IFR Usage of the GPS

Objective

Understand and apply the different autopilot modes, how the autopilot operates, and how it's effective use in an IFR environment.

Timing

30 minutes

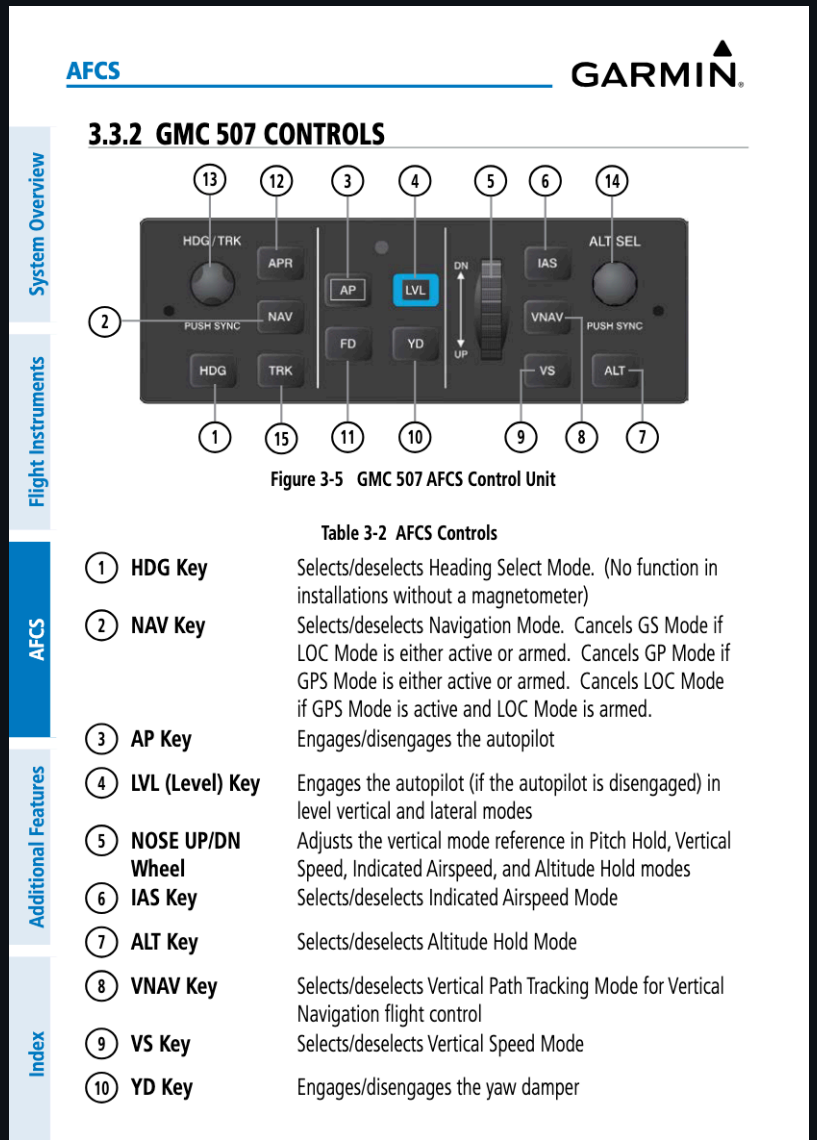
Overview

- Effective use of the autopilot
- Autopilot Documents
- Mode Annunciations
- Lateral Modes
- Vertical Modes
- Approach Modes
- Specific scenarios
    - How to use VNAV Mode
    - Fully-Coupled Go-Around

Effective Use of the Autopilot

- Workload reduction
- Allows you to focus your attention elsewhere.
  Thinking of heads-down work:
  - Talking to ATC
  - Briefing and approach
  - Programming avionics
  - Dealing with passengers
- Spatial disorientation (LVL button)

Autopilot Documents



AFCS GARMIN

System Overview | Flight Instruments | AFCS | Additional Features | Index

3.3.2 GMC 507 CONTROLS

Figure 3-5 GMC 507 AFCS Control Unit

Table 3-2 AFCS Controls

(1) **HDG Key**	Selects/deselects Heading Select Mode. (No function in installations without a magnetometer)
(2) **NAV Key**	Selects/deselects Navigation Mode. Cancels GS Mode if LOC Mode is either active or armed. Cancels GP Mode if GPS Mode is either active or armed. Cancels LOC Mode if GPS Mode is active and LOC Mode is armed.
(3) **AP Key**	Engages/disengages the autopilot
(4) **LVL (Level) Key**	Engages the autopilot (if the autopilot is disengaged) in level vertical and lateral modes
(5) **NOSE UP/DN Wheel**	Adjusts the vertical mode reference in Pitch Hold, Vertical Speed, Indicated Airspeed, and Altitude Hold modes
(6) **IAS Key**	Selects/deselects Indicated Airspeed Mode
(7) **ALT Key**	Selects/deselects Altitude Hold Mode
(8) **VNAV Key**	Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control
(9) **VS Key**	Selects/deselects Vertical Speed Mode
(10) **YD Key**	Engages/disengages the yaw damper

- Retrofit autopilots are installed per an STC
- GFC 500 Pilots's Guide
- GFC 500 AFMS - Flight Manual Supplement
  - Must be in the plane


GMU11 Magnometer


GAD13 / OAT Probe

GPS Antenna


G5 PFD

CAN Bus


G5 HSI


GAD29A

ARINC 429


Garmin GTN750 Xi

RS-232


Garmin GNC255

GPS Antenna #2


Garmin GTX 345

RS-232

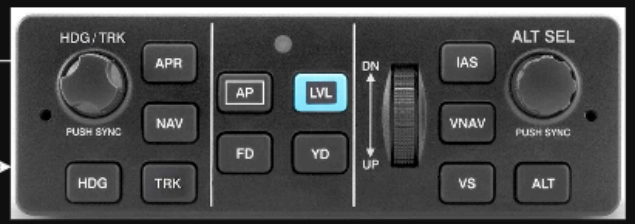

Pitch Servo


Pitch trim servo

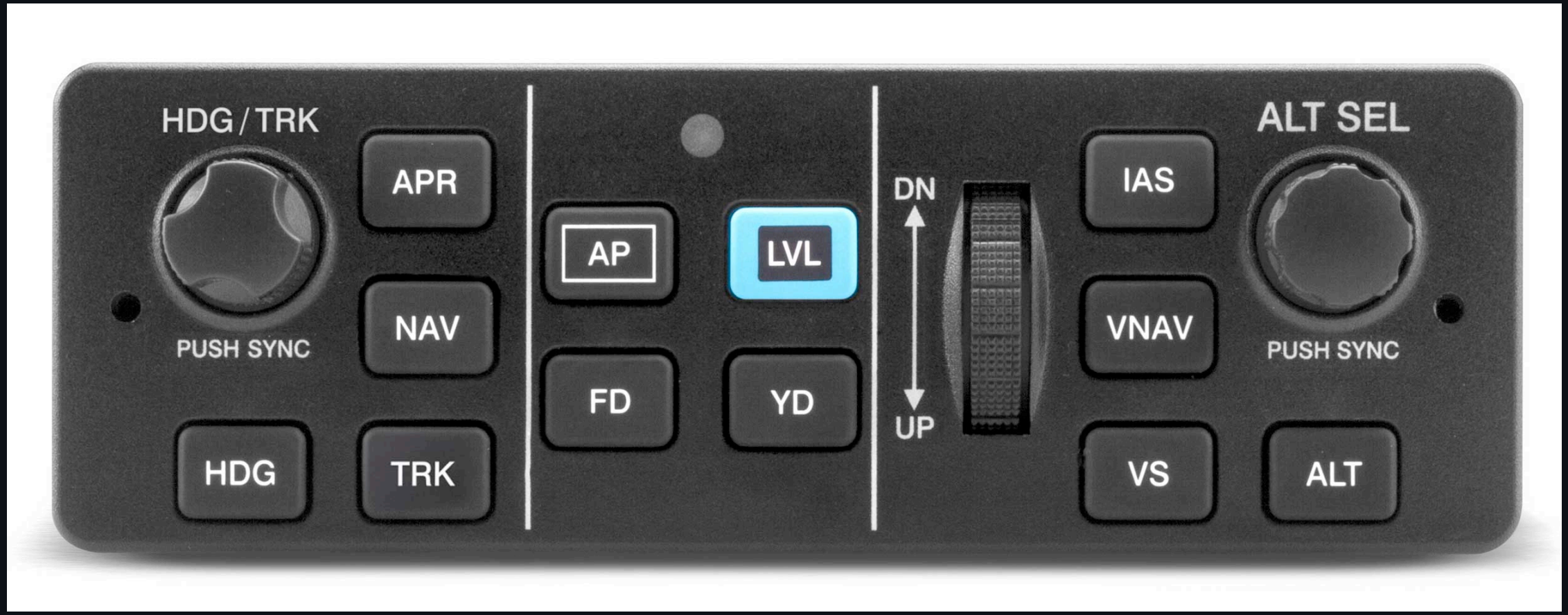

Roll servo

Electronic Trim Switch

G/A Switch


GFC 500

Garmin GFC 500 Operations



Mode Annunciations

- Green: Mode active
- White: Mode armed

Initial Mode Activation

Table 3-4 Flight Director Activation (GMC 507)

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
GA Button	Takeoff (on-ground) Go Around (in-air)	TO GA	Takeoff (on-ground) Go Around (in-air)	TO GA
ALT Key	Roll Hold (default)	ROL	Altitude Hold	ALT
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
VNAV Key	Roll Hold (default)	ROL	Vertical Navigation*	VNAV
IAS Key	Roll Hold (default)	ROL	Indicated Airspeed	IAS
APR Key	Approach**	GPS/VOR/ LOC/ILS	Pitch Hold (default)	PIT
NAV Key	Navigation**	GPS/VOR/ LOC	Pitch Hold (default)	PIT

Control Pressed	Modes Selected			
	Lateral		Vertical	
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT
TRK Key	Track Select	TRK	Pitch Hold (default)	PIT
LVL Key	Level Hold	LVL	Level Hold	LVL

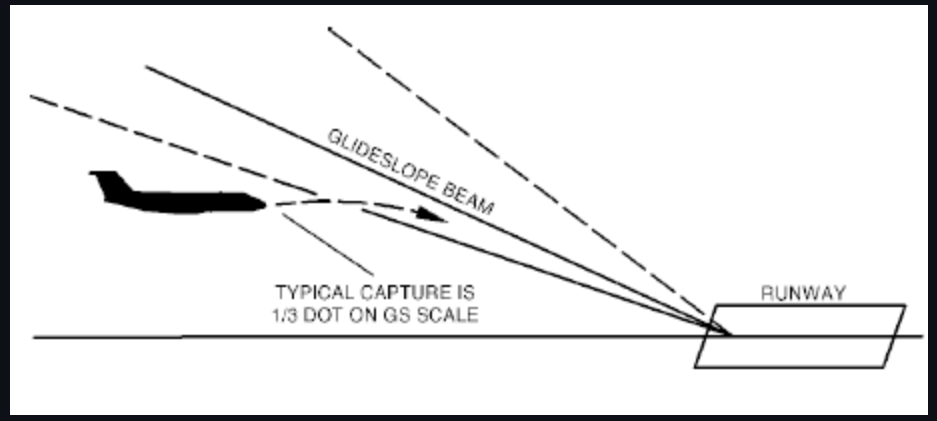
Lateral Modes

Lateral Mode	Control	Annunciation	Maximum Roll Command Limit
Roll Mode	(default)	ROL	30°
Heading Select	**HDG** Key	HDG	30°
Track Select	**TRK** Key	TRK	30°
Navigation, GPS Arm/Capture/Track	**NAV** Key	GPS	30°
Navigation, VOR Enroute and Approach Arm/Capture/Track		VOR	30°
Navigation, LOC Arm/Capture/Track (No Glideslope)		LOC	30°
Backcourse Arm/Capture/Track		BC	30°
Approach, GPS Arm/Capture/Track (Glidepath Mode Automatically Armed, if available)	**APR** Key	GPS	30°
Approach, ILS Arm/Capture/Track (Glideslope Mode Automatically Armed)		LOC	30°
Takeoff or Go Around	**GA** Button	TO or GA	Wings Level
LVL (Level)	**LVL** Key	LVL	Wings Level
ESP Roll Attitude Engagement	ESP Roll Attitude engages at 45°		

Vertical Modes

Vertical Mode	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	(default)	PIT	20° Nose Up 15° Nose Down	0.5°
Selected Altitude Capture	*	ALTS		
Altitude Hold	**ALT** Key	ALT nnnnn		10 FT
Vertical Speed	**VS** Key	VS nnnn	-2000 to +2000 FPM	100 FPM
IAS Hold	**IAS** Key	IAS nnn	65 to 165 KT (75 to 190 MPH)	1 KT (1 MPH)
Vertical Path Tracking (VNAV)	**VNV** Key	VNAV		
VNAV Target Altitude Capture	**	ALTV		
Glidepath	**APR** Key	GP		
Glideslope		GS		
Takeoff or Go Around	**GA** Button	TO or GA	7°	
Level (LVL)	**LVL** Key	LVL	Zero Vertical Speed	
ESP High Pitch Engagement			ESP High Pitch Attitude engages at 20° nose up	
ESP Low Pitch Engagement			ESP Low Pitch Attitude engages at 15° nose down	
ESP High Airspeed Engagement			ESP High Airspeed engages at 176 KIAS (202 MPH)	
ESP Low Airspeed Engagement			When above 200 FT AGL, ESP Low Airspeed engages at 60 KIAS (69 MPH). (This mode only available if height above terrain is available from a compatible Garmin GPS).	

Approach Modes



- APR: Approach mode
  - Follows glideslope and localizer
  - Will only capture glideslope from below
- Note that NAV mode can also be used for approaches without vertical guidance

How to use VNAV Mode

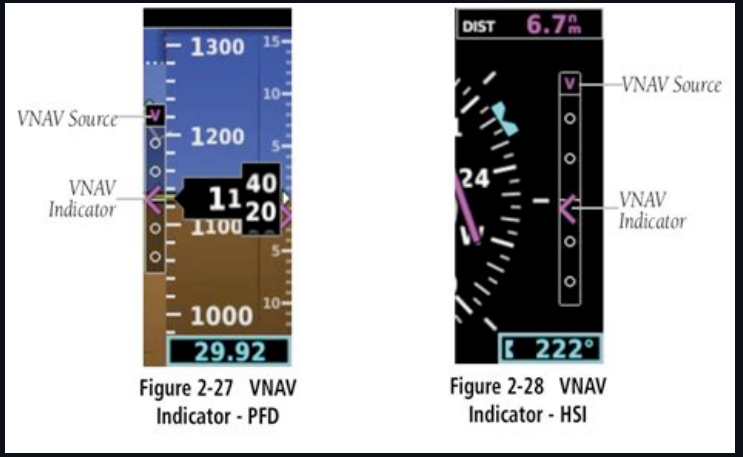


Figure 2-27 VNAV Indicator - PFD

Figure 2-28 VNAV Indicator - HSI

1. Ensure altitudes are configured on the GTN
2. Ensure you're in GPS mode on the CDI
3. Altitude preselect: Set to clearance limit
4. Press the VNAV button to arm VNAV (white VNAV)
5. "Vertical Track" audio alert 1 minute before TOD (similar to a GS capture)
6. Intermediate level offs will show with ALTV annunciation

Note: "VNAV mode will not capture a descending profile unless the selected altitude is valid and at least 75 feet below the current aircraft altitude."

Fully-Coupled Go-Around

- Ensure the missed approach altitude is set in the altitude preselect
- At the go-around point, hit GA switch twice
  - This will put the AP in G/A mode, which pitches up to 7°, wings level
- Switch to IAS or VS mode, as appropriate to follow missed altitudes
- Switch to NAV or HDG mode, as appropriate to follow missed procedure

Summary

- Use autopilot to shed workload in a busy cockpit
- Beware of mode confusion
  - Particularly around PIT and ROL modes (which are usually not what you want)
  - VNAV requires altitude bug set below you at your final altitude
  - Glideslope only capture from below
  - G/A around mode uses 7° nose-up and wings level (with ALT mode armed)