

G-1000 AFCS Expanded Course Overview

This information is the expanded version of the online course and is a work in progress. Comments are welcome to help improve the course. Please also let us know what you thought was useful, needs to be more thoroughly covered or needs to be deleted.

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G-1000 Updates

All G-1000 aircraft will be getting a new software update. There are some subtle changes to the programming and an increase in the capabilities of the flight planning functions. Big picture, they have added both a Lo- and Hi- airway flight planning function. Since CAP will not be using the hi-altitude airway system info (used primarily with turbo models), it will not be covered in this course. The flight plan pagination has changed, instead of 3 pages to choose, there are only 2. Garmin removed the vertical path calculation page and actually incorporated it into the primary flight planning page, page one. This page can be viewed in two modes, both soft key selectable, wide and narrow. The difference is the amount of information viewed on the screen at one time. Additionally, when using the wide mode, you can adjust altitude crossing constraints at any point in your flight plan. You can choose either MSL or AGL altitude restrictions—**WARNING: ENSURE THE CORRECT ALTITUDE IS SELECTED BEFORE FINALIZING THE ENTRY.**

The need to standardize the map displays and other aircraft configurations are a necessity to enhancing safety and interoperability. By standardizing display presentations, we will have minimal confusion, increase flight safety and give everyone the ability to have critical information needed for their flights. Since the primary purpose is to enhance safety, we are to use all available resources, meaning all forms of navigation, both lateral and vertical, to reach our desired destination and complete the mission.

Once the databases are updated, any saved flight plans **which include airways**, must have the airways reloaded to ensure accuracy of the flight plan. Some of the airways may have changed named points or segments, therefore, the necessity to save the updated flight plan each time there is a database update (5-88).

Vertical navigation functions and their importance of defining the correct altitudes in flight plans, such as constraint altitudes, have been added. The KAP 140 altitudes must be flown manually for all flight modes. The GFC 700 can be set to automatically capture and fly defined vertical nav profiles—a neat feature for long distance flying.

I will use the Checklist found in the Information Manual as the basis for the differences review. The checklists for both aircraft are similar and the differences will be noted. This review will cover the basic differences of each aircraft checklist and not the G-1000 specific changes.

First of all, as a refresher for everyone, the only two sections of the POH and Pilot's Information Manual (PIM) that are FAA APPROVED (vs manufacturer recommended procedures) they are Section 2, Limitations, and the Supplements Section. You will note the "FAA APPROVED" notation on the bottom inside corner of pages in those sections to see the approval. Therefore, emphasis will be placed on those differences.

Aircraft Specific Changes:

- The KAP 140 autopilot WILL NOT be available in the C-182T Nav III aircraft. They will be available in all C-172R & S model aircraft currently manufactured by Cessna (2007). In 2008, ALL Cessna aircraft will have the GFC 700 autopilot.
- Carbon Monoxide detector has been incorporated into the G-1000 System, behind the instrument panel. During preflight, a physical CO detector will not be seen in the cabin area. It will be assumed to function correctly unless CO DET SRVC or CO DET FAIL is displayed in the alert window.
- No Changes to the Audio Panel or CAP's added equipment.
- Control Wheel Steering (CWS) Button:
 - o While pressed, allows manual control of the aircraft while the autopilot is engaged and synchronizes the flight director's Command Bars with the current aircraft pitch (if not in a Vertical Navigation, Glideslope or Glidepath Mode) and roll (if in Roll Hold Mode).
 - o Upon release of the CWS Button, the flight director may establish new reference points, depending on the current pitch and roll modes.
 - o The CWS Button is located on the top of the pilot's control wheel left grip.
- Go-Around Switch:
 - o Disengages the autopilot and selects flight director Go Around Mode.
 - o This switch also activates the missed approach when the selected navigation source is GPS or when the navigation source is VOR/LOC and a valid frequency has been tuned.
 - o The GA Switch is located on the instrument panel above the throttle.

G-1000 Changes:

- Electronic Checklists have NOT been purchased by CAP.
- Flight ID Mode is NOT added to the TMR/REF
- Wind Data Display can be changed to enable a more user friendly depiction of the wind's effect on the aircraft.
- Reversionary Mode allows more information to be displayed. The Inset Map can be displayed during reversionary mode use—great for enhanced situational awareness.
- G-1000 Navigation and Flight Planning changes:
 - o WAAS approved approaches
 - o Vertical nav (VNV) functionality
 - o GFC 700 autopilot will fly Non-Precision Approach Holding
 - o Added both Victor (Lo) and Jet (Hi) Airways to the database
 - o Added Track Offsets
 - o Terrain Awareness and Warning System (TAWS) NOT INSTALLED
 - o ADS-B Traffic System NOT installed
 - o TIS System (functions as long as ground based equipment is available).
 - o SafeTaxi, ChartView and FliteCharts are factory installed. They features DO NOT include the **required** subscription service. Individual wings may pay for their own subscription service for each aircraft if they so desire.
 - o Flight Plan pages reduced to 2 pages
 - Deleted the vertical nav page and combined it all on page 1
 - Page 1 information displayed as a narrow (summary) or wide (detailed) view. Each of those views can also be displayed as LEG-LEG information or CUM (cumulative) flight plan/trip information.

- All new model year 2007 aircraft for CAP do not have any factory options. The only options installed will be those performed by YingLing Aviation involving radios and the additional audio panel.

Go-Around Switch Use:

- The GA Switch can be used for emergency escape maneuvers to give the pilot an initial reference point from which to start the correct evasive maneuver. If flying along and terrain or another obstacle interfere with the flight path of the aircraft, an emergency escape maneuver (not flying an instrument approach with a missed approach procedure) can be performed by:
 - o Throttle – FULL IN
 - o GA Switch – PUSH IN
 - Autopilot Off – Command Bars will display showing a wings level, approx 7° nose-up pitch attitude (approx 500 FPM rate of climb)
 - Autopilot On – Autopilot will disengage, command bars will display a wing level, 7° nose-up pitch.
 - o Pilot will determine the aggressiveness and immediacy of the maneuver to maintain a safe flight path and recover the aircraft to a normal flight condition.
- GA – Once the GA has begun and the aircraft is at a safe altitude, the autopilot may be re-engaged and a NAV source can be selected, usually GPS, to fly the missed approach as published and verified in the database prior to the beginning of the approach.
- The GFC 700 will fly the published missed approach holding pattern as depicted. The KAP 140 will also do the same, but must be monitored. This is the result of software updates Garmin has published.

CWS Button Use:

- CWS – there are two possible outcomes when using the CWS Button, resume and reset.
 - o **RESUME** – the following functions will “resume” their intended course guidance once the CWS is released: HDG, NAV, APCH, Back Course (BC), Glide Path and Glide Slope.
 - o **RESET** – the following functions will “reset” or default to the their native modes: Roll, Alt Hold, Vertical Speed, FLC and Pitch (PIT)

Autopilot Malfunctions:

- Both the KAP 140 and GFC 700 have required immediate action items published in the POH/PIM for **Autopilot or Electric Trim Malfunction/Failure**. These are the very similar for both autopilots and should be committed to memory—just as other emergency action items.
 - **1. Control Wheel – GRASP FIRMLY (regain control of airplane)**
 - **2. A/P TRIM DISC Button – PRESS and HOLD (throughout recovery)**
 - **3. Elevator and Rudder Trim Controls – ADJUST MANUALLY (as necessary)**
 - **4. AUTO PILOT Circuit Breaker – OPEN (pull out)**
 - **5. A/P TRIM DISC Button - RELEASE**

WARNING
FOLLOWING AN AUTOPILOT, AUTOTRIM OR MANNUAL
ELECTRIC TRIM SYSTEM MALFUNCTION, DO NOT ENGAGE
THE AUTOPILOT UNTIL THE CAUSE OF THE MALFUNCTION
HAS BEEN CORRECTED

Checklist Differences

Chapter 1 – Has remained essentially the same

Chapter 2 – LIMITATIONS –

- G-1000 LIMITATIONS –
 - The fuel quantity, fuel used and fuel remaining functions of the G1000 are supplemental information only and must be verified by the pilot. (NEW)
- TRAFFIC MAP (displays only the Traffic Information System [TIS] data)
- TERRAIN PROXIMITY information is still available in our new aircraft
- GPS –WAAS (IFR Only) (NEW)
- GARMIN GFC 700 AFCS
 - 1. The GFC 700 AFCS preflight test must be successfully completed prior to the use of the autopilot, flight director or manual electric trim.
 - 2. A pilot, with the seat belt fastened, must occupy the left pilot’s seat during all autopilot operations.
 - 3. The autopilot must be off during all takeoff and landings.
 - 4. Autopilot maximum engagement speed – 165 KIAS
Autopilot minimum engagement speed – 70 KIAS
Electric Trim maximum operating speed – 175 KIAS
 - 5. Maximum fuel imbalance with the autopilot engaged – 90 pounds.
 - 6. The autopilot must be disengaged below 200 feet AGL during approach operations and below 800 feet AGL during all other operations.
 - 7. ILS approaches using the autopilot/flight director are limited to Category I approaches only.
 - 8. Use of the autopilot is prohibited when the audio panel is inoperative (since the aural alert will not be provided when autopilot is disengaged).
 - 9. Use of the autopilot is prohibited when conducting missed approach procedures until an established rate of climb that ensures all altitude requirements of the procedure will be met.

COMPARE TO THE LIMITATIONS FOR THE KAP 140

1. *The entire Preflight procedure given in the Normal Procedures section of this supplement must be satisfactorily completed prior to each flight. Use of the autopilot or manual electric trim system is prohibited before the satisfactory completion of the Preflight procedure.*
2. *The autopilot must be OFF during takeoff and landing.*
3. *During autopilot operation, a pilot must be seated in the left front seat with their set belt fastened.*
4. *The system is approved for Category I operation only (Approach mode selected).*
5. *Autopilot maximum airspeed limitation – 160 KIAS.
Autopilot minimum airspeed limitation – 80 KIAS.*
6. *Maximum flap extension - 10°.*
7. *Maximum lateral fuel imbalance with autopilot engaged – 90 lbs.*
8. *The autopilot must be disengaged below 200 feet AGL during approach operations and below 800 feet AGL for all other phases of flight.*
9. *Manually overriding the autopilot to change pitch or roll attitude is prohibited. (Disengage the autopilot before moving the control wheel manually).*
10. *If the red “PITCH TRIM” warning annunciator (shown on the PFD) comes on during flight, do the Recovery Procedure shown in Emergency Procedures. The electric trim and autopilot systems will be de-energized when the AUTO PILOT circuit breaker is open.*
11. *Operation of the KAP 140 Autopilot is prohibited when the GMA 1347 Audio Panel is inoperative (no warning tone will be supplied when the Autopilot disengages).*

NOTE: The differences are subtle, but with different aircraft in some wings, you will need to ensure compliance with those differences of aircraft equipment—great topic for hangar flying!

Chapter 3 – EMERGENCY PROCEDURES

- As with newer aircraft and more complex systems, it should be pointed out that there are more immediate action items in this chapter.
 - o WING FIRE (Both)
 - o INADVERTENT ICING ENCOUNTER DURING FLIGHT (Both)
 - o STATIC SOURCE BLOCKAGE (Both)
 - o VACUUM SYSTEM FAILURE (Both)
 - o HIGH CARBON MONOXIDE (CO) LEVEL ADVISORY (NEW)
 - o AUTOPILOT OR ELECTRIC TRIM MALFUNCTION/FAILURE (Both)
- Please note, it will remain with the WG/RGN Stan/Eval as to which of these need to be committed to memory in addition to those already required on the aircraft questionnaire.

Chapter 4 – NORMAL PROCEDURES

- Preflight Inspection
 - o Cabin

- 11. FUEL QTY (L and R) – CHECK
 - *Note: This is a good time to check the Engine, System page and note specific fuel quantity and if necessary, reset Fuel Used to zero and enter actual total fuel quantity.*
- Nose
 - 3. Engine Oil Dipstick/Filler Cap:
 - Published note: **Do Not operate with less than 4 quarts.** Fill to 9 quarts for extended flight.
 - *Sect 7, pg 7-37 of the PIM defines this to mean “...fill to 8 quarts for normal flights of less than three hours.”*
 - *Also note, it does not say minimum quantity for takeoff as the aircraft questionnaire asks.*
- Starting Engine
 - *Note: Refer to the expanded checklist, pg 4-26, for Leaning For Ground Operations. Required for both aircraft.*
 - *Note: Refer to the expanded checklist, pg 4-43, for Cold Weather Operations. When the air temperature is below 20°F (-6°C) use a preheater and external power source. I am sure wings have policies already in place. Required for both aircraft.*
- Before Takeoff
 - 7. Altimeters:
 - a. PFD (BARO) –SET
 - b. Standby Altimeter – SET
 - 13. Manual Electric Trim (MET) System – CHECK (refer to Garmin G1000 Cockpit Reference Guide (CRG), Section 6, for Manual Electric Trim check procedures)
 - *Note: There is no preflight procedure printed for the GFC 700 autopilot. Therefore, it is assumed to work unless an advisory or alert message is annunciated or there is another indication that the system is inoperative.*
 - ***Note: KAP 140 autopilot requires the MET preflight check printed in the POH in the Supplement Section prior to use before each flight. Ensure pilots are aware of this significant difference in procedures.***
 - 14 Autopilot – ENGAGE (push AP button on either PFD or MFD bezel)
 - 15. Flight Controls – CHECK (verify autopilot can be overpowered in both pitch and roll axes)
 - 16. A/P TRIM DISC Button – PRESS (verify autopilot disengages and aural alert is heard)
 - 17. Flight Director – OFF (push FD button on either the PFD or MFD bezel)
 - *Note: These last few autopilot steps have been added to the checklist to ensure compliance with the A/P limitations.*
 - *Note: The Flight Director must be **OFF** for Take Off as indicated by this step. **DO NOT** press the GA Button prior to the Take Off roll.*
 - *Keep in mind, during takeoff the PIC should be clearing looking outside the aircraft and not focused on the command bars during climbout.*

- 26. FMS/GPS Flight Plan – AS DESIRED

NOTE

Check GPS availability on AUX-GPS STATUS page. No annunciation is provided for loss of GPS2.

- *Note: The autopilot receives all of its information from GPS #2, if it doesn't work, neither does the autopilot. I agree with some of the Cessna factory pilots—this should be a check list item.*

Chapters 5-8 (Remaining) – Performance and other pertinent data remains relatively unchanged.

Flight Director/Autopilot

The following AFCS controls are located in the cockpit separately from the MFD:

- AP DISC Switch (Autopilot Disconnect) Disengages the autopilot and interrupts pitch trim operation. The red AP DISC Switch is located forward of the MET Switch on the pilot's control wheel left grip. This switch may be used to acknowledge an autopilot disconnect and mute the associated aural tone.
- CWS Button (Control Wheel Steering) - Momentarily disengages the autopilot and synchronizes the flight director's Command Bars with the current aircraft pitch (if not in Glideslope Mode) and roll (if in Roll Hold Mode). The CWS Button is located on the top of the pilot's control wheel right grip. Upon release of the CWS Button, the flight director may establish new reference points, depending on the current pitch and roll modes.
- GA Switch (Go-Around) - Disengages the autopilot, selects flight director Go-Around Mode, and activates the missed approach. The GA Switch is located on the instrument panel above the throttle.
- MET Switch (Manual Electric Trim) The MET Switch is located on the pilot's control wheel left grip. This composite switch is split into left and right sides. The left switch is the ARM contact and the right switch controls the DN (forward) and UP (rearward) contacts. The MET ARM switch can be used to disengage the autopilot and to acknowledge an autopilot disconnect alert and mute the associated aural tone. Manual trim commands are generated only when both sides of the switch are operated simultaneously. If either side of the switch is active separately for more than three seconds, MET function is disabled and 'PTRM' is displayed as the AFCS Status Annunciation on the PFD. The function remains disabled until both sides of the switch are inactivated.

FLIGHT DIRECTOR OPERATION

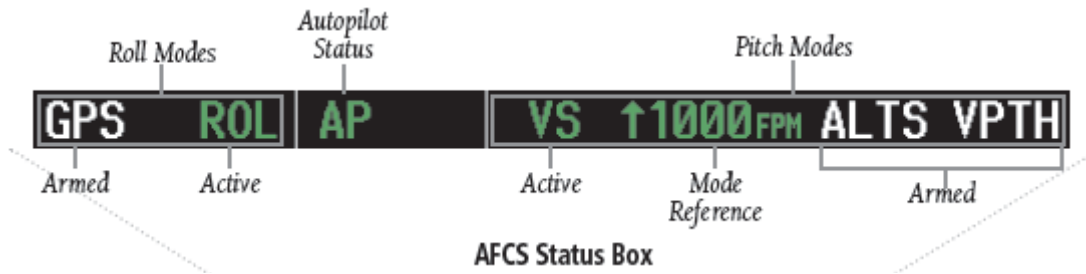
With the flight director activated, the aircraft can be hand-fl own to follow the path shown by the Command Bars. Maximum commanded pitch (+20°/-15°) and bank (22°) angles, vertical acceleration, and roll rate are limited to values established during AFCS certification. The flight director also provides commands to the autopilot.

Activating the Flight Director

Pressing the FD or AP Key (when the flight director is not active) activates the flight director in default pitch/roll modes. Pushing the GA Switch or any flight director mode key activates the flight director in the respective mode(s). The flight director may be turned off by pressing the FD Key.

Command Bars

Upon activation of the flight director, Command Bars are displayed on the PFD as a single cue. If the attitude information sent to the flight director becomes invalid or unavailable, the Command Bars are removed from the display. The Command Bars do not override the aircraft symbol.



The only indication that the autopilot is engaged is seen in the above AFCS Status Box view.



The above PFD view on the AFSC line displays default view of what you will see when the 'FD' button is pressed and the Flight Director System is active. The following roll modes will be annunciated when the appropriate button is selected:

- Roll Hold (default mode) — Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle
- Heading Select — Captures and tracks the Selected Heading
- Navigation (GPS, VOR, LOC) — Captures and tracks the selected navigation source
- Backcourse — Captures and tracks a localizer signal for backcourse approaches
- Approach (GPS, VAPP, LOC) — Captures and tracks the selected navigation source with greater sensitivity for approach
- Go Around — Commands a constant pitch angle and wings level while in the air

NOTE: ENSURE THE AFCS BAR DISPLAYS THE DESIRED FLIGHT MODE STATUS. IF THE 'AP' INDICATION IS MISSING, THE AUTOPILOT IS NOT ENGAGED.

Control Wheel Steering

During autopilot operation, the aircraft may be hand flown without disengaging the autopilot. Pressing and holding the CWS Button disengages the pitch and roll servos from the flight control surfaces and allows the aircraft to be hand-fl own. At the same time, the flight director is synchronized to the aircraft attitude during the maneuver. The ‘AP’ annunciation is temporarily replaced by ‘CWS’ in white for the duration of CWS maneuvers. In most scenarios, releasing the CWS Button reengages the autopilot with a new reference. See the Cockpit Reference Guide or Garmin Integrated Flight Deck Pilot’s Guide for more info.



Disengaging the Autopilot

Automatic disengagement occurs due to:

- System failure
- Inability to compute default flight director modes (FD also disengages automatically)
- Invalid sensor data
- Stall warning

Automatic autopilot disengagement is indicated by a flashing red ‘AP’ annunciation and by the autopilot disconnect aural alert, which continue until acknowledged by pushing the AP DISC or MET Switch.



The autopilot is manually disengaged by pushing the AP DISC Switch, GA Switch, MET ARM Switch, or the AP Key on the MFD. Manual disengagement is indicated by a five-second flashing yellow ‘AP’ annunciation and a three-second autopilot disconnect aural alert. After manual disengagement, the autopilot disconnect aural alert may be cancelled by pushing the MET ARM or AP DISC Switch (AP DISC Switch also cancels the flashing ‘AP’ annunciation).



When we have a terrain or TAS warning, what are the recovery actions necessary to safely rectify the situation and correct the flight path?

Vertical Navigation Modes (VPTH, ALTV)

NOTES:

- Pressing the **CWS** Button while Vertical Path Tracking Mode is active does not cancel the mode. The autopilot guides the aircraft back to the descent path upon release of the **CWS** Button.
- VNAV flight director pitch modes are available only in conjunction with GPS roll modes.
- The Selected Altitude takes precedence over any other vertical constraints.

Vertical Navigation (VNAV) flight control is available for enroute/terminal cruise and descent operations when VNAV has been enabled and a VNAV flight plan (with at least one vertical

waypoint) or direct-to with a vertical constraint has been activated. The flight director may be armed for VNAV at any time, but no target altitudes are captured during a climb. The Command Bars provide vertical profile guidance based on specified altitudes (entered manually or loaded from the database) at waypoints in the active flight plan or vertical direct-to. The appropriate VNAV flight control modes are sequenced by the flight director to follow the path defined by the vertical profile. Upon reaching the last waypoint in the VNAV flight plan, the flight director transitions to Altitude Hold Mode and cancels any armed VNAV modes.

Vertical Path Tracking Mode (VPTH)

NOTE:

- If another pitch mode key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed.

When a vertical profile (VNAV flight plan) is active and the VNV Key is pressed, Vertical Path Tracking Mode is armed in preparation for descent path capture. 'VPTH' (or '/V' when Glidepath or Glideslope Mode is concurrently armed) is annunciated in white in addition to previously armed modes. If applicable, the appropriate altitude capture mode is armed for capture of the next VNAV Target Altitude (ALTV) or the Selected Altitude (ALTS), whichever is greater.

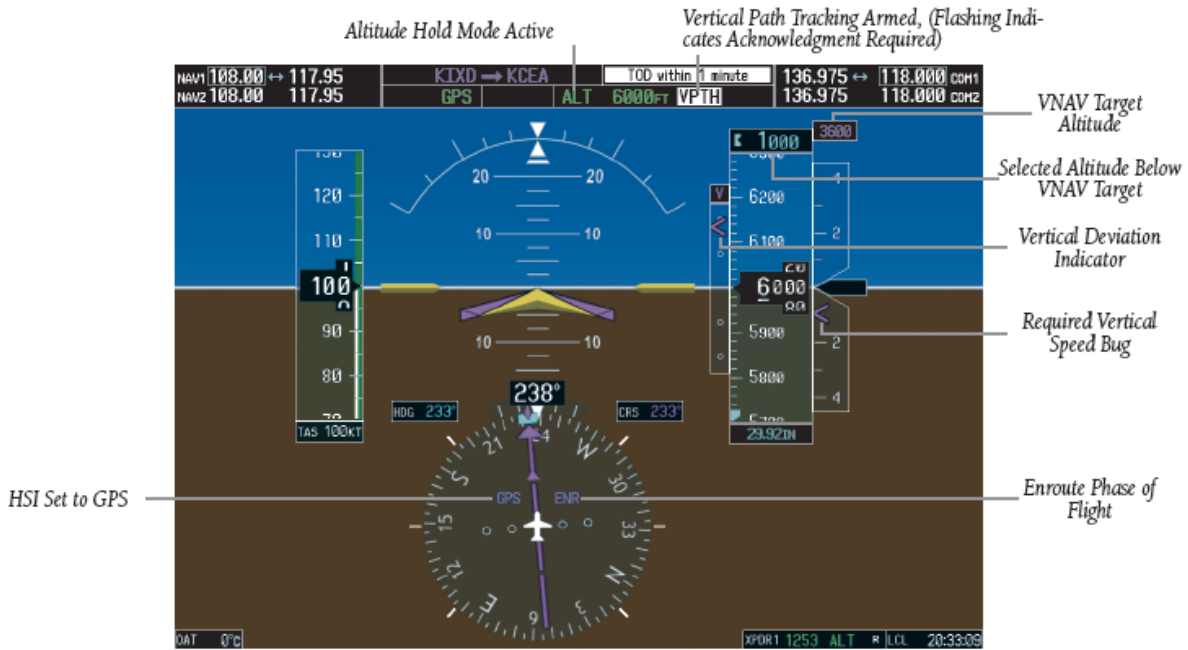


Prior to descent path interception, the Selected Altitude must be set below the current aircraft altitude by at least 75 ft. For the flight director to transition from Altitude Hold to Vertical Path Tracking Mode, acknowledgment is required within five minutes of descent path capture by:

- Pressing the VNV Key
- Adjusting the Selected Altitude

If acknowledgment is not received within one minute of descent path interception, the white 'VPTH' annunciation and the VNV Key annunciator light start to flash. Flashing continues until acknowledged or the descent path is intercepted. If the descent is not confirmed by the time of interception, Vertical Path Tracking Mode remains armed and the descent is not captured.

In conjunction with the "TOD [top of descent] within 1 minute" annunciation in the Navigation Data Box, VNAV indications (VNAV Target Altitude, vertical deviation, and vertical speed required) appear on the PFDs in magenta.



Automatic Pitch Hold Reversion

Several situations can occur while Vertical Path Tracking Mode is active which cause the flight director to revert to Pitch Hold Mode. Vertical Path Tracking and the appropriate altitude capture modes are armed for possible descent profile recapture if the vertical deviation:

- Exceeds 200 ft during an overspeed condition
- Experiences a discontinuity exceeding 200 ft due to a flight plan change
- Becomes invalid due to excessive cross-track error, track angle error
- Cannot be computed for a leg type (such as a hold or procedure turn)

The following circumstances cause mode reversion without arming Vertical Path Tracking Mode:

- Navigation source manually changed from GPS
- CNCL VNV Softkey selected on the Active Flight Plan Page (MFD)
- All remaining vertical waypoints deleted from the flight plan
- Displays entering Reversionary Mode

Non-Path Descents

Pitch Hold, Vertical Speed, and Flight Level Change modes can also be used to fly non-path descents while flight control is selected. If the VS or FLC Key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed along with the appropriate altitude capture mode to allow profile recapture.

To prevent immediate profile re-capture, the following must be satisfied:

- At least ten seconds have passed since the non-path transition was initiated
- Vertical deviation from the profile has exceeded 250 ft, but is now less than 200 ft

Pressing the VNV Key twice re-arms Vertical Path Tracking for immediate profile re-capture.

VNAV Target Altitude Capture Mode (ALTV)

NOTE:

- Armed VNAV Target Altitude and Selected Altitude capture modes are mutually exclusive. However, Selected Altitude Capture Mode is armed implicitly (not annunciated) whenever VNAV Target Altitude Capture Mode is armed. This ensures the Selected Altitude is not violated during a change from VNAV Target Altitude Capture to Selected Altitude Capture Mode close to Selected Altitude interception.

VNAV Target Altitude Capture is analogous to Selected Altitude Capture Mode and is armed automatically after the VNV Key is pressed and the next VNAV Target Altitude is to be intercepted before the Selected Altitude. The annunciation 'ALTV' indicates that the VNAV Target Altitude is to be captured. VNAV Target Altitudes are shown in the active flight plan or vertical direct-to, and can be entered manually or loaded from a database (see the GPS Navigation Section for details). At the same time as "TOD within 1 minute" is annunciated in the Navigation Data Box, the VNAV Target Altitude is displayed above the Vertical Speed Indicator. VNAV Target Altitudes can be modified until VNAV Target Altitude Capture Mode becomes active. As the aircraft nears the VNAV Target Altitude, the flight director automatically transitions to VNAV Target Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green 'ALTV' annunciation flashing for up to ten seconds and the appearance of the white 'ALT' annunciation. The VNAV Target Altitude is shown as the Altitude Reference beside the 'ALTV' annunciation. At 50 ft from the VNAV Target Altitude, the flight director automatically transitions from VNAV Target Altitude Capture to Altitude Hold Mode and tracks the level leg. As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active pitch mode field and flashes green for ten seconds to indicate the automatic transition. The flight director automatically arms Vertical Path Tracking, allowing upcoming descent legs to be captured and subsequently tracked.

Changing the VNAV Target Altitude

NOTE:

- Pressing the **CWS** Button while in VNAV Target Altitude Capture Mode does not cancel the mode.

Changing the current VNAV Target Altitude while VNAV Target Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode. Vertical Path Tracking and the appropriate altitude capture mode are armed in preparation to capture the new VNAV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first. VNAV target altitudes can be changed while editing the active flight plan (see the GPS Navigation Section for details).

Approach Mode (GPS, VAPP, LOC)

NOTE:

- The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Approach Mode.

Approach Mode is activated when the APR Key is pressed. Approach Mode acquires and tracks the selected navigation receiver on the HSI (GPS, VOR, or LOC), depending on the loaded approach. This mode uses the selected navigation receiver deviation and desired course inputs to fly the approach. Approach Mode provides greater sensitivity for signal tracking than Navigation Mode. Pressing the APR Key when the CDI is greater than one dot arms the selected approach mode (annunciated in white to the left of the active roll mode). If the selected navigation receiver is GPS,

pressing the APR Key arms GPS Approach Mode, provided that a GPS approach has been loaded into the flight plan. If the loaded approach provides WAAS-based vertical guidance, Glidepath Mode is also armed. If GPS Approach Mode is selected while in GPS Navigation Mode, capture can occur with crosstrack error of up to 2 nm.

LOC Approach Mode allows the autopilot to fly a LOC/ ILS approach with a glideslope. LOC Approach Mode is armed (along with Glideslope Mode) when the APR Key is pressed and either of the following have been done:

- Navigation source is set to LOC
- A LOC/ILS approach is loaded into the flight plan

and the corresponding localizer frequency tuned (even if the selected navigation source is GPS) Localizer capture is suppressed until the navigation source is changed to LOC. If Approach Mode is active and either of the following occur, the flight director reverts to Roll Hold Mode (wings rolled level):

- Vectors-to-Final is activated
- Navigation source is manually switched
- Localizer signal is not captured by the final approach fix (FAF) while in LOC Navigation

Mode

Changing the Selected Course

The Selected Course on the PFD is controlled using the CRS Knob. Pressing the CWS Button and hand-flying the aircraft does not change the Selected Course while in Approach Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the CWS Button is released.

Backcourse Mode (BC)

NOTE:

- When making a backcourse approach, set the Selected Course to the localizer front course.

Backcourse Mode captures and tracks a localizer signal. The mode may be selected by pressing the BC Key. Backcourse Mode is armed if the CDI is greater than one dot when the mode is selected. The flight director creates roll steering commands from the Selected Course and deviation when in Backcourse Mode.

Changing the Selected Course

The Selected Course on the PFD is controlled using the CRS Knob. Pressing the CWS Button and hand-flying the aircraft does not reset any reference data while in Backcourse Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the CWS Button is released.

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