Fifty Five X

Cirrus SR20/22 Aircraft
with
Cirrus Perspective Avionics

Pilot's Operating Handbook

List of Effective Pages	* Asterisk indicates pages changed, added, or deleted by current revision.

Page No. **Issue**

Record of Revisions	Retain this record in front of handbook. Upon receipt of a revision, insert changes and complete table below.	
Revision Number	**Revision Date**	**Insertion Date/Initials**
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OVERVIEW

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1.1 Document Organization

Section 1 Overview

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1.2 Purpose

This Pilot's Operating Handbook (POH) provides Pre-Flight and In-Flight operating procedures for the S-TEC System Fifty Five X Autopilot (AP), installed in the Cirrus SR20/22 aircraft (A/C), and integrated with the Cirrus Perspective by Garmin Avionics.

Note:

This POH must be carried in the A/C and made available to the pilot at all times. It can only be used in conjunction with the Federal Aviation Administration (FAA) approved Aircraft Flight Manual (AFM) or Aircraft Flight Manual Supplement (AFMS). Refer to the applicable AFM or AFMS for A/C specific information, such as unique ground tests, limitations, and emergency procedures.

Note:

The System Fifty Five X autopilot is a tool provided to Cirrus SR20/22 aircraft owners, that serves to assist them with cockpit workload management. The ability of the autopilot to provide optimum assistance and performance is directly proportional to the pilot's knowledge of its operating procedures. Therefore, it is highly recommended that the pilot develop a thorough understanding of the autopilot, its modes, and operating procedures in Visual Meteorological Conditions (VMC), prior to using it under Instrument Flight Rules (IFR).

1.3 General Control Theory

The System Fifty Five X is a rate based autopilot. When in control of the roll axis, the autopilot senses turn rate, as well as closure rate to the selected course, along with the non-rate quantities of heading error, course error, and course deviation indication. When in control of the pitch axis, the autopilot senses vertical speed, acceleration, and closure rate to the selected glideslope, along with the non-rate quantities of altitude and glideslope deviation indication. These sensed data provide feedback to the autopilot, which processes them in order to control the aircraft through the use of mechanisms coupled to the control system. The roll trim cartridge is coupled to the ailerons. The pitch trim cartridge and pitch servo are coupled to the elevator. Activation of roll axis control must always precede activation of pitch axis control.

1.4 Modes of Operation

1.4.1 Roll Axis Control

Heading (HDG) Mode

Used to Turn onto a Selected Heading and Hold it

Navigation (NAV) Mode

Used to Intercept and Track a VOR Course

Navigation Approach (NAV APR) Mode

Used to Intercept and Track a LOC and VOR Front Course Inbound

Reverse (REV) Mode

Used to Intercept and Track the Reciprocal of a Specified VOR Course

Reverse Approach (REV APR) Mode

Used to Intercept and Track a LOC Back Course Inbound

Navigation Global Positioning System Steering (NAV GPSS) Mode

Used to Laterally Steer along a Course defined by GPS

1.4.2 Pitch Axis Control

Altitude Hold (ALT HOLD) Mode

Used to Hold Altitude

Vertical Speed (VS) Mode

Used to Hold Vertical Speed

Glideslope (GS) Mode

Used to Intercept and Track ILS Glideslope and GPS Glidepath

1.5 Block Diagram

The System Fifty Five X Block Diagram is shown in Fig. 1-1.

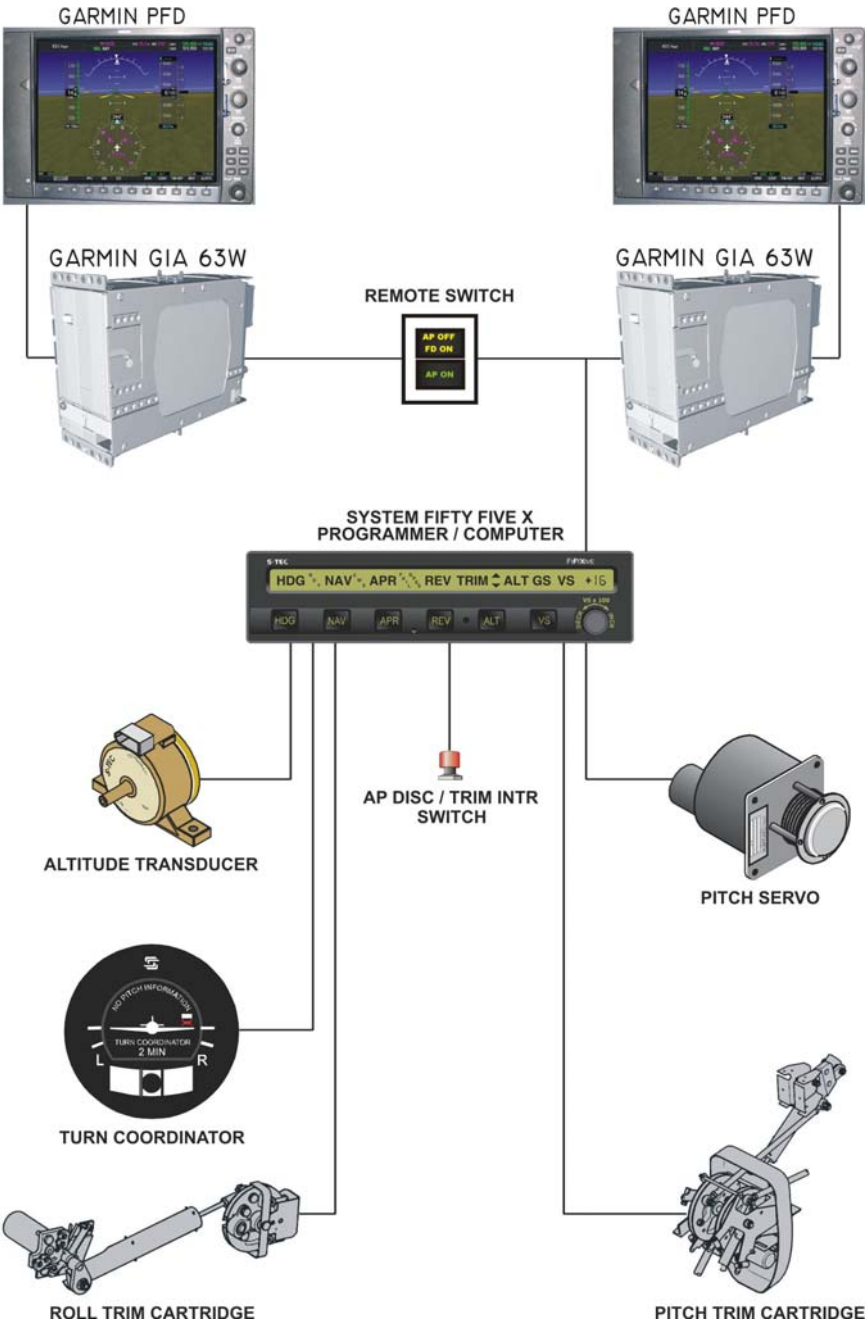

Fig. 1-1. System Fifty Five X Block Diagram

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SECTION 2
PRE-FLIGHT PROCEDURES

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2.1 Power-Up Test

Perform the actions shown in Table 2-1. For each action, verify the corresponding response where applicable.

Table 2-1. Power-Up Test

ACTION	RESPONSE
1. Set Battery Master Switch to ON position.	All annunciations appear on AP display as shown in Fig. 2-1, and then extinguish. Software revision number briefly appears on AP display as shown in Fig. 2-2, and then extinguishes. RDY annunciation alone re-appears on AP display within 3 minutes, as shown in Fig. 2-3 *(Notes 1, 2)*.

Notes:

1. Should a failure be detected, the FAIL annunciation alone will re-appear on the AP display as shown in Fig. 2-4, and the autopilot will not operate.

2. Should the rate gyro internal to the Turn Coordinator fail to reach sufficient speed, the AP display will remain blank indefinitely and the autopilot will not operate. This typically indicates that the Turn Coordinator needs repair.

Fig. 2-1. AP Display, Power-Up Annunciations

Fig. 2-2. AP Display, Software Revision Number

Fig. 2-3. AP Display, RDY Annunciation

Fig. 2-4. AP Display, FAIL Annunciation

2.2 Pre-Flight Test

Prior to takeoff and with engine running, perform the actions shown in Table 2-2. For each action, verify the corresponding response where applicable. All actions pertaining to mode selector switches apply to the autopilot, and not the PFD.

Table 2-2. Pre-Flight Test (continued on page 2-8)

ACTION	RESPONSE
1. Move A/C Control Sidestick left and right, to sense its freedom of movement about roll axis.	------
2. Set PFD HDG Bug under Lubber Line.	------
3. Press HDG mode selector switch to engage heading mode.	HDG annunciation alone appears on AP display, as shown in Fig. 2-5. HDG annunciation appears on PFD display, as shown in Fig. 2-6.
4. Attempt movement of A/C Control Sidestick left and right.	A/C Control Sidestick's reduced freedom of movement indicates that Roll Servo is engaged. Roll Servo can be overridden. If not, disconnect autopilot and do not use.
5. Turn PFD HDG Bug to the left side of Lubber Line.	A/C Control Sidestick moves to the left.
6. Turn PFD HDG Bug to the right side of Lubber Line.	A/C Control Sidestick moves to the right.
7. Set PFD HDG Bug under Lubber Line.	A/C Control Sidestick stops.
8. Move A/C Control Sidestick forward and aft, to sense its freedom of movement about pitch axis (A/C with Pitch Servo Only).	------

Fig. 2-5. AP Display, HDG Mode Engaged (Pre-Flight)

Fig. 2-6. PFD Display, HDG Mode Engaged (Pre-Flight)

Table 2-2. Pre-Flight Test (continued from page 2-5)

ACTION	RESPONSE
10. Press VS mode selector switch to engage vertical speed mode.	VS annunciation appears with HDG on AP display, as shown in Fig. 2-7. VS annunciation appears with HDG on PFD display, as shown in Fig. 2-8. FD Steering Command Bars appear on PFD display, as shown in Fig. 2-8.
11. Attempt movement of A/C Control Sidestick forward and aft (A/C with Pitch Servo Only).	A/C Control Sidestick's reduced freedom of movement indicates that Pitch Servo is engaged. Pitch Servo can be overridden. If not, disconnect autopilot and do not use.
12. Rotate Modifier Knob CW until +5 (500 FPM climbing) is commanded.	A/C Control Sidestick moves in aft direction.
13. Rotate Modifier Knob CCW until -5 (500 FPM descending) is commanded.	A/C Control Sidestick moves in forward direction.
14. Rotate Modifier Knob CW until +0 (0 FPM) is commanded.	A/C Control Sidestick stops.
15. Press AP DISC / TRIM INTR Switch, to disconnect autopilot. ***Note:*** ***Pressing and holding AP DISC / TRIM INTR Switch will limit audible alert to a single "beep".***	RDY annunciation flashes and audible alert sounds a periodic tone, while all other annunciations are extinguished. After 5 seconds, RDY annunciation stops flashing but remains, and audible alert is squelched. FD Steering Command Bars on PFD are extinguished.
16. Trim A/C for takeoff.	------

Fig. 2-7. AP Display, HDG and VS Modes Engaged (Pre-Flight)

Fig. 2-8. PFD Display, HDG and VS Modes Engaged (Pre-Flight)

SECTION 3
IN-FLIGHT PROCEDURES

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3.1 Normal Operating Procedures

3.1.1 Heading (HDG) Mode

Set the PFD HDG Bug to the desired heading on the compass card, and then press the HDG mode selector switch to engage the heading mode. The HDG annunciation will appear as shown in Fig. 3-1, to acknowledge that this mode is engaged. The autopilot will turn the aircraft onto the selected heading and hold it. A new heading can be subsequently selected by setting the PFD HDG Bug to it. A typical view of the PFD with the heading mode engaged is shown in Fig. 3-2.

Fig. 3-1. AP Display, HDG Mode Engaged

Fig. 3-2. PFD Display, HDG Mode Engaged

3.1.2 Navigation (NAV) Mode

Select the VOR frequency on the HSI Navigation Source. Set the PFD CRS Pointer to the desired course on the compass card, and then press the NAV mode selector switch to engage the navigation mode. The NAV annunciation will appear as shown in Fig. 3-3, to acknowledge that this mode is engaged.

If the Course Deviation Indication (CDI) is at full scale (100%) needle deflection from center, then the autopilot will establish the aircraft on a 45° intercept angle relative to the selected course. Even if CDI needle deflection is less than 100%, the autopilot may still establish an intercept angle of 45°, provided that the aircraft's closure rate to the selected course is sufficiently slow. Otherwise, the intercept angle will be less than 45°. A typical view of the PFD during this stage of the intercept sequence is shown in Fig. 3-4.

Fig. 3-3. AP Display, NAV Mode Engaged

Fig. 3-4. PFD Display, NAV Mode Engaged, A/C on 45° Intercept Angle

As the aircraft approaches the selected course, the autopilot senses the corresponding rate at which the CDI needle approaches center (closure rate), in order to initiate the aircraft's turn onto the course at the proper point, and thereby prevent overshoot. The point at which this turn begins is variable, being further from the course at faster closure rates, and closer to the course at slower closure rates. Although closure rate is principally a function of groundspeed, the distance of the aircraft from the VOR station also has an effect. Nevertheless, the turn will always begin between 100% and 20% CDI needle deflection. A typical view of the PFD during this stage of the intercept sequence is shown in Fig. 3-5.

During this stage of the intercept sequence, the autopilot operates at maximum gain and sensitivity to closure rate. In addition, it limits the aircraft's turn rate to 90% of a standard rate turn.

When the aircraft arrives at 15% CDI needle deflection, the course is captured. At that instant, a step reduction in autopilot gain occurs, so that the PFD CRS Pointer has sufficient authority to complete the intercept. In addition, the sensitivity to closure rate is reduced. The overall authority of the autopilot during this stage of the intercept sequence is called the HIGH GAIN condition.

Fifteen seconds after course capture, a second step reduction in autopilot gain occurs, to limit the aircraft's turn rate to 45% of a standard rate turn. In addition, the sensitivity to closure rate is reduced again. The overall authority of the autopilot during this stage of the intercept sequence is called the INTERMEDIATE GAIN condition.

Thirty seconds after course capture, the autopilot establishes the required crosswind correction angle.

Fig. 3-5. PFD Display, NAV Mode Engaged, A/C Turning onto Course

Seventy five seconds after course capture, a third step reduction in autopilot gain occurs to limit the aircraft's turn rate to 15% of a standard rate turn. In addition, the sensitivity to closure rate is reduced once more. This marks the end of the intercept sequence, and the beginning of tracking. The overall authority of the autopilot during tracking is called the LOW GAIN condition. A typical view of the PFD during tracking is shown in Fig. 3-6.

The pilot should make speed, distance, and time considerations during the 75 second period from course capture to the beginning of tracking, to account for the aircraft's position. For example at 115 kts, a distance of 2.4 nautical miles will be traveled in 75 seconds.

If it should happen that the PFD CRS Pointer is already within 5° of the selected course, and CDI needle deflection is less than 10%, then the autopilot will immediately establish the LOW GAIN condition upon engagement of the navigation mode.

While tracking in the LOW GAIN condition, the autopilot ignores short term CDI needle deflections (excursions), to thereby inhibit aircraft scalloping during VOR station passage. Should CDI needle deflection exceed 50% for a period of 60 seconds, the autopilot will revert to the INTERMEDIATE GAIN condition as a means to re-establish the aircraft on course.

The NAV annunciation will flash whenever the CDI needle deflection exceeds 50%, or the NAV Flag is in view. In the latter event, the FAIL annunciation will also appear.

While tracking in the LOW GAIN condition and within 50% CDI needle deflection, should it be desired to track in the higher authority INTERMEDIATE GAIN condition instead, press the APR mode selector switch to engage the navigation approach (NAV APR) mode. This is acknowledged as shown in Fig. 3-7.

While tracking in either the LOW GAIN or INTERMEDIATE GAIN condition, if a new course is selected that is different from the original course by 10° or more, then the autopilot will revert to the HIGH GAIN condition.

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Fig. 3-6. PFD Display, NAV Mode Engaged, A/C Tracking Course

Fig. 3-7. AP Display, NAV APR Mode Engaged

3.1.2.1 Pilot Selectable Intercept Angle

To select an intercept angle other than 45°, set the PFD CRS Pointer to the desired course on the compass card. Then set the PFD HDG Bug to the desired intercept heading, such that the difference between this heading and the desired course is the intercept angle. Press and hold the HDG mode selector switch, and then press the NAV mode selector switch to engage the heading mode and arm the navigation mode. The HDG and NAV annunciations will appear as shown in Fig. 3-8, to acknowledge this.

Fig. 3-8. AP Display, HDG Mode Engaged, NAV Mode Armed

The autopilot will establish the aircraft on the selected intercept angle (heading). A typical view of the PFD during this stage of the intercept sequence is shown in Fig. 3-9. The autopilot will hold this heading until it must turn the aircraft onto the selected course, to prevent overshoot. At that point in the intercept sequence, the HDG annunciation will extinguish to indicate engagement of the navigation mode.

Fig. 3-9. PFD Display, HDG Mode Engaged, NAV Mode Armed

3.1.3 Navigation Global Positioning System Steering (NAV GPSS) Mode

Program a predefined course into the GPS Navigation Receiver, comprised of course segments connected by waypoints. Press the NAV mode selector switch twice to engage the navigation global positioning system steering mode, unless the navigation mode is already engaged. In the latter event, only press the NAV mode selector switch once. The NAV and GPSS annunciations will appear as shown in Fig. 3-10, to acknowledge that this mode is engaged. The autopilot will laterally steer the aircraft along the predefined course, and limit its turn rate to either:

130% of a standard rate turn (Prog/Comp Hardware Mod Code AM and below)
90% of a standard rate turn (Prog/Comp Hardware Mod Code AN and AP)
110% of a standard rate turn (Prog/Comp Hardware Mod Code AR and above)

During this mode of operation, the autopilot will not accept any course error input from the PFD CRS Pointer. A typical view of the PFD with the NAV GPSS mode engaged is shown in Fig. 3-11.

If it should happen that a predefined course has not been programmed into the GPS Navigation Receiver upon attempted engagement of the navigation global positioning system steering mode, then the FAIL annunciation will appear, the NAV and GPSS annunciations will flash, and the autopilot will hold the aircraft's wings level.

Fig. 3-10. AP Display, NAV GPSS Mode Engaged

Fig. 3-11. PFD Display, NAV GPSS Mode Engaged

3.1.3.1 Pilot Selectable Intercept Angle

To select an intercept angle, set the PFD HDG Bug to the desired intercept heading on the compass card, such that the difference between this heading and the next course segment is the intercept angle. Press and hold the HDG mode selector switch, and then press the NAV mode selector switch twice to engage the heading mode and arm the navigation global positioning system steering mode. The HDG, NAV, and GPSS annunciations will appear as shown in Fig. 3-12, to acknowledge this.

Fig. 3-12. AP Display, HDG Mode Engaged, NAV GPSS Mode Armed

The autopilot will establish the aircraft on the selected intercept angle (heading). A typical view of the PFD during this stage of the intercept sequence is shown in Fig. 3-13. The autopilot will hold this heading until it must turn the aircraft onto the next course segment to prevent overshoot. At that point in the intercept sequence, the HDG annunciation will extinguish to indicate engagement of the navigation global positioning system steering mode.

Fig. 3-13. PFD Display, HDG Mode Engaged, NAV GPSS Mode Armed

3.1.4 Altitude Hold (ALT HOLD) Mode

The altitude hold mode can only be engaged if a roll mode (HDG, NAV, NAV APR, REV, REV APR, NAV GPSS) is already engaged. With a roll mode engaged and the aircraft at the desired altitude, press the ALT mode selector switch to engage the altitude hold mode. The ALT annunciation will appear as shown in Fig. 3-14, to acknowledge that this mode is engaged. The autopilot will hold the aircraft at its current (captured) altitude. This altitude may be modified for barometric pressure changes, by rotating the Modifier Knob either clockwise (CW) for an increase in altitude, or counter-clockwise (CCW) for a decrease in altitude. Each detent equals 20 feet, and the range is ±360 feet from the original captured altitude.

Engagement of the altitude hold mode will reset the PFD ALT Bug to the captured altitude. Subsequent modifications to this altitude will cause the PFD ALT Bug to follow the Modifier Knob. A typical view of the PFD with the altitude hold mode engaged is shown in Fig. 3-15.

Fig. 3-14. AP Display, HDG and ALT HOLD Modes Engaged

Fig. 3-15. PFD Display, HDG and ALT HOLD Modes Engaged

3.1.5 Vertical Speed (VS) Mode

Caution:

The vertical speed mode is used to establish and hold a PILOT selected vertical speed. Since the autopilot receives no airspeed information, it is the responsibility of the pilot to ensure that the vertical speed selection is within the operating limits of the aircraft's capabilities. Selection of a vertical speed beyond the capability of the aircraft can create a condition of reduced airspeed, and possibly lead to a stall condition.

The vertical speed mode can only be engaged if a roll mode (HDG, NAV, NAV APR, REV, REV APR, NAV GPSS) is already engaged. With a roll mode engaged and the aircraft at the desired vertical speed, press the VS mode selector switch to engage the vertical speed mode. The VS annunciation will appear as shown in Fig. 3-16, to acknowledge that this mode is engaged, along with the current vertical speed. The latter appears as a number in units of FPM x 100, prefixed by either a "+" to indicate a climb, or a "-" to indicate a descent (i.e., for example, +6 indicates 600 FPM climbing, if within the aircraft's capabilities). The autopilot will hold the aircraft at its current (captured) vertical speed. The vertical speed may be modified by rotating the Modifier Knob. In a climb, rotating the Modifier Knob clockwise (CW) increases the climb rate, whereas rotating it counter-clockwise (CCW) decreases the climb rate. In a descent, rotating the Modifier Knob CCW increases the descent rate, whereas rotating it CW decreases the descent rate. Each detent equals 100 FPM, and the range is ±1600 FPM from the original captured vertical speed.

Engagement of the vertical speed mode will reset the PFD VSI Bug to the captured vertical speed. Subsequent modifications to this vertical speed will cause the PFD VSI Bug to follow the Modifier Knob. A typical view of the PFD with the vertical speed mode engaged is shown in Fig. 3-17.

During a climb, should the aircraft become unable to hold the captured vertical speed for a period of fifteen seconds, the VS annunciation will flash as an alert to the potential for an impending stall condition. In that event, immediately increase the aircraft's thrust if possible, reduce the commanded vertical speed using the Modifier Knob, or both, until the VS annunciation stops flashing.

Fig. 3-16. AP Display, HDG and VS Modes Engaged

Fig. 3-17. PFD Display, HDG and VS Modes Engaged

3.1.6 Autotrim (A/C with Pitch Servo Only)

When the Remote AP ON Switch has been selected (reference section 3.4.1), and both a roll mode (HDG, NAV, NAV APR, REV, REV APR, NAV GPSS) and a pitch mode (ALT HOLD, VS, GS) are engaged, the autopilot will provide an annunciation whenever it is automatically trimming the aircraft about the pitch axis. A pitch mode can only be engaged after a roll mode has been engaged.

Should the pitch servo loading exceed a preset threshold for a period of three seconds, the autopilot will annunciate either Trim ∧ or Trim ∨ as an advisement that it is automatically trimming the aircraft in the indicated direction. This is shown in Fig. 3-18. If the autopilot is still in the process of automatically trimming the aircraft after four more seconds, then the annunciation will flash. Once the aircraft has been sufficiently trimmed, such that the pitch servo loading is below the preset threshold, the annunciation will extinguish.

Fig. 3-18. AP Display, HDG and ALT HOLD Modes Engaged, Autotrim in Progress

3.1.7 Manual Electric Trim

A Remote Manual Electric Trim Switch is located on each Control Sidestick. It can only be used to trim the aircraft from the RDY, or when the Remote AP OFF / FD ON Switch has been selected. To trim the aircraft nose up, press aft and maintain pressure on the Remote Manual Electric Trim Switch. To trim the aircraft nose down, press forward and maintain pressure on the Remote Manual Electric Trim Switch.

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3.2 Precision Approach Procedures

3.2.1 Straight-In ILS Approach

Execute a straight-in intercept and track of the FRONT INBOUND LOC course (reference section 3.3.3), while holding the approach altitude. The NAV, APR, and ALT annunciations will appear as shown in Fig. 3-19. A typical view of the PFD during this stage of the ILS approach sequence is shown in Fig. 3-20.

Fig. 3-19. AP Display, NAV APR and ALT HOLD Modes Engaged

Fig. 3-20. PFD Display, NAV APR and ALT HOLD Modes Engaged

The glideslope mode must normally be armed prior to engagement. Once the following conditions have existed simultaneously for a period of one second, the GS annunciation will appear to acknowledge that the glideslope mode has automatically armed, as shown in Fig. 3-21:

1. NAV APR mode engaged
2. ALT HOLD mode engaged
3. NAV Flag out of view
4. GS Flag out of view
5. LOC frequency selected
6. A/C within 50% CDI needle deflection of LOC centerline
7. A/C more than 10% Glideslope Deviation Indication (GDI) needle deflection below GS centerline

A typical view of the PFD during this stage of the ILS approach sequence is shown in Fig. 3-22.

The armed glideslope mode can be subsequently disabled by pressing the APR mode selector switch. The GS annunciation will flash to acknowledge this. To then re-arm the glideslope mode, press the APR mode selector switch again. The GS annunciation will immediately extinguish, but re-appear after 1 second.

With the glideslope mode armed, once the aircraft arrives at 5% GDI needle deflection below the GS centerline, the ALT annunciation will extinguish to indicate engagement of the glideslope mode, as shown in Fig. 3-23. This marks the end of the intercept sequence, and the beginning of tracking. A typical view of the PFD during this stage of the ILS approach sequence is shown in Fig. 3-24.

Note:

If the approach positions the aircraft slightly above the GS centerline, then manual engagement of the glideslope mode can be instantly achieved by pressing the ALT mode selector switch.

Caution:

Manual engagement of the glideslope mode above the GS centerline will result in the aircraft aggressively moving toward the GS centerline. DO NOT manually engage the glideslope mode if the aircraft is more than 20% above the GS centerline.

The GS annunciation will flash whenever GDI needle deflection exceeds 50%, or the GS Flag is in view. In the latter event, the FAIL annunciation will also appear.

At the Decision Height (DH) or Missed Approach Point (MAP), disconnect the autopilot to execute either a manual landing or go-around, respectively.

A pictorial of this procedure is shown in Fig. 3-25.

Fig. 3-21. AP Display, NAV APR and ALT HOLD Modes Engaged, GS Mode Armed

Fig. 3-22. PFD Display, NAV APR and ALT HOLD Modes Engaged, GS Mode Armed

Fig. 3-23. AP Display, NAV APR and GS Modes Engaged

Fig. 3-24. PFD Display, NAV APR and GS Modes Engaged

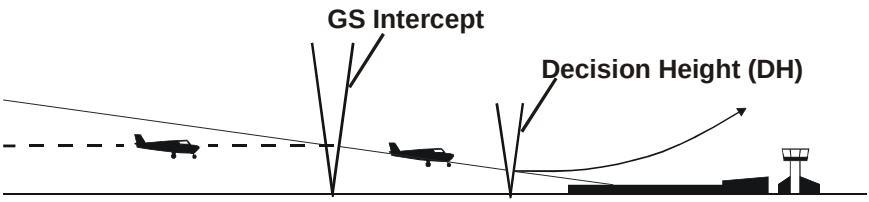


Fig. 3-25. Straight-In ILS Approach

3.2.2 ILS Approach with Procedure Turn

Execute a procedure turn intercept and track of the FRONT INBOUND LOC course (reference section 3.3.4) above the approach altitude, just until the aircraft is established on the FRONT INBOUND PROCEDURE TURN heading, with the heading mode still engaged. Establish the desired vertical descent speed, and then press the VS mode selector switch to engage the vertical speed mode. Upon reaching the approach altitude, press the ALT mode selector switch to engage the altitude hold mode. Press the NAV mode selector switch to engage the navigation approach mode, such that the autopilot will execute a straight-in intercept and track of the FRONT INBOUND LOC course (reference section 3.3.3). Execute a straight-in intercept and track of the glideslope (reference section 3.2.1).

With the NAV GPSS mode engaged, the autopilot is capable of executing virtually the entire lateral approach sequence if it has been programmed into the GPS Navigation Receiver.

Once on the FRONT INBOUND LOC course, with the GPS Navigation Receiver set to VLOC and conditions 2 thru 7 of section 3.2.1 satisfied, press the NAV mode selector switch to engage the NAV APR mode and complete the ILS approach.

3.3 Non-Precision Approach Procedures

3.3.1 Straight-In Back Course Approach

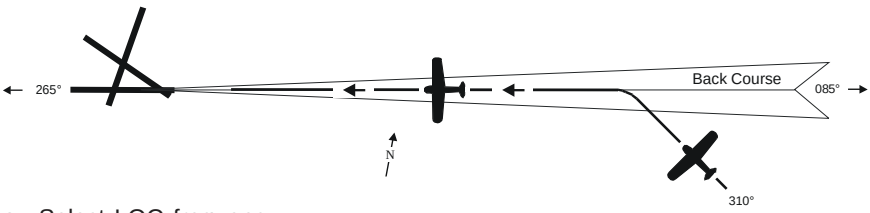
Select the LOC frequency on the Navigation Receiver. Set the PFD CRS Pointer to the FRONT INBOUND LOC course on the compass card. Press the REV mode selector switch to engage the reverse approach mode. The REV and APR annunciations will appear as shown in Fig. 3-26, to acknowledge that this mode is engaged. The autopilot will intercept and track the BACK INBOUND LOC course. A typical view of the PFD during tracking is shown in Fig. 3-27.

Fig. 3-26. AP Display, REV APR Mode Engaged, Back Course

The REV annunciation will flash whenever CDI needle deflection exceeds 50%, or the NAV Flag is in view. In the latter event, the FAIL annunciation will also appear.

A summary pictorial of this procedure is shown in Fig. 3-28.

Fig. 3-27. PFD Display, REV APR Mode Engaged, Back Course



a. Select LOC frequency.

b. Set PFD CRS Pointer to FRONT INBOUND LOC course.

c. Press REV mode selector switch to engage reverse approach mode.

d. Intercept and track BACK INBOUND LOC course.

Fig. 3-28. Straight-In Back Course Approach

3.3.2 Back Course Approach with Procedure Turn

Select the LOC frequency on the Navigation Receiver. Set the PFD CRS Pointer to the FRONT INBOUND LOC course on the compass card. Press the NAV mode selector switch to engage the navigation approach mode. The NAV and APR annunciations will appear as shown in Fig. 3-29, to acknowledge that this mode is engaged. The autopilot will intercept and track the BACK OUTBOUND LOC course.

Fig. 3-29. AP Display, NAV APR Mode Engaged, Track LOC Back Course Outbound

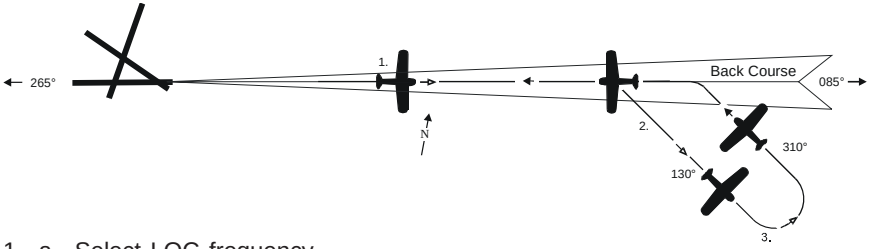
At the appropriate time, set the PFD HDG Bug to the BACK OUTBOUND PROCEDURE TURN heading, and then press the HDG mode selector switch to engage the heading mode. Hold this heading until the point at which it is time to turn the aircraft again. At that point, turn the PFD HDG Bug in two successive 90° increments, to establish the aircraft on the BACK INBOUND PROCEDURE TURN heading. Press the REV mode selector switch to engage the reverse approach mode. The REV and APR annunciations will appear as shown in Fig. 3-30, to acknowledge that this mode is engaged. The autopilot will intercept and track the BACK INBOUND LOC course.

Fig. 3-30. AP Display, REV APR Mode Engaged, Track LOC Back Course Inbound

A summary pictorial of this procedure is shown in Fig. 3-31.

With the NAV GPSS mode engaged, the autopilot is capable of executing virtually this entire lateral approach sequence if it has been programmed into the GPS Navigation Receiver.

Once on the BACK INBOUND LOC course, with the GPS Navigation Receiver set to VLOC, press the REV mode selector switch to engage the REV APR mode and complete the back course approach.



1. a. Select LOC frequency.

   b. Set PFD CRS Pointer to FRONT INBOUND LOC course.

   c. Press NAV mode selector switch to engage navigation approach mode.

   d. Intercept and track BACK OUTBOUND LOC course.

2. a. At appropriate time, set PFD HDG Bug to BACK OUTBOUND PROCEDURE TURN heading.

   b. Press HDG mode selector switch to engage heading mode.

3. a. Turn PFD HDG Bug in two successive 90° increments, to establish aircraft on BACK INBOUND PROCEDURE TURN heading.

   b. Press REV mode selector switch to engage reverse approach mode.

   c. Intercept and track BACK INBOUND LOC course.

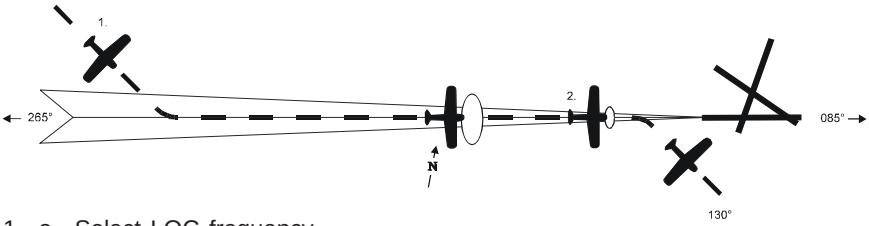
Fig. 3-31. Back Course Approach with Procedure Turn

3.3.3 Straight-In LOC Approach

Select the LOC frequency on the Navigation Receiver. Set the PFD CRS Pointer to the FRONT INBOUND LOC course on the compass card. Press the NAV mode selector switch to engage the navigation approach mode. The NAV and APR annunciations will appear as shown in Fig. 3-32, to acknowledge that this mode is engaged. The autopilot will intercept and track the FRONT INBOUND LOC course.

Fig. 3-32. AP Display, NAV APR Mode Engaged, Track LOC Front Course Inbound

A summary pictorial of this procedure is shown in Fig. 3-33.



1. a. Select LOC frequency.
   b. Set PFD CRS Pointer to FRONT INBOUND LOC course.
   c. Press NAV mode selector switch to engage navigation approach mode.
   d. Intercept and track FRONT INBOUND LOC course.
2. a. At missed approach point, if missed approach is declared, disconnect autopilot.
   b. Stabilize aircraft.
   c. Set PFD HDG Bug to missed approach heading.
   d. Press HDG mode selector switch to engage heading mode.

Fig. 3-33. Straight-In LOC Approach

3.3.4 LOC Approach with Procedure Turn

Select the LOC frequency on the Navigation Receiver. Set the PFD CRS Pointer to the FRONT INBOUND LOC course on the compass card. Press the REV mode selector switch to engage the reverse approach mode. The REV and APR annunciations will appear as shown in Fig. 3-34, to acknowledge that this mode is engaged. The autopilot will intercept and track the FRONT OUTBOUND LOC course.

Fig. 3-34. AP Display, REV APR Mode Engaged, Track LOC Front Course Outbound

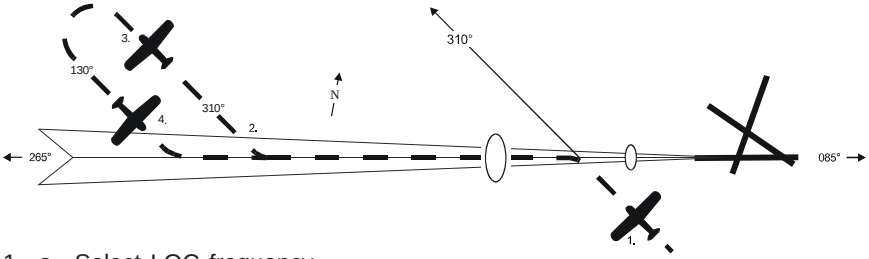
At the appropriate time, set the PFD HDG Bug to the FRONT OUTBOUND PROCEDURE TURN heading, and then press the HDG mode selector switch to engage the heading mode. Hold this heading until the point at which it is time to turn the aircraft again. At that point, turn the PFD HDG Bug in two successive 90° increments, to establish the aircraft on the FRONT INBOUND PROCEDURE TURN heading. Press the APR mode selector switch to engage the navigation approach mode. The NAV and APR annunciations will appear as shown in Fig. 3-35, to acknowledge that this mode is engaged. The autopilot will intercept and track the FRONT INBOUND LOC course.

Fig. 3-35. AP Display, NAV APR Mode Engaged, Track LOC Front Course Inbound

A summary pictorial of this procedure is shown in Fig. 3-36.

With the NAV GPSS mode engaged, the autopilot is capable of executing virtually this entire lateral approach sequence if it has been programmed into the GPS Navigation Receiver.

Once on the FRONT INBOUND LOC course, with the GPS Navigation Receiver set to VLOC, press the NAV mode selector switch to engage the NAV APR mode and complete the front course approach.



1. a. Select LOC frequency.

   b. Set PFD CRS Pointer to FRONT INBOUND LOC course.

   c. Press REV mode selector switch to engage reverse approach mode.

   d. Intercept and track FRONT OUTBOUND LOC course.

2. a. At appropriate time, set PFD HDG Bug to FRONT OUTBOUND PROCEDURE TURN heading.

   b. Press HDG mode selector switch to engage heading mode.

3. a. Turn PFD HDG Bug in two successive 90° increments, to establish aircraft on FRONT INBOUND PROCEDURE TURN heading.

4. a. Press NAV mode selector switch to engage navigation approach mode.

   b. Intercept and track FRONT INBOUND LOC course.

   c. At missed approach point, if missed approach is declared, disconnect autopilot.

   d. Stabilize aircraft.

   e. Set PFD HDG Bug to missed approach heading.

   f. Press HDG mode selector switch to engage heading mode.

Fig. 3-36. LOC Approach with Procedure Turn

3.3.5 Straight-In VOR Approach

Select the VOR frequency on the Navigation Receiver. Set the PFD CRS Pointer to the VOR course on the compass card. Press the APR mode selector switch to engage the navigation approach mode. The NAV and APR annunciations will appear as shown in Fig. 3-37, to acknowledge that this mode is engaged. The autopilot will intercept and track the VOR course.

Fig. 3-37. AP Display, NAV APR Mode Engaged, Track VOR Course

A summary of this procedure is as follows:

1. a. Select VOR frequency.
   b. Set PFD CRS Pointer to VOR course.
   c. Press APR mode selector switch to engage navigation approach mode.
   d. Intercept and track VOR course.
2. a. At missed approach point, if missed approach is declared, disconnect autopilot.
   b. Stabilize aircraft.
   c. Set PFD HDG Bug to missed approach heading.
   d. Press HDG mode selector switch to engage heading mode.

3.3.6 VOR Approach with Procedure Turn

Select the VOR frequency on the Navigation Receiver. Set the PFD CRS Pointer to the RECIPROCAL VOR course on the compass card. Press the REV mode selector switch to engage the reverse mode. The REV annunciation will appear as shown in Fig. 3-38, to acknowledge that this mode is engaged. The autopilot will intercept and track the RECIPROCAL VOR course.

Fig. 3-38. AP Display, REV Mode Engaged, Track Reciprocal VOR Course

At the appropriate time, set the PFD HDG Bug to the RECIPROCAL VOR PROCEDURE TURN heading, and then press the HDG mode selector switch to engage the heading mode. Hold this heading until the point at which it is time to turn the aircraft again. At that point, turn the PFD HDG Bug in two successive 90° increments, to establish the aircraft on the VOR PROCEDURE TURN heading. Press the APR mode selector switch to engage the navigation approach mode. The NAV and APR annunciations will appear as shown in Fig. 3-39, to acknowledge that this mode is engaged. The autopilot will intercept and track the VOR course.

Fig. 3-39. AP Display, NAV APR Mode Engaged, Track VOR Course

A summary of this procedure is as follows:

1. a. Select VOR frequency.

   b. Set PFD CRS Pointer to RECIPROCAL VOR course.

   c. Press REV mode selector switch to engage reverse mode.

   d. Intercept and track RECIPROCAL VOR course.

2. a. At appropriate time, set PFD HDG Bug to RECIPROCAL VOR PROCEDURE TURN heading.

   b. Press HDG mode selector switch to engage heading mode.

3. a. Turn PFD HDG Bug in two successive 90° increments, to establish aircraft on VOR PROCEDURE TURN heading.

4. a. Press APR mode selector switch to engage navigation approach mode.

   b. Intercept and track VOR course.

   c. At missed approach point, if missed approach is declared, disconnect autopilot.

   d. Stabilize aircraft.

   e. Set PFD HDG Bug to missed approach heading.

   f. Press HDG mode selector switch to engage heading mode.

With the NAV GPSS mode engaged, the autopilot is capable of executing virtually this entire lateral approach sequence if it has been programmed into the GPS Navigation Receiver.

Once on the VOR course, with the GPS Navigation Receiver set to VLOC, press the APR mode selector switch to engage the NAV APR mode and complete the VOR approach.

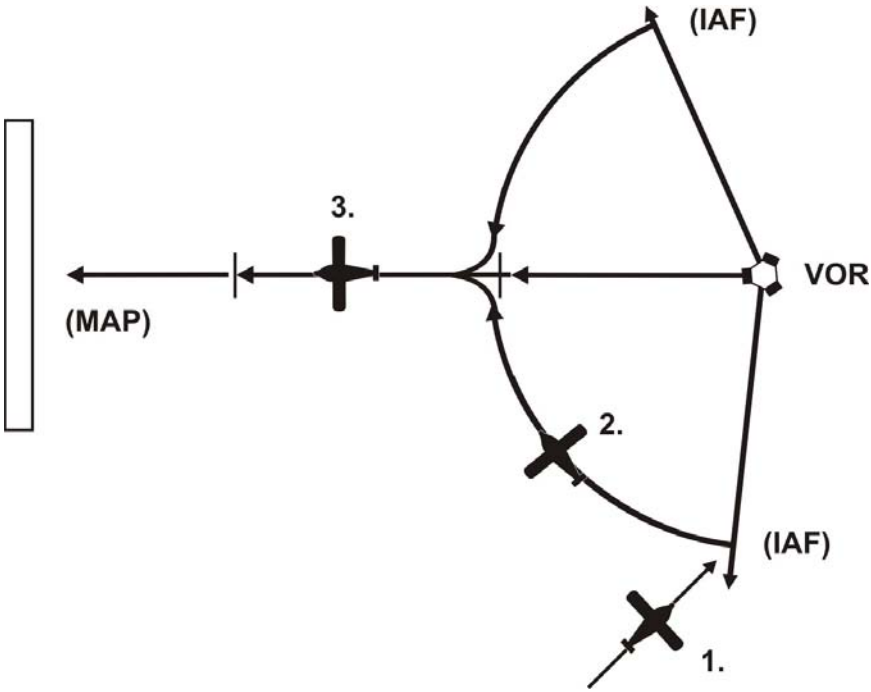
3.3.7 NAV GPSS Approaches (Lateral Guidance Only)

3.3.7.1 Standard Approach

Program a predefined approach into the GPS Navigation Receiver. Press the NAV mode selector switch twice to engage the NAV GPSS mode (reference section 3.1.3). The autopilot will laterally steer the aircraft along the predefined approach. To control the assigned altitudes and rates of descent, use the altitude hold mode (reference section 3.1.4) and vertical speed mode (reference section 3.1.5).

3.3.7.2 GPS Overlay of VOR / DME-A Approach

Refer to Fig. 3-40.



1. a. Program approach into GPS Navigation Receiver.

   b. Press NAV mode selector switch twice to engage NAV GPSS mode.

   c. Track to Initial Approach Fix (IAF).

2. a. Intercept Inital Approach Fix (IAF) and track around arc.

3. a. Become established on inbound course.

   b. At missed approach point (MAP), if missed approach is declared, disconnect autopilot.

   c. Stabilize aircraft.

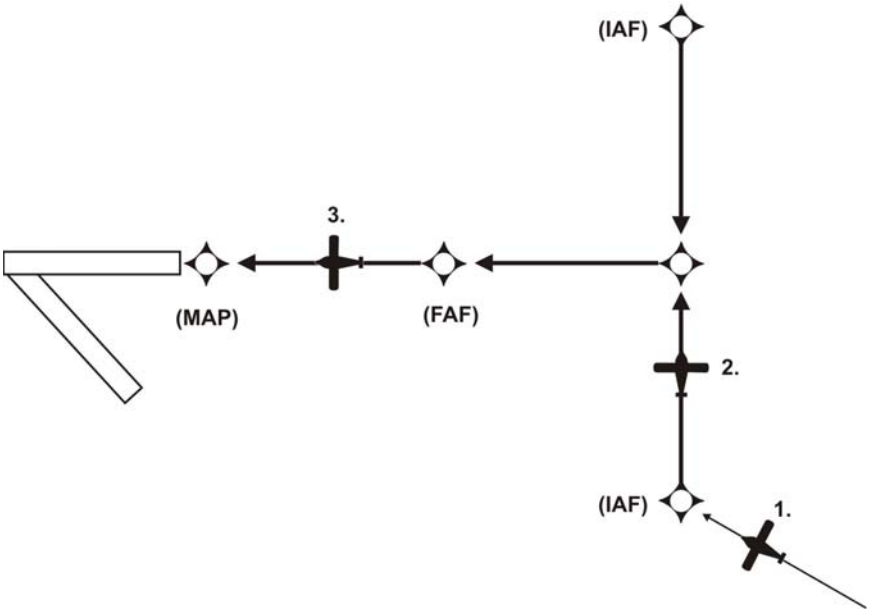
   d. Set PFD HDG Bug to missed approach heading.

   e. Press HDG mode selector switch to engage heading mode.

Fig. 3-40. GPS Overlay of VOR / DME-A Approach

3.3.7.3 GPS-T Approach

Refer to Fig. 3-41.

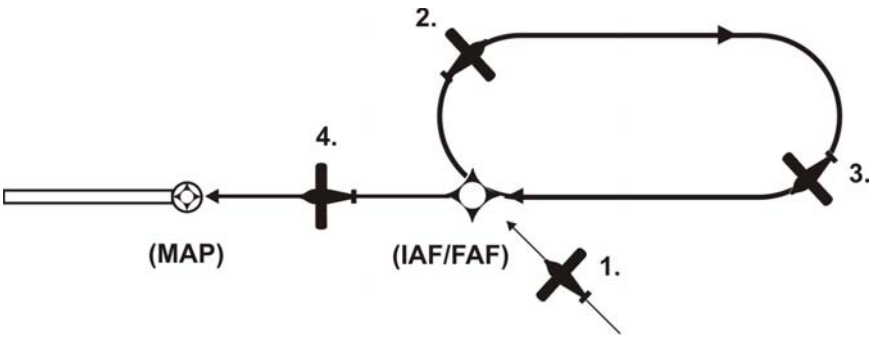


1. a. Program approach into GPS Navigation Receiver.
   b. Press NAV mode selector switch twice to engage NAV GPSS mode.
   c. Track to Initial Approach Fix (IAF).
2. a. Intercept IAF, make a 90° turn, and then track to Final Approach Fix (FAF).
3. a. Become established on inbound course.
   b. At missed approach point (MAP), if missed approach is declared, disconnect autopilot.
   c. Stabilize aircraft.
   d. Set PFD HDG Bug to missed approach heading.
   e. Press HDG mode selector switch to engage heading mode.

Fig. 3-41. GPS-T Approach

3.3.7.4 GPS Approach with Holding Pattern

Refer to Fig. 3-42.

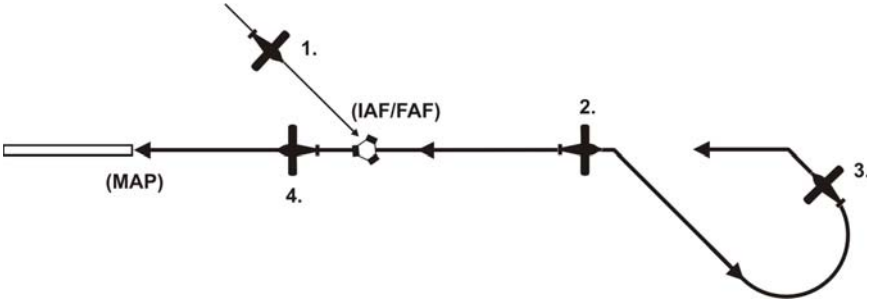


1. a. Program approach into GPS Navigation Receiver.
   b. Press NAV mode selector switch twice to engage NAV GPSS mode.
   c. Track to Initial Approach Fix (IAF).
2. a. Track outbound leg of holding pattern.
3. a. Track to Final Approach Fix (FAF).
4. a. Become established on inbound course.
   b. At missed approach point (MAP), if missed approach is declared, disconnect autopilot.
   c. Stabilize aircraft.
   d. Set PFD HDG Bug to missed approach heading.
   e. Press HDG mode selector switch to engage heading mode.

Fig. 3-42. GPS Approach with Holding Pattern

3.3.7.5 GPS Overlay of VOR Approach with Procedure Turn

Refer to Fig. 3-43.



1. a. Program approach into GPS Navigation Receiver.
   b. Press NAV mode selector switch twice to engage NAV GPSS mode.
   c. Track to Initial Approach Fix (IAF).
2. a. Track procedure turn.
3. a. Track to Final Approach Fix (FAF).
4. a. Become established on inbound course.
   b. At missed approach point (MAP), if missed approach is declared, disconnect autopilot.
   c. Stabilize aircraft.
   d. Set PFD HDG Bug to missed approach heading.
   e. Press HDG mode selector switch to engage heading mode.

Fig. 3-43. GPS Overlay of VOR Approach with Procedure Turn

3.4 Flight Director (FD) Operation

The FD is a display of the flight profile. It is commanded by the autopilot. A pair of Steering Command Bars and an Aircraft Reference Symbol (ARS), superimposed upon a pitch ladder, are the principal FD components of interest. The FD operates in either the AP mode or the FD mode.

3.4.1 AP Mode

Press the Remote AP ON Switch, and then engage an autopilot roll mode and pitch mode to engage the AP mode. The autopilot will steer the aircraft toward the Steering Command Bars, until the ARS is tucked into them. The FD provides a visual indication of how accurately the autopilot is tracking its own roll and pitch commands. A typical view of the PFD with the AP mode engaged is shown in Fig. 3-44.

Fig. 3-44. PFD Display, AP Mode Engaged

3.4.2 FD Mode

Press the Remote AP OFF / FD ON Switch, and then engage an autopilot roll mode and pitch mode to engage the FD mode. The pilot must steer the aircraft toward the Steering Command Bars, until the ARS is tucked into them. The FD provides a visual indication of how accurately the pilot is tracking the autopilot's roll and pitch commands. A typical view of the PFD with the FD mode engaged is shown in Fig. 3-45.

Fig. 3-45. PFD Display, FD Mode Engaged

3.5 Wide Area Augmentation System (WAAS) Procedures

3.5.1 GPS Approach (With Vertical Guidance)

When conducting a WAAS approach with the NAV GPSS mode engaged, the autopilot will execute virtually the entire lateral approach sequence (i.e., intercept and track front outbound course, complete procedure turn, intercept and track front inbound course).

In addition, the autopilot will execute the following vertical approaches:

1. LPV (precision and LNAV/VNAV)

2. LNAV+V (non-precision)

Note:

LPV approaches require the appropriate approved equipment.

Once established on the inbound course, the NAV APR and ALT HOLD modes must be engaged, in order to intercept and track either GPS glidepath listed above. The remainder of the approach should be flown like a straight-in ILS (reference 3.2.1).

Caution:

The aircraft will not automatically level off at the Decision Height (DH) or Minimum Descent Altitude (MDA). The pilot must maintain an awareness of their altitude at all times, and disconnect the autopilot at DH or MDA for either a landing or go-around.

3.5.2 Missed Approach

During a missed approach, once established in a climb, engaging the NAV GPSS mode will cause the aircraft to follow the missed approach procedure, if it has been programmed into the GPS Navigation Receiver.

If the missed approach procedure includes holding, then the autopilot will enter the aircraft into the holding pattern. In that event, maintain vertical speed and altitude using the VS and ALT HOLD modes, respectively.

3.6 Autopilot Disconnect

The autopilot can be disconnected by any of the following means:

1. Press Remote AP DISC / TRIM INTR Switch.

2. Pull AP Circuit Breaker.

3. Stall Warning is activated.

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SECTION 4
OPERATING PARAMETERS

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4.1 Roll Axis Limits

Turn Rate

90% Standard Rate Turn (HDG, NAV, NAV APR, REV, REV APR Modes)

130% Standard Rate Turn (NAV GPSS Mode) for Programmer/Computers with Hardware Mod Code AM and below.

90% Standard Rate Turn (NAV GPSS Mode) for Programmer/Computers with Hardware Mod Code AN and AP.

110% Standard Rate Turn (NAV GPSS Mode) for Programmer/Computers with Hardware Mod Code AR and above.

4.2 Pitch Axis Limits

Altitude

32,000 FT

Vertical Force Due to Acceleration

±0.6 g disregarding 1 g due to gravity

Vertical Speed

1600 FPM Climbing or Descending

Modes

A pitch mode (ALT HOLD, VS, GS) can only be engaged after a roll mode (HDG, NAV, NAV APR, REV, REV APR, NAV GPSS) has been engaged.

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SECTION 5
GLOSSARY

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Term	Meaning
A/C	Aircraft
AHRS	Attitude and Heading Reference System
ALT	Altitude
AP	Autopilot
APR	Approach
ARS	Aircraft Reference Symbol
ASI	Airspeed Indication
CDI	Course Deviation Indication
CW	Clockwise
CCW	Counter–Clockwise
CRS	Course
DH	Decision Height
DISC	Disconnect
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FD	Flight Director
FPM	Feet–per–Minute
FT	Feet
GDI	Glideslope Deviation Indication
GPS	Global Positioning System
GPSS	Global Positioning System Steering
GS	Glideslope
HDG	Heading
hPa	Hecto Pascal
HSI	Horizontal Situation Indicator
IAF	Initial Approach Fix
IFR	Instrument Flight Rules
ILS	Instrument Landing System
inHg	Inches of Mercury
INTR	Interrupt
KTS	Knots
LNAV	Lateral Navigation
LNAV+V	Lateral Navigation with Advisory Vertical Guidance
LOC	Localizer
LPV	Lateral Precision with Vertical Guidance
MAP	Missed Approach Point
mbar	Millibars
MDA	Minimum Descent Altitude
NAV	Navigation
PFD	Primary Flight Display
PN	Part Number
POH	Pilot's Operating Handbook
RCVR	Receiver
RDY	Ready
REV	Reverse
VLOC	VOR or LOC Frequency
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
VOR	Very High Frequency Omnidirectional Radio Range
VS	Vertical Speed
VSI	Vertical Speed Indication
WAAS	Wide Area Augmentation System

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Notice:

Contact S-TEC Customer Support at 800-872-7832 for a Service Repair Order (SRO) number prior to the return of any component for any reason.

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