Pilots should always strive to avoid heavy icing conditions. If heavy icing is encountered unexpectedly or unavoidably, prompt action must be taken to get into more favorable flying weather conditions.

NOTE

When all items of equipment listed above are installed, the B. F. Goodrich placard "Warning - This aircraft is not fully equipped for flight in icing conditions." IS NOT REQUIRED. When the heated panel is removed or any of the above listed installed equipment is inoperable (known before flight) the warning placard must be reinstalled.

b. Pneumatic Deicing System
(1) Operating Procedures
  (a) Preflight Check
    1. Check wing deice indicator (press-to-test).
    2. Check source indicator for pump malfunction.
    3. At approximately 2000 RPM, check the deicer operation. Actuate wing deice switch. In approximately three seconds the indicator light will glow, indicating inflation. Also check the deicer boots visually.

  (b) Normal Operation
    1. Light Icing - Actuate wing deice switch. Boots will complete one inflation cycle. Wing deice indicator will glow during the six-second inflation period. Most effective deicing is obtained if a thickness of 1/4 to 1/2" of ice is collected before the deicers are operated.
    2. Heavier Icing - The wing deice switch will permit the operator to manually cycle the system at any desired time interval, should icing conditions require.

NOTE

With both engines at 2000 RPM and all other system checks normal, a time between boot actuation and indicator light illumination exceeding 4 seconds indicates a leak in the system.

(2) Altitude Limitations on Deicer Boots

The deicer boots have been tested and approved for all altitudes up to and including 24,000 feet with the following limitations in icing conditions:

No. of Pneumatic Pumps	Engine Speed RPM	Altitude	Max. Altitude for Optimum Boot Effectiveness
2	2200	20,000 ft. and below	20,000 ft.
2	2575	Above 20,000 ft.	24,000 ft.
1	2575	All altitudes	15,000 ft.

6. INSTALLATION OF ANTI-COLLISION (STROBE) LIGHTS

1. OPERATING LIMITATIONS

Placards:

a. On left window moulding in full view of the pilot when RED anti-collision (Strobe) lights are installed:

WARNING
TO AVOID OPTICAL ILLUSION AND SEVERE VERTIGO, TURN ANTI-COLLISION LIGHTS OFF UPON ENTERING CLOUDS, FOG OR HAZE.

b. On left window moulding in full view of the pilot when supplementary WHITE anti-collision (Strobe) lights are installed: (Serial Nos. up to and including 27-7554041)

WARNING
TURN OFF STROBE LIGHTS WHEN TAXIING IN VICINITY OF OTHER AIRCRAFT, OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE.

STANDARD POSITION LIGHTS TO BE ON FOR ALL NIGHT OPERATIONS.

c. On left window moulding in full view of the pilot when supplementary WHITE anti-collision (Strobe) lights are installed: (Serial Nos. 27-7554042 and up)

WARNING
TURN OFF ANTI-COLLISION LIGHTS WHEN TAXIING IN VICINITY OF OTHER AIRCRAFT, OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE.

STANDARD POSITION LIGHTS TO BE ON FOR ALL NIGHT OPERATIONS.

13. INSTALLATION OF PIPER ALTIMATIC IIIC (Includes Roll, Pitch and Pitch Trim Sections)

NOTE

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.

1. LIMITATIONS
   a. The maximum speed for autopilot operation is 215 MPH CAS. (Autopilot Vmo)
   b. Reduce autopilot Vmo 5 MPH CAS each 1000 feet above 21,000 feet.
   c. Use of flaps not authorized during autopilot operation.
   d. Autopilot "OFF" for takeoff and landing.
   e. Placard P/N 13A660 "Conduct Trim Check Prior to Flight (See AFM)" to be installed in clear view of pilot.
   f. During autopilot operation, the pilot must be in his seat with the safety belt fastened.

2. PROCEDURES
   a. PREFLIGHT
      (1) Roll Section
         (a) Place Radio Coupler in "Heading" mode and place Roll rocker switch in 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 Roll Command Knob.
         (b) Set proper D.G. Heading on D.G. and turn Heading Bug to aircraft heading. Engage HDG 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.
         (c) Disengage Autopilot by depressing trim switch. Check Aileron operation is free and A/P is disconnected from controls.
      (2) Pitch Section
         (a) Engage "Roll" rocker switch.
         (b) Center pitch command disc and engage "Pitch" rocker switch.
         (c) Rotate pitch command disc full DOWN and full UP and check control wheel describes a corresponding fore and aft movement. Check to see that servo can be overridden by hand at control wheel.

NOTE

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

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

(3) Trim Section (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 Section 2.d. of this supplement.

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

(a) When the top bar (A/P off) is pressed, it disconnects the Autopilot.
(b) 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.

PREFLIGHT: Command Trim - Before Each Flight

(a) Check trim circuit breaker - IN.
(b) Trim Master Switch - ON.
(c) A/P OFF - Check normal trim operation - UP. Grasp trim crank and check override capability. Check nose DOWN operation. Recheck override.
(d) With trim operating - depress interrupt switch - trim should stop - release interrupt switch - trim should operate.
(e) Activate center bar only - push rocker fore and aft - only. Trim should not operate with either separate action.

AUTOTRIM - Before Each Flight

(a) A/P ON - (Roll and Pitch Sections) Check automatic operation by activating A/P Pitch Command Disc UP, then DN. Observe trim operation follows Pitch Command Direction.

NOTE

In Autopilot Mode, there will be approximately a 3 second delay between operation of Pitch Command and operation of trim.

(b) Press center bar (A/P OFF) - release - check autopilot disengagement.
(c) Rotate trim crank to check manual trim operation. Reset to takeoff position prior to takeoff.

b. IN-FLIGHT

(1) Trim airplane (ball centered).
(2) Check air pressure or vacuum to ascertain that the Directional Gyro and Attitude Gyro are receiving sufficient air.

(3) Roll Section

(a) To engage, center Roll Command Knob, push Roll rocker switch to the "ON" position. To turn, rotate Roll Command Knob in desired direction. (Maximum angle of bank should not exceed 30°.)

(b) For heading mode, set Directional Gyro with Magnetic Compass. Push directional gyro HDG knob in, rotate to select desired heading. Push HDG rocker switch to the "ON" position. (Maximum angle of bank will be 20° with heading lock engaged.)

(4) Pitch Section - (Roll Section must be engaged prior to engaging Pitch Section.)

(a) Center pitch trim indicator with the Pitch Command Disc.

(b) Engage pitch rocker switch. To change attitude, rotate Pitch Command Disc in the desired direction.

(5) Altitude Hold

Upon reaching desired or cruising altitude, engage ALT Hold Mode rocker switch. For best results reduce rate of climb or descent to 500 FPM before engaging altitude hold mode.

NOTE

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

(6) Radio Coupling VOR/ILS with H.S.I. (Horizontal Situation Indicator) Type Instrument Display. (Optional)

VOR Navigation

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

(b) Select OMNI mode on Radio Coupler.

(c) Engage 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 noisey, VOR signals. NAV mode should be selected after the aircraft is established on course.

ILS/LOC Front Course

(a) Set inbound, front, localizer course on H.S.I.

(b) Select LOC/NORM mode on Radio Coupler to intercept and track inbound on the localizer. Select LOC/REV to intercept and track the localizer course outbound to the procedure turn area.

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

ILS/Back Course

(a) Set inbound, front, localizer course on H.S.I.

(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.

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

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

(a) 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.

(b) For ILS Front Course Intercepts and Tracking:
Tune the localizer frequency and place the HDG bug on the inbound, front course heading. Select LOC-NOR mode on the coupler and HDG mode on the autopilot console.

(c) 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.

c. 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 b.(6) or (7), as appropriate.

(b) Use HDG mode and Pitch or ALT Hold modes as appropriate during procedure turn.

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

(d) **At the M.D.A. engage ALT 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 Command Disc and disengage ALT 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 the flaps and landing gear. Adjust attitude as necessary for desired airspeed and engage HDG mode for turn from the VOR final approach course.

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

(a) Track inbound to L.O.M. as described in Section b.(6) or (7) with ALT Hold mode engaged.

(b) Inbound to L.O.M. Slow to 120 MPH IAS.

(c) Automatic Glide Slope capture will occur at Glide Slope Intercept if the following conditions are met:

1. Radio Coupler in LOC/NORM Mode.
2. Altitude Hold Mode engaged (ALT rocker switch 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 120 MPH 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 through out 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 Section c.(1)(e).

NOTE

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

(1) Disengage ALT Hold mode.
(2) Switch Radio Coupler to HDG mode.
(3) Disengage Autopilot.

d. EMERGENCY OPERATIONS

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 operation 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 the Circuit Breakers for both systems.

(1) In the event of an Autopilot malfunction the Autopilot can be:
(a) 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.

(b) Disconnected by depressing the Master Disc/Inter Switch.
(c) Disconnected by depressing the Trim Switch "A/P OFF" bar.
(d) Disconnected by pushing the Roll rocker switch "OFF."

(2) In the event of a Trim malfunction:
(a) Depress and hold the Master Trim Interrupt Switch.
(b) Trim Master Switch - OFF. Retrim aircraft as necessary using manual trim system.
(c) Release Master Trim Interrupt Switch - be alert for possible trim action.
(d) Trim Circuit Breaker - Pull. Do not operate trim until problem is corrected.
(e) 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.

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

(4) Single Engine Operations
(a) Engine failure during an Autopilot approach operation: Disengage Autopilot conduct remainder of approach manually.
(b) Engine failure during Go-Around: Disengage Autopilot, retrim aircraft, perform normal aircraft engine out procedures then re-engage Autopilot.
(c) Engine failure during normal climb, cruise, descent: Retrim aircraft, perform normal aircraft engine out procedures.
(d) Maintain aircraft yaw trim throughout all single engine operations.

(5) 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° of bank and 420 foot altitude loss.
(b) Altitude loss - high altitude descent - 3 second delay in recovery could result in a 35° bank and a 600 foot altitude loss.
(c) An Autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 20° of bank and a 100 foot altitude loss. Maximum altitude loss measured in approach configuration gear down and operating either coupled or uncoupled, single or multi-engine.

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

NSD 306A
(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 below.
6. Reset heading card while checking slaving meter. If proper slaving indication is not obtained,
7. Switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE

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

3. PERFORMANCE
No change

INTRODUCTION

The Edo-Aire Mitchell Century III is a lightweight (18 lbs.) automatic flight system utilizing an advanced electronic design for maximum performance and utility. Operating on the versatile and adaptable 5000 cycle audio frequency, the Edo-Aire Mitchell Century III represents a new design concept in which the conventional follow up, or control position feed back signals, are replaced by solid state analytical computers. In addition to providing a more stable and adaptable autopilot platform for advanced navigational coupling, this new system can cope with uneven fuel loads, directional mistrim and power changes without the usual directional errors, altitude losses, or command change requirements.

Roll and pitch responses are time controlled for human-like control action and smooth attitude transitions.

This manual describes the basic characteristics of each control function and its relationship to other functions in the flight system. Maximum utility will be realized after familiarization and practice.

CONTENTS

INTRODUCTION	1
COMMAND CONSOLE	3
Roll (Aileron) Engagement	3
Roll Command Knob	4
Heading Mode	4
Course Selector	5
Aircraft Trim Effects	5
Trim Indicator and Pitch Command Wheel	6
Pitch (Elevator) Engagement	7
Altitude Hold	7
AUTOMATIC TRIM OPERATIONS	8
GENERAL OPERATIONS	8
Pilots Preflight Procedure	9
Trim Check	10
	10
AIR FILTER	11
Mitchell Filter and Elements	11
LATERAL GUIDANCE SYSTEM	12
Modes	13
Lateral Guidance System Operation	15
VOR Navigation	16
VOR Approach	18
ILS Approach - Normal	20
ILS Approach - Back Course	22
INTERCEPT CHARACTERISTICS	24
LOCALIZER AND/OR GLIDE SLOPE COUPLER	26
EDO-AIRE MITCHELL AUTOPILOT WARRANTY	30

COMMAND CONSOLE

The Century III console is designed to provide convenient fingertip command of all basic autopilot functions. Magnetic engage and mode switches are designed with logical interlocking features for operational ease and simplicity. The lucite face panel incorporates optically engineered night lighting with provisions for dimming control through the standard aircraft rheostat.

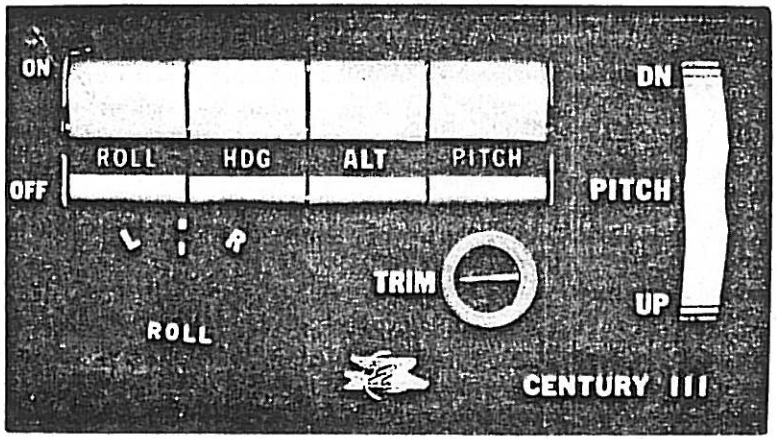


FIG. 1

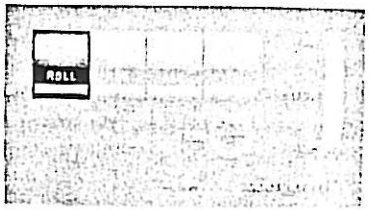


FIG. 2

ROLL (AILERON) ENGAGEMENT

The Century III is separated into two distinct systems, the Roll/Heading and Pitch/Altitude. Each is engaged separately by means of a fail safe electric servo engage mechanism.

Because the roll is first in logical sequence, the roll engage acts as an autopilot master switch. In this capacity the roll must be engaged for all other engage and mode switches to become operative. With this roll switch only engaged, the autopilot is responsive only to the roll axis of the attitude gyro and the commands of the console roll/turn control.

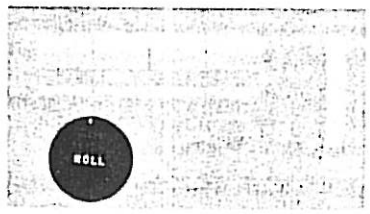


FIG. 3

ROLL COMMAND KNOB

The roll command knob controls the roll axis of the aircraft when roll mode switch is engaged. It is useful in manuevering and will permit steeper bank angles (up to 30°) than those resulting from D.G. heading commands. When the heading mode switch is engaged the roll knob is removed from the autopilot circuit and is ineffective. However, it should be left in the centered position for convenience.

NOTE: Do not use roll mode during approach configuration on twin engine aircraft as engine failure will result in excessive heading deviation.

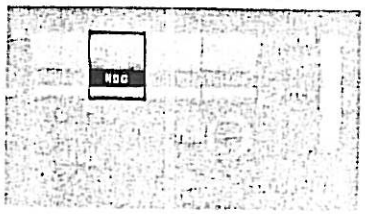


FIG. 4

HEADING MODE

The heading mode switch is located directly adjacent and to the right of the roll engage switch. It is the function of the heading mode switch to remove the roll command knob from the autopilot circuit and add the D.G. heading command and coupler functions to the basic roll attitude control. This switch is interlocked with the roll engage so that the roll function will be engaged simultaneously with the heading mode switch. Prior to engagement of the heading mode, the D.G. course selector and coupler modes should be set. (See sections on coupler operation when optional coupler is installed.)



FIG. 5

COURSE SELECTOR D.G.

The course selector D.G. replaces the standard directional gyro and provides a fully visible course indicator around the normal D.G. opening. The D.G. dial is marked in 5° intervals and numbered each 30° around its azimuth. A center indice is provided at the top to align selected headings. Additional indices are located each 45° to facilitate rapid turn selection without mental arithmetic. Any heading may be selected, either before or after engagement, and turns up to 180° may be programmed directly, either right or left. If the course indicator is rotated beyond 180° from the D.G. card heading, the course selector will command a reversal in bank to reach the resultant selected heading in the shortest direction.

The D.G. card is normally set to the magnetic compass with the caging knob on the left in the usual fashion, while the course selector indicator is rotated by the heading knob on the right. Direction of rotation of both the knob and indicator commands the same direction of turn.

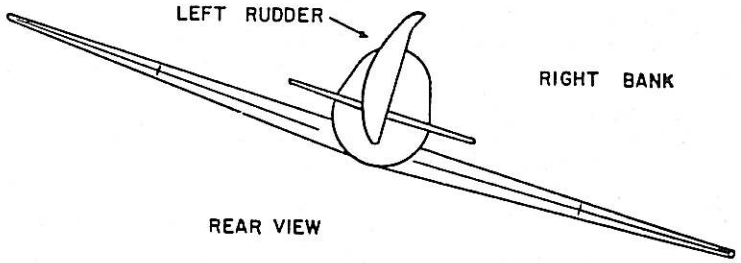


FIG. 6

AIRCRAFT TRIM EFFECTS

An important axiom to remember is that if the airplane is properly *trimmed*, an Edo-Aire Mitchell autopilot in heading mode will never fly the airplane with a wing down.

This statement can be changed slightly to apply to an airplane without an autopilot: In order to fly a *trimmed* airplane on a constant heading, the wings must be held level.

Consider the effect of rudder trim in the above drawing (Fig. 6). Viewing the airplane from the rear, note that with left rudder applied the right wing must be lowered to offset the rudder effect and keep the heading constant, i.e. the left turn effect of the rudder is cancelled by the right turn effect of the bank.

Since the Century III is slaved to heading, this is exactly what it will do in order to hold a heading when the rudder is out of trim.

Thus when operating on autopilot heading mode the pilot knows rudder trim in the direction toward the low wing is required.

TRIM INDICATOR AND PITCH COMMAND WHEEL



FIG. 7

Prior to engagement of the pitch axis, it is desirable to adjust the autopilot pitch to match the attitude being flown. In this way the pilot can transition from hand flight to autopilot smoothly during the climbout or other pitch maneuvering. The pitch servo effort meter (trim) to the left of the pitch control wheel indicates the position of the pitch command wheel with relation to the attitude being flown. Thus, if it is pointing upward prior to engagement it indicates that the aircraft can be expected to increase pitch attitude upon engagement, conversely a down meter indicates pitch attitude will be decreased upon engagement.

The pitch command wheel is in the autopilot circuit when the pitch mode switch only is engaged. It is removed from the circuit and becomes ineffective upon engagement of the altitude hold. During altitude hold operation it may be set to level or preprogrammed to produce climb or descent upon altitude hold disengagement.

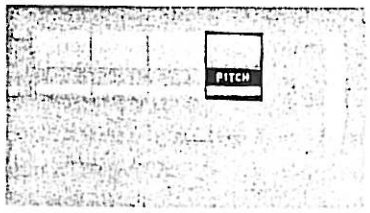


FIG. 8

PITCH (ELEVATOR) ENGAGEMENT

The pitch mode switch engages the autopilot pitch servo and makes the autopilot responsive to the pitch attitude of the gyro horizon and the commands of the pitch control wheel. Constant attitudes may be directed by rotating the command wheel in the appropriate direction. The computor system in combination with the automatic trim will maintain this constant attitude through power changes and during gear and flap position transitions. On aircraft not equipped with Edo-Aire Mitchell automatic trim, it will be necessary to disengage the pitch and manually trim the airplane during attitude, airspeed, or gear flap transitions. (See section on automatic trim.)

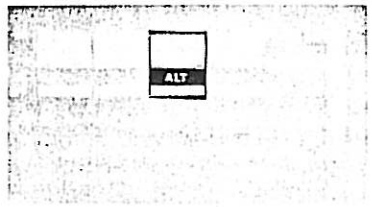


FIG. 9

ALTITUDE HOLD

The altitude hold is a "command" type which requires no pitch command adjustment prior to engagement. Engagement of the altitude mode switch will remove the pitch command wheel from the circuit and initiate a smooth transition to the pressure altitude at which it was engaged. Barometric sensors provide precise altitude holding with nominal climb and dive limitations for operation in turbulence.

AUTOMATIC TRIM OPERATIONS

Three different versions of Edo-Aire Mitchell Automatic Pitch Trim Systems are used with Century III Autopilots.

	AUTOPILOT PITCH ON	AUTOPILOT OFF
Normal	Automatic	Push Button
Dual Contact	Automatic	Push Button
Toggle	Automatic	Toggle Switch

The type used is based on the characteristics of the aircraft and FAA approval.

Trim operation with all three types is identical when the Autopilot Pitch is engaged. The Trim System operates on a full time basis and will automatically correct aircraft trim for airspeed changes that are called for by the Autopilot Pitch Command, Altitude Hold or power changes.

Push Button Automatic Trim operates when the autopilot is OFF. The pilot may press the wheel mounted push button any time he wishes to automatically relieve control forces. This will be particularly helpful during approaches when speed is being reduced and to make trim changes caused by lowering of flaps or gear.

Toggle Switch Trim operates when the autopilot is OFF. The pilot may press the wheel switch to cause electric trim action in the desired direction to relieve control wheel forces.

The pilot can override the trim system at any time by manual operation of the aircraft trim control. In addition, the circuit breaker switch labeled "Trim" on the instrument panel may be pulled to disconnect the trim from the aircraft electrical system.

GENERAL OPERATIONS

The Century III coupler and automatic trim systems are FAA approved on each make and model aircraft under a "Supplemental Type Certificate" (STC).

There are no restrictions to operations in turbulence and, as a general rule, autopilot operation in turbulence will result in lower "G" forces being imposed on the structure.

Autopilot and automatic trim operating airspeed limitations (if any) will be specified on the operation placard or in the flight manual supplement.

The Century III servo mechanisms are designed with a fail safe electric engage and disengage features. The autopilot may also be overriden by the pilot without damage to the system. Override forces are adjusted to the servo power output requirements of particular aircraft.

NOTE: Only Edo-Aire Mitchell trained specialists at approved service centers should adjust servo torque outputs.

PILOTS PREFLIGHT PROCEDURE

1. With engines running and gyros erected, check vacuum gage readings. Should be 4.75" to 5.00" Hg.
2. With all mode switches off, place coupler on HDG position (if applicable) and center roll and pitch commands and D.G. course selector indicator.
3. Engage roll mode master switch, rotate roll knob left and right and note that wheel responds in each direction.

NOTE: Without the aerodynamic response of flight in the computor circuit the aileron travel will continue to stops witl. command off center.

4. Engage "HDG" mode switch and rotate course selector indicator to either side, note roll servo response; again, without aerodynamic response, servo action is not limited.
5. While engaged, override the roll in both directions. Force required should be 10-15 lbs. at wheel edge dependent on aircraft model.
6. Center D.G. course selector so as to stop roll servo action while checking pitch.
7. Adjust pitch command knob so as to center "Trim" indicator.
8. Engage pitch mode switch and rotate pitch command knob in each direction. Observe pitch control action in each direction.

NOTE: Without the aerodynamic response of flight, pitch action is not limited in ground operation.

NOTE: If aircraft has heavy controls due to loading springs or bob weights, it may be necessary to assist the pitch control motion as servo input power may be limited to match inflight responses and override requirements.

NOTE: If autopilot ground check is prolonged, automatic trim may run to up or down limit. In such cases it may be desirable to temporarily pull the trim circuit breaker switch.

9. Check pitch override in each direction. Override forces will vary considerably with aircraft and direction of motion due to elevator spring and bob weight effect and the servo force adjustment.

TRIM CHECK

(Autopilot)

10. The automatic trim is activated by engagement of autopilot pitch mode switch. On systems equipped with Edo-Aire Mitchell automatic pitch trim, note that trim action follows control *force*, (not motion) in ground check.

(Manual Push Button)

11. With all autopilot controls off, depress automatic trim button on control wheel. Apply forward and aft load on control wheel and note that trim wheel or handle follows.

11a. (Manual Toggle Switch)

With all autopilot controls OFF, press Toggle Switch in both directions and note that Trim Wheel or handle runs in correct direction.

NOTE: Aircraft equipped with dual contact trim system require a special pre-flight check — consult airplane flight manual supplement or placards for these procedures.

NOTE: On aircraft equipped with springs and/or bob weights it may not be possible to apply a down loading on the elevator system.

12. Check pilot's trim control override in each direction.

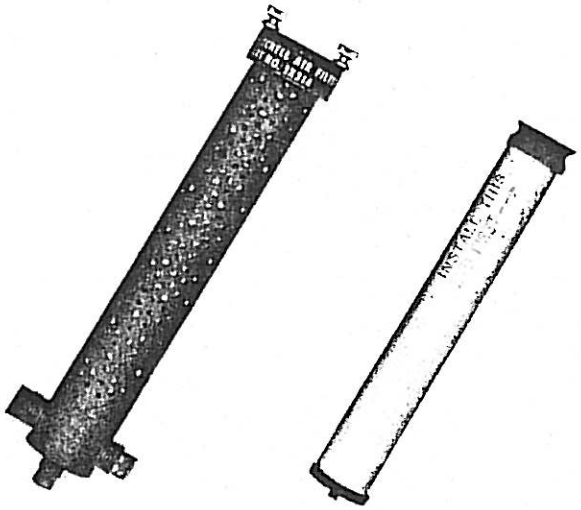
13. Be sure all autopilot controls are off, that trim circuit breaker is reset, and that elevator trim is set prior to takeoff.

AUTOPILOT ENGAGE SEQUENCE (IN FLIGHT)

1. Trim aircraft to desired flight attitude.
2. Center roll knob and engage "Roll" mode switch.
3. Center D.G. course selector indicator and engage "HDG" mode switch.
4. Center "Trim" indicator with pitch command wheel and engage "Pitch" mode switch.
5. Engage "Alt" mode switch at desired altitude.

NOTE: When system is not equipped with Edo-Aire Mitchell automatic pitch trim, it will be necessary to disengage pitch mode and manually adjust aircraft pitch trim for attitude and airspeed changes.

AIR FILTER



AIR FILTER AND ELEMENT

The 1X314 central air filter is incorporated on all 3" gyro systems with the exception of aircraft with original equipment filters of like quality.

The 1X314 filter system uses the 51A5 replaceable filter element which is capable of removing 97% of all contaminating substances above .3 microns. This includes tobacco tars that would otherwise be harmful to bearings and vanes. Because of this exceptional filtering ability, contaminants tend to accumulate at a higher rate than in other types. It is therefore considered necessary that filter elements be replaced at each 100 hour period and that filters subjected to tobacco tars, industrial smoke and like environment, be inspected each 50 hours for possible replacement.

Gyro warranty is dependent upon following this procedure.

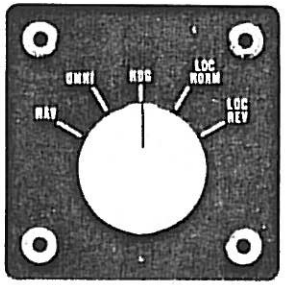


FIGURE 15

LATERAL GUIDANCE SYSTEM

The Edo-Aire Mitchell Lateral Guidance System contains a completely automatic, analog computer that directs the autopilot in both VOR and ILS navigation. The system contains a five position mode selector switch which mounts in the instrument panel. Track interception angles are 45° and an automatic 15° crosswind correction capability is provided. The complete capture, intercept and tracking sequence is accomplished automatically without monitoring or multiple switching.

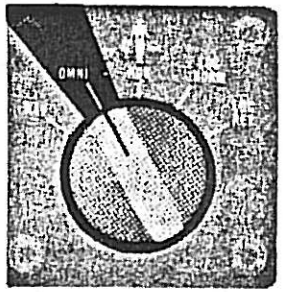


Figure 16

OMNI MODE

When in the OMNI MODE position, the system is coupled to the Radio Omni Bearing Indicator. By setting the D.G. Course Indicator to match the Omni Course selection, all headings are then controlled by the Omni radio signals. A full deflection on the Omni Indicator (10° or more off selected radial) will produce a 45° interception angle. Inside the 10° area, the system will automatically compute the location and closure rate to direct a smooth, tangential intercept without overshoot and arrive over the radial with crosswind correction established. The same dynamic intercept is accomplished whether 2 miles or maximum reception distance from station. Below 2 miles, the aircraft bank limitations will alow a slight overshoot when making maximum angle interception.



Figure 16A

NAV MODE

The NAV Mode is designed to extend the coupler utility by making operation practical under the adverse conditions of unsteady or eratic VOR Signals. Several factors such as terrain, distance, bent courses, etc., produce short term needle deflections which can cause excessive roll motion when in the OMNI Mode. The NAV Mode incorporates an extended time delay in the computor circuit which reduces reaction to these short term needle deflections. Close in OMNI approach work requires the proportioned dynamic response as provided in the OMNI Mode. Therefore the NAV Mode should not be used for close in work.

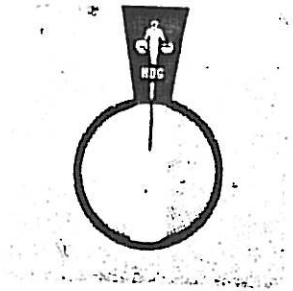


Figure 17

HEADING MODE

When in the HDG. mode the Century III Autopilot will function in the same manner as described in section I of this manual.



Figure 18

LOCALIZER (Normal) MODE

In the LOC NORM mode, the system automatically adjusts its sensitivity to accommodate the 2½° full needle signal instead of the 10° as found in Omni navigation. As the Localizer beam which is only ¼ as wide as the Omni, additional damping circuits are also switched in to produce the same smooth intercept track as described for the Omni. Intercept angles of 45° are still automatic with full signal deflection and tangential intercepts with automatic crosswind correction are accomplished beyond the Outer Marker. As with the Omni mode, the Course Selector D.G. must be set to correspond with the desired magnetic track.



Figure 19

LOCALIZER (Reverse) MODE

All Edo-Aire Mitchell Lateral Guidance Systems are equipped with the Localizer Reverse feature to permit automatic back-course approaches and to track outbound on the Front Course prior to procedure turn. The features of LOC-REV are identical to the LOC-NORM except that the aircraft will fly away from the Localizer Indicator needle instead of toward. When using the LOC-REV mode, the Course Selector D.G. is set to the reciprocal of the Front-Course heading.

LATERAL GUIDANCE SYSTEM OPERATION

A. Establish aircraft in normal flight with autopilot as outlined in first part of manual.

B. With Guidance Mode Selector in HDG position, engage the HDG Mode Switch on autopilot console.

C. Lateral control is now directed by the "Lateral Guidance" Mode Selector.

D. Set D.G. Card to the magnetic compass in normal manner.

NOTE

Some navigation receivers are designed in same package as the associated transmitter in such a manner that the visual navigation signal is temporarily interrupted when transmitting.

CAUTION

The NSD has an optional slaving feature that requires initial heading setting on start-up. Subsequent resetting of the heading card, required manually on non-slaved versions, is automatically accomplished with the slaved version.

Proper heading synchronization must be verified on both non-slaved and slaved NSD-360A units. This is accomplished by comparing the heading displayed under the lubber line with the magnetic compass.

The NSD-360A incorporates a heading warning flag to warn of loss of either air or electric power. Appearance of the flag during flight should be sufficient grounds to question the validity of the displayed heading. In slaved versions, the slaving meter should oscillate about a 45° point to show that the slaving circuits are accomplishing their function. Should the needle remain motionless or either vertical or horizontal for an extended period (two minutes) in level flight, the heading should be manually set using the magnetic compass and the performance of the heading card observed. If this condition persists, set the slaving mode switch to SL#2 on free gyro. In free gyro mode, the instrument must be periodically reset to manually counteract the effects of gyro precession.

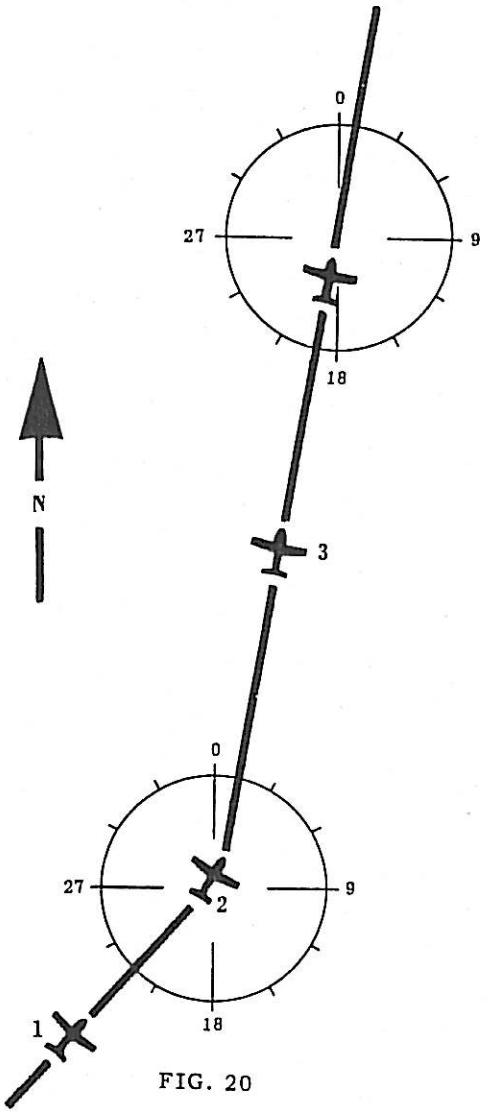


FIG. 20

VOR NAVIGATION (See Fig. 20)

1. TO INTERCEPT
   - A. Using Omni Bearing Selector, dial desired course, inbound or outbound.
   - B. Set identical heading on Course Selector D.G.
   - C. After aircraft has stabilized, position coupler mode selector knob to OMNI mode.

NOTE

If less than 45° from selected radial, aircraft will intercept before station. If more than 45°, interception will occur after station passage.

   - D. As aircraft nears selected radial, interception and crosswind correction will be automatically accomplished without further switching.
   - E. As the aircraft nears the OMNI station, (½ mile) the zone of confusion will direct an "S" turn in alternate directions as the OMNI indicator needle swings. This alternate banking, limited to the standard D.G. bank angle, is an indication of station passage.

2. TO SELECT NEW COURSE
   - A. To select any different outbound course or radial, including reciprocal of the previous inbound radial, dial the new course into the Course Selector D.G.
   - B. Rotate OBS to the new course.
   - C. Aircraft will automatically turn, in the shortest direction to the interception heading for the new course.

3. TO CHANGE STATIONS
   - A. If same course is desired, merely tune receiver to new station frequency.
   - B. If different course is desired, position coupler mode selector to HDG Mode.
   - C. Dial Course Selector D.G. to new course.
   - D. Dial OBS to new course.
   - E. Position mode selector to OMNI mode.

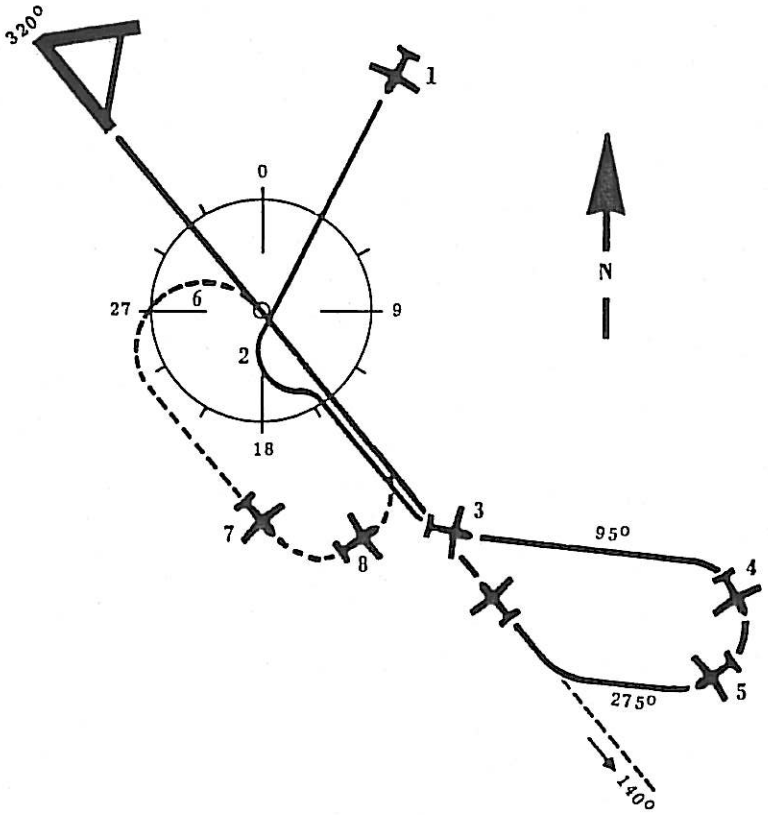


FIG. 21

VOR APPROACH (See Fig. 21)

1. Track inbound to station as described in VOR Navigation section.

2. After station passage (when "S" turn starts) dial outbound course on Course Selector D.G. then dial same course on OBS.

3. After established on outbound radial, position mode selector to HDG mode and select outbound procedure turn heading.

4. After one minute, dial inbound procedure turn heading on Course Selector D.G. dialing toward desired turn. Set OBS to inbound course.

5. When 90° to inbound course, dial Course Selector D.G. to inbound course and position mode selector to OMNI mode.

6. If holding pattern is desired, position mode selector on HDG mode at station passage inbound and select outbound heading in direction of turn.

7. After elapsed time, dial inbound course on Course Selector D.G.

8. When 90° to radial, position mode selector on OMNI mode.

NOTE

For precise tracking over Omni Station, without "S" turn. position mode selector on HDG. Until station passage.

ILS APPROACH—NORMAL

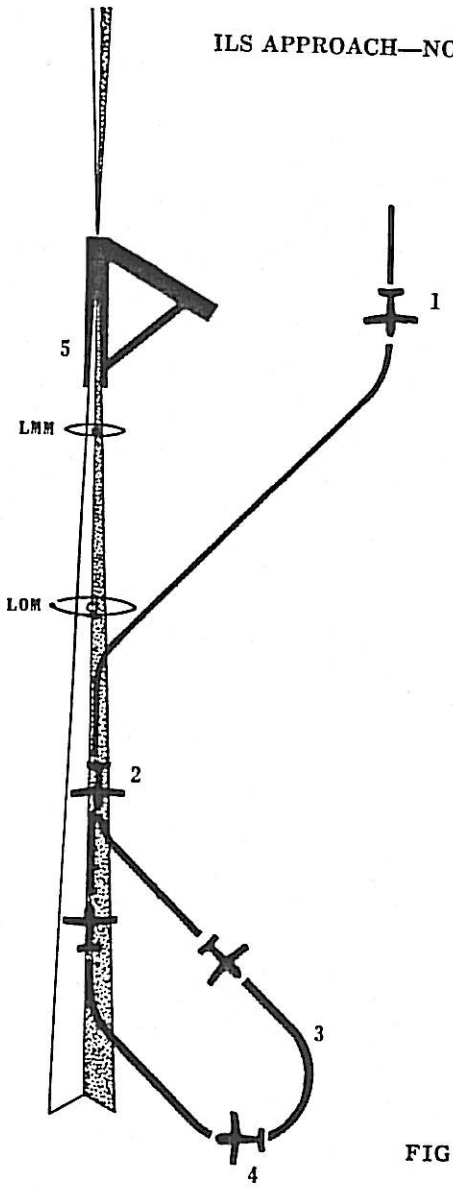


FIG. 22

ILS APPROACH—NORMAL (See Fig. 22)

1. To Intercept
   A. Dial ILS outbound course on Course Selector D.G.
   B. When stabilized; position mode selector to LOC REV mode.
2. After interception and when beyond outer marker, position mode selector to HDG and dial outbound procedure turn heading.
3. After one minute, dial inbound procedure turn heading in direction of turn.
4. When between 90 degrees and 45 degrees to ILS inbound course, dial inbound course on Course Selector D.G. and position mode selector to LOC NORM mode.
5. When beyond midpoint of runway, or when missed approach is elected, position mode selector to HDG mode and execute missed approach procedure.

ILS APPROACH-BACK COURSE

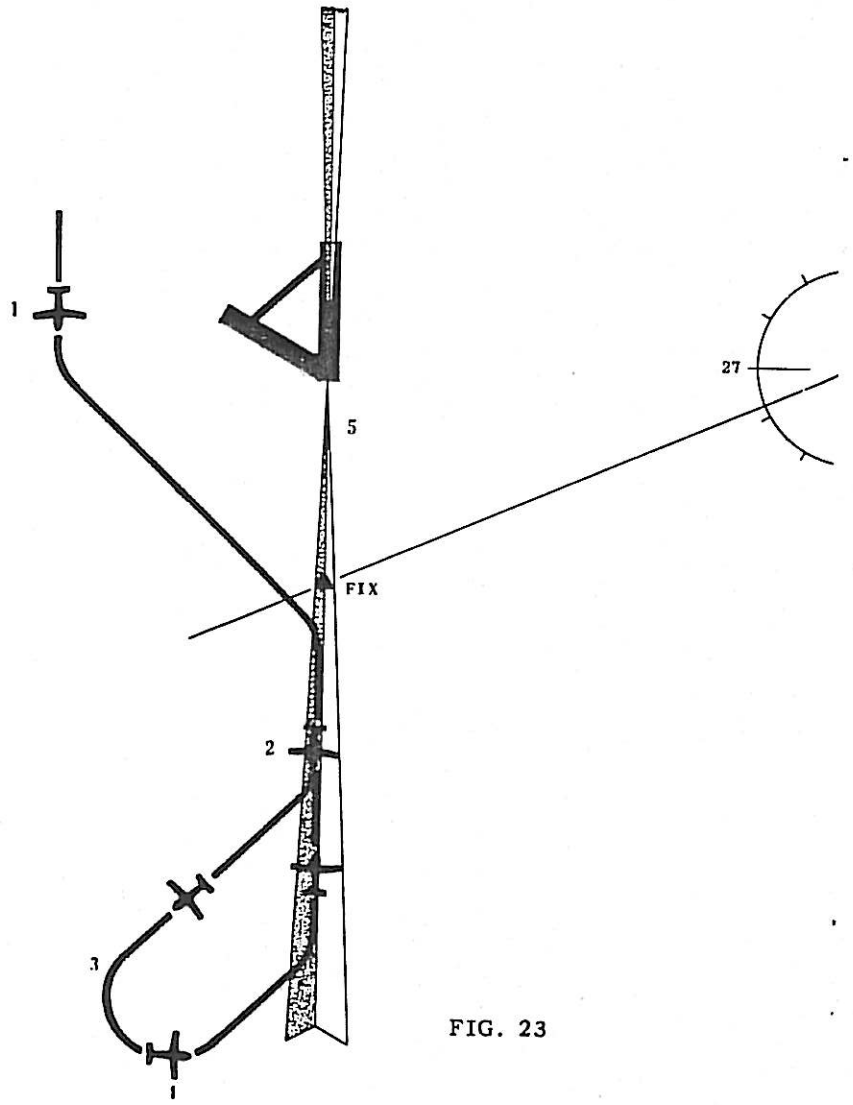


FIG. 23

ILS APPROACH-BACK COURSE (See Fig. 23)

1. To Intercept
   A. Dial ILS Back Course outbound heading on Course Selector D.G.
   B. When stabilized, position mode selector to LOC NORM mode.
2. After interception and when beyond fix, position mode selector to HDG and dial outbound procedure turn heading.
3. After one minute, dial inbound procedure turn heading in direction of turn.
4. When between 90 degrees and 45 degrees to inbound course, dial inbound course on Course Selector D.G. and position mode selector on LOC REV mode.
5. Approximately ½ mile from runway, position mode selector to HDG mode to prevent "S" turn over ILS station near runway threshold.

INTERCEPT CHARACTERISTICS

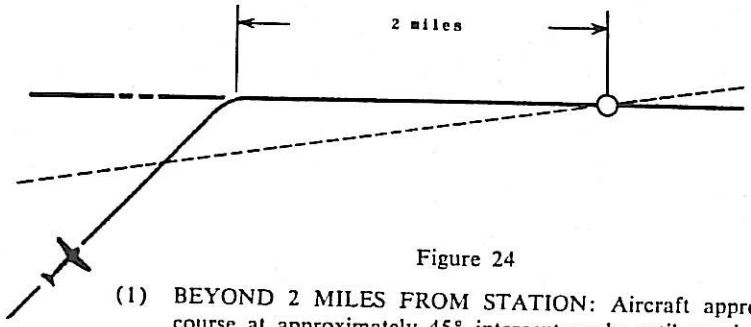


Figure 24

(1) BEYOND 2 MILES FROM STATION: Aircraft approaches course at approximately 45° intercept angle until omni needle deflection is 50% of full scale, then turns to required heading (cross wind corrected for) with no overshoot of course.

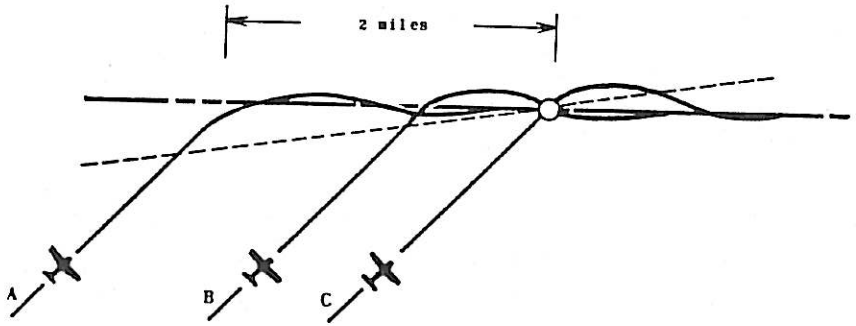


Figure 25

(2) CLOSE IN INTERCEPT: With a given intercept angle established the time required to pass through the active region near the desired radial (-50% full needle deflection) is proportional to the distance from the station. For this reason overshoot occurs when close in intercepts are made. (This is true of all systems, since the turning rate or bank angle must be limited). The three paths show what might be expected as the intercept distance is made nearer and then finally at the station. It will be noted that if the intercept heading takes the aircraft very near to the station, no maneuvering would occur until the aircraft has passed the station.

(3) INTERCEPT BEYOND THE STATION: Behavior beyond the station is similar to that explained in paragraph 2 in that as the intercept distance is made larger, the tendency for overshoot is reduced.

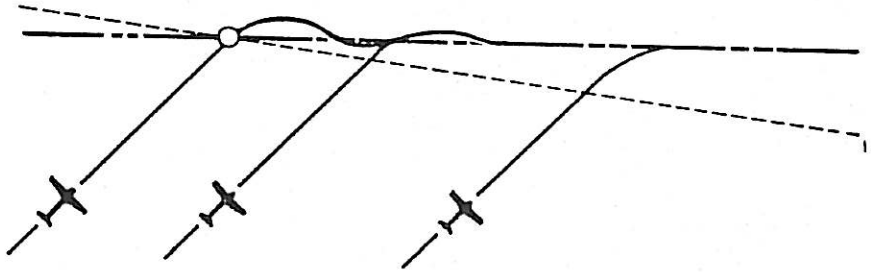


Figure 26

(4) CROSS WIND EFFECTS: Crosswind effects which might be expected are illustrated in the three plots below. Curve A is the no wind condition and performance will be as per sections (1) thru (3). Curve B shows the effect of approaching the desired course. Because this rate is reduced by the wind, the tendency to overshoot is likewise reduced. Curve C shows the effect of a wind which tends to increase the rate at which the aircraft approaches the course. As would be expected, this will tend to cause an overshot.

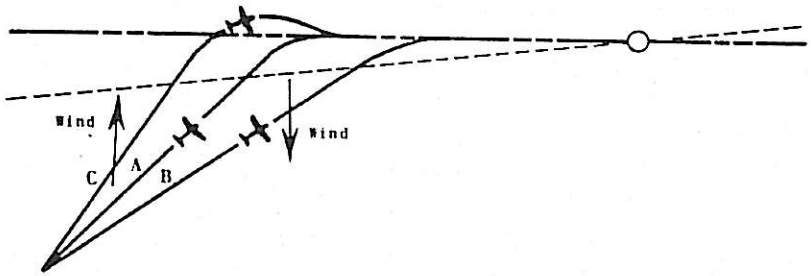


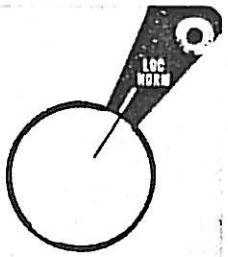
Figure 27

LOCALIZER AND/OR GLIDE SLOPE COUPLER

OPERATING INSTRUCTIONS

SYSTEM DESCRIPTION

The Edo-Aire Mitchell Glide Slope Coupler is a completely automatic analog computer that directs the Autopilot to intercept and track the approach glide path. The system automatically provides for variances in glide path angle, wind direction and various approach configurations of the aircraft. A self contained Logic Circuit provides for certain necessary conditions to be prevalent before automatic Glide Slope coupling will occur. These conditions are explained in the following sections.



LOCALIZER (Normal) MODE

The Radio Coupler Mode Selector must be in the LOC NORM mode for at least 20 seconds before the Logic Circuit of the Glide Slope Coupler is armed. This provides safety against inadvertent coupling when flying reverse course or tracking outbound on the front course. After coupling, the Glide Slope may be de-coupled by the momentary switching of the mode selector from LOC-NORM position.

NOTE: In order to use Localizer as a navigation aid where glide slope coupling is not desired, do not use the LOC NORM mode. The Lateral Guidance System will fly the Localizer beam in the OMNI mode once your position on the beam is established.



ALTITUDE MODE

The Altitude switch must also be depressed in the ALT position for at least 20 seconds before the logic circuit of the Glide Slope Coupler is armed. This condition provides for Glide Slope Coupling from all normal procedures but prevents attempting coupling from a high rate descent. After coupling, the Glide Slope may be de-coupled by momentarily switching "OFF" the ALT button.

GLIDE SLOPE DEVIATION INDICATOR

The Glide Slope Deviation Indicator must be deflected upward for at least 20 seconds before the logic circuit of the Glide Slope Coupler is armed. This provides assurance that the Glide path will be intercepted from below in the normal manner and prevents inadvertent coupling from above. A 60% full scale deflection for 20 seconds will always accomplish arming.

NOTE: **Once coupled, the deviations Indicator will not de-couple the Glide Slope regardless of needle deflection. The Deviation Indicator however must be monitored during approach to determine the aircraft's true position relative to the localizer beam and the glide path.**

INDICATOR LIGHT

The Glide Slope Coupler incorporates a panel mounted green indicator light. This light will turn ON at the same time automatic switching takes place to couple the Autopilot to the glide path. This light will stay lit until such time as the unit is de-coupled. As this light *only* shows that the Glide Slope Coupler is switched into the Autopilot and not actual position relative to glide path. The deviation indicator must be monitored during the approach.

ILS APPROACH PROCEDURES
GLIDE SLOPE APPROACH (Typical)

1. To intercept ILS
   A. Dial ILS outbound course on course selector D.G.
   B. Position Radio Coupler mode switch to LOC REV mode.
   C. Altitude Hold or Pitch Mode, for Altitude Control.
2. After intercept and at appropriate time, descent to approach altitude.
3. Press ALT Hold switch on console at published approach altitude. Dial procedure turn outbound heading on D.G. and position mode selector to HDG.
4. After one minute, dial the published in bound procedure turn heading moving D.G. course selector in direction of turn. When between 90 and 45 degrees to the inbound heading, dial inbound course on Course Selector D.G. and position mode selector to LOC NORM mode. NOTE: For optimum results, switch to localizer normal at 45°. At this point the airplane will automatically intercept and track the localizer beam, you should be at the proper altitude and on ALT Hold and the glide slope deviation needle should be up. If the above conditions are met for 20 seconds or more, the Glide Slope Coupler logic circuit will be armed. Adjust power for the gear down or normal approach speed.
5. Upon interception of glide path (when deviation needle drops to center) the Glide Slope Coupler will automatically engage, the indicator light will come on, and the aircraft will assume a preset nose-down attitude for descent. Drop gear and re-adjust power as necessary to maintain approach speed. Position flaps not to exceed 15° for approach at this time. Do not change gear or flap setting after initial glide slope intercept for remainder of glide slope coupler operation. Power and airspeed changes must be made carefully to prevent excessive attitude changes.

   NOTE: Monitor deviation indicators for actual position on Localizer and glide path. Transmissions may cause deviation needle to fluctuate on some radio installations. On such installations, the coupler will attempt to follow these deviations.

   (A) Upon completion of Glide Slope Coupler approach, or when VFR, disconnect Autopilot and adjust aircraft for landing configuration.

   (B) For missed approach procedure, set Pitch Command to Climb Attitude. Switch Coupler to HDG mode and apply climb power, gear and flap up, disengage Altitude Hold and set Autopilot to missed approach HDG.
6. To de-couple any one of the following methods may be used:
   A. Switch ALT Hold OFF. This will de-couple Glide Slope and revert pitch control to the "Pitch Command Knob," which may be pre-set to desired climb attitude.
   B. Switch ALT Hold OFF then ON. This will de-couple Glide Slope and return to altitude hold.
   C. Switch Radio Coupler OFF, LOC-NORM mode. This will de-couple Glide Slope and return pitch control to ALT Hold.
   D. Disconnect entire autopilot and hand fly aircraft.

CAUTION:

Do not fly airplane on Autopilot below height above ground specified on placard (or flight manual supplement) for "ALT" loss, approach configuration, with 1 second delay recovery."

Emergency Operation

(1) In the event of a malfunction in the ROLL or PITCH SECTION, push the ROLL ON/OFF button "OFF" This disengages both ROLL and PITCH SECTIONS of the Century III from the control system.

(2) The PITCH TRIM SECTION may be overpowered manually. In the event of a malfunction in the PITCH—TRIM SECTION, pull the Pitch Trim circuit breaker.

(3) The Century III ROLL SECTION may be overpowered manually on either control wheel. The Century III PITCH SECTION may be overpowered manually on either control wheel.

(4) Engine Failure (Multi-engine Airplanes)

   (a) When on ROLL and PITCH mode only, any one of the following applies during engine failure.

      1. Disengage Autopilot and trim aircraft.
      2. Level wings with roll knob, and handle emergency.
      3. Switch to HDG. mode, (Course Selected) see (b).

   (b) Autopilot on HDG. or coupled: Autopilot will compensate for yaw caused by engine power loss by banking toward the operating engine. Perform normal Engine Out Emergency Procedures and re-trim aircraft.

(5) Single Engine Operation

Operate aircraft in accordance with manufacturer's instruction for single engine. Do Not permit airspeed to drop below Single Engine Best Rule of Climb speed.

CAUTION

When electrical power is first applied to the NSD-360A instrument, the compass card may rotate or "slew" rapidly. This is NOT an indication that the compass system is orienting itself to the proper magnetic heading. The proper heading orientation must be verified and set prior to takeoff and should be verified prior to approach to landing using the magnetic compass.