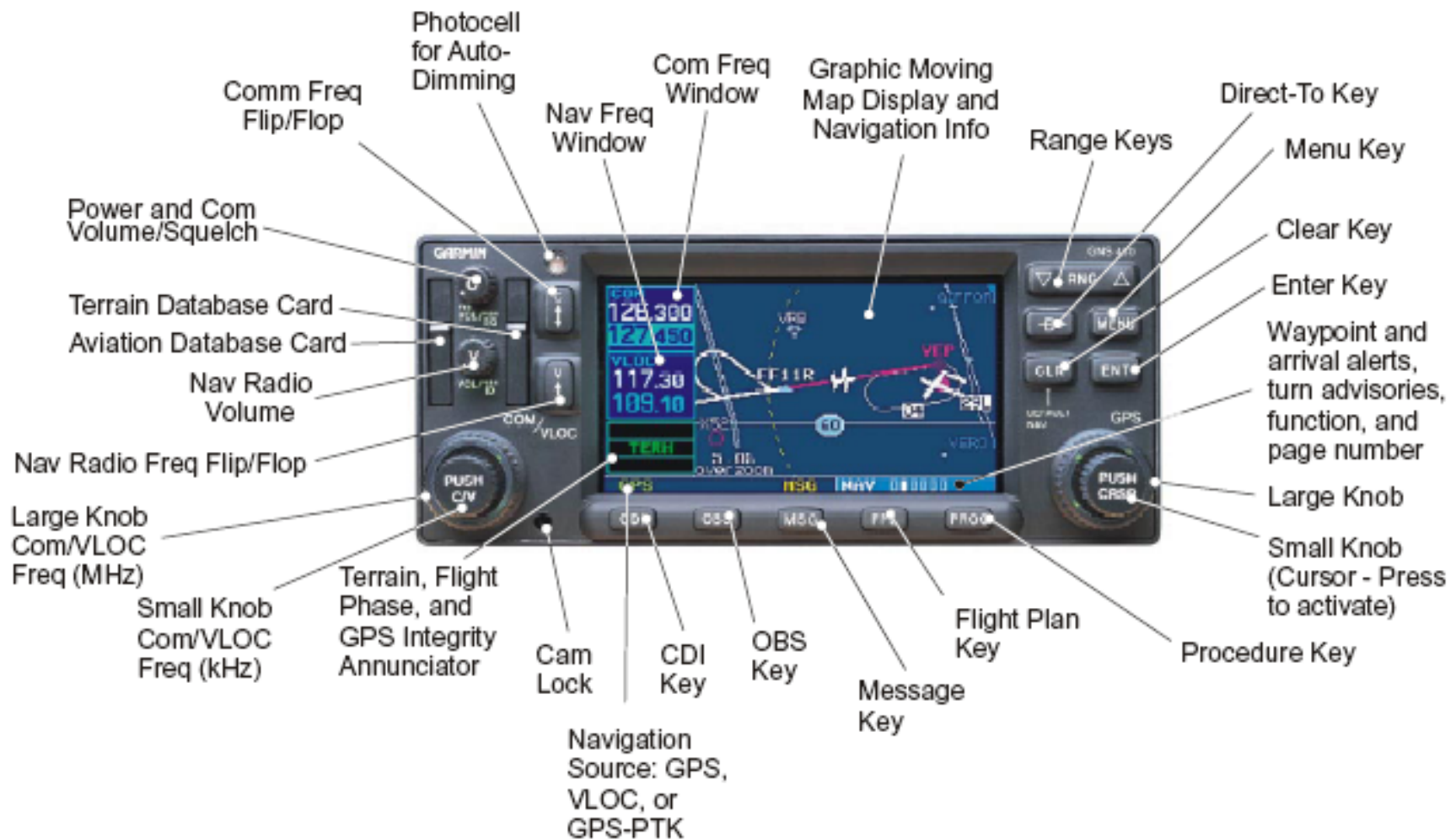


# GPS Training

## Garmin GNS-430W GPS

Cape Air / Nantucket Airlines

# Garmin GNS-430W Panel



# A little bit about the GNS-430W

- The Garmin GNS-430W is a Global Positioning System that is WAAS-enabled.
- It is a variant of the popular GNS-430.
- Copies of manuals are available in the Cape Air Training Department.

# Unit Boot Sequence

- The GNS-430W has its power supplied by the AVIONICS MASTER switch
  - During an electrical fire, the unit can be independently switched OFF by turning the “C” knob on the left side of the panel all the way to the left until it clicks.
  - Cape Air reserves this power control to electrical fire situations only!

# Unit Boot Sequence

- A series of screens will appear. These screens will auto-sequence.
- While the screens are auto-sequencing, the GPS is conducting a self-test of its internal components.
- The screens will stop at a screen with some dates on it.





# Unit Boot Sequence

- The dates are the valid dates of the GPS' Navigation and Terrain and Obstacles databases.
- Cape Air only keeps the Navigation database current.
- If the database is not current, contact MOC.
  - YOU MAY NOT USE THE GPS FOR NAVIGATION!!



# Unit Boot Sequence

- A flashing cursor will appear in the bottom right of the screen asking to acknowledge that the database is current.
- To acknowledge that the database is current, press the “ENT” (Enter) key on the right side of the panel.

# Unit Boot Sequence

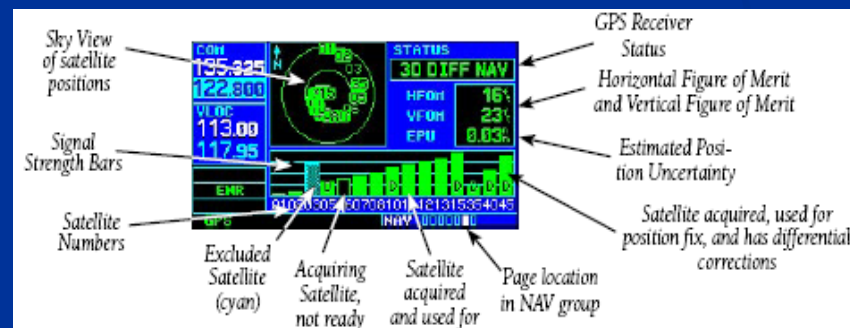
- The next screen will be the Instrument Panel Self-Test screen.
- Verify that all instruments are in the prescribed positions.
- Acknowledge by pressing ENT.





# Unit Boot Sequence

- The next screen is the Acquiring Satellites page. (Same as NAV-6, will be discussed later)
- This screen will auto-sequence when a position has been calculated and verified.
- The next page you will see is NAV-2.



# NAV/COM

- The COM window is located on the top left of the screen
- The NAV window is located right below it
- The active (ACTV) frequency is on top and the standby (STBY) is on the bottom.



# NAV/COM

- To switch between ACTV and STBY frequencies, press the “arrow button” next to the window.
- To tune frequencies, turn the large knob for the whole numbers, and turn the small knob for the decimal numbers.
- To send the cursor down to the NAV window, press the “PUSH C/V” button



# NAV/COM

- To adjust volume on the COM, turn the “C” knob
- To adjust volume on the NAV, turn the “V” knob
- To “break squelch”, press in on the “C” knob
- To identify a NAVAID, press in on the “V” knob



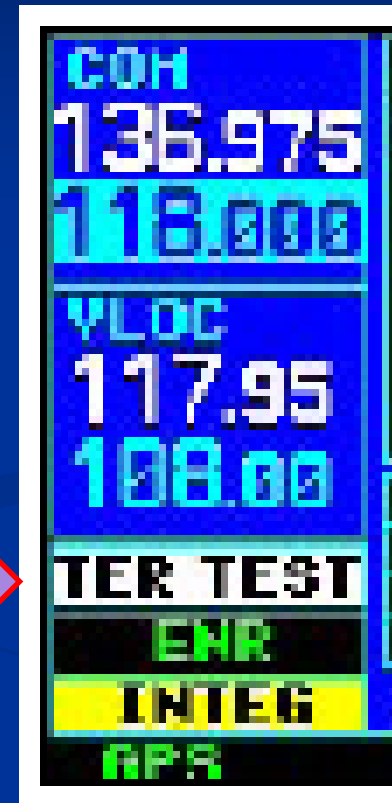
# NAV/COM

- While transmitting, a “TX” will appear in the top right of the COM window
- While receiving, a “RX” will appear in the same place
- While identifying a NAVAID, an “ID” will appear in the top right of the NAV window



# Annunciators and Buttons

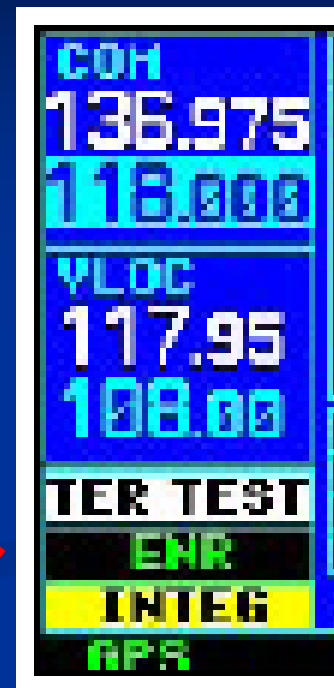
- Three rectangular boxes
  - Terrain
  - Flight Phase
  - RAIM
- Terrain annunciator will illuminate whenever there is impending danger of flight into terrain.





# Annunciators and Buttons

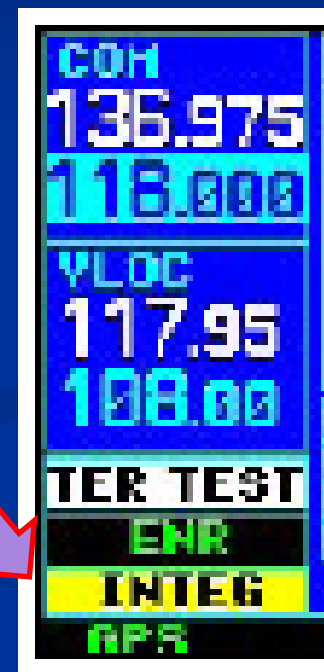
- Flight Phase annunciator tells you what mode the GPS is set in
  - Important to know because of different CDI sensitivities
- The most common ones you will see are:
  - ENR — enroute - +/- 2nm
  - TERM — terminal - +/- 1nm (annunciates within 30 nm of airport)
  - LNAV, LNAV+V, L/VNAV, LPV deal with approaches
    - LNAV, LNAV+V, and L/VNAV are +/- .3nm



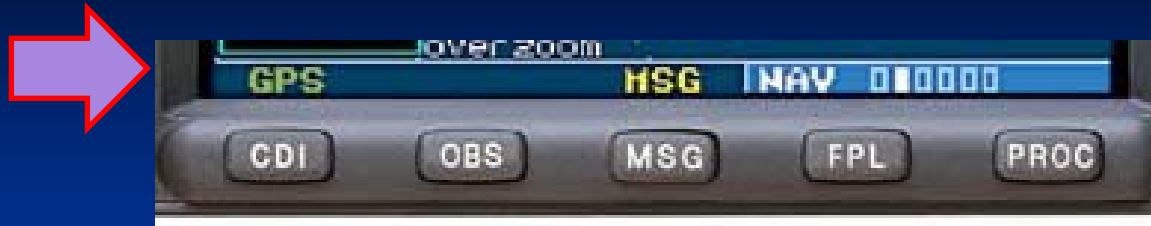
LPV approaches, like ILS and Localizer approaches, get more sensitive as you get closer to the runway.

# Annunciators and Buttons

- RAIM annunciator will illuminate whenever RAIM is lost
- If you lose RAIM, immediately contact ATC and begin use of a secondary method of navigation
- If the RAIM annunciator comes on, you have been without RAIM for 5 minutes! Verify your location before making course changes



# Bottom Row Annunciators and Buttons



- NAV source annunciator will show either “GPS” in green, “VLOC” in white, or “GPS-PTK” in green.
  - GPS means that your CDI is receiving its data from the GPS
  - VLOC means that your CDI is receiving its data from the VLOC frequency (i.e.: ILS, VOR, etc.)
  - GPS-PTK means that your CDI is receiving its data from an offset GPS course
    - You must program this mode, so unless you know how to use it, you shouldn't see this!

# Bottom Row Annunciators and Buttons



- The CDI button directly under the NAV source annunciator controls where the CDI is receiving its data.
- If using GPS enroute and will follow with an ILS approach, when tuning the localizer frequency, make sure to select VLOC mode.
  - Try and make this part of your flow... tune the frequency, identify the Morse code, select GPS or VLOC, and twist in the final approach course
  - “Tune, identify, select, twist”

# Bottom Row Annunciators and Buttons



- The OBS mode annunciator and the button serve two purposes.
  - One is the GPS's ability to use any waypoint as a VOR by assigning 360 radials off of the waypoint.
  - The second deals with suspending automatic waypoint sequencing. This will be discussed later.
- If OBS mode is selected ON, in the space directly above the OBS button, a green "OBS" will appear (not pictured)

# Bottom Row Annunciators and Buttons



- The Message annunciator will illuminate anytime there is a GPS-produced message for the crew, such as a reminder to set an HSI course, that the aircraft is approaching an airspace (approaching BOS Class B), or other programmed messages.
- If a message is present, the “MSG” annunciator will flash.
- To read the message, press the MSG button
- To go back to the previous screen, press the MSG button again. If nothing was done to correct for the message, the annunciator will remain ON.



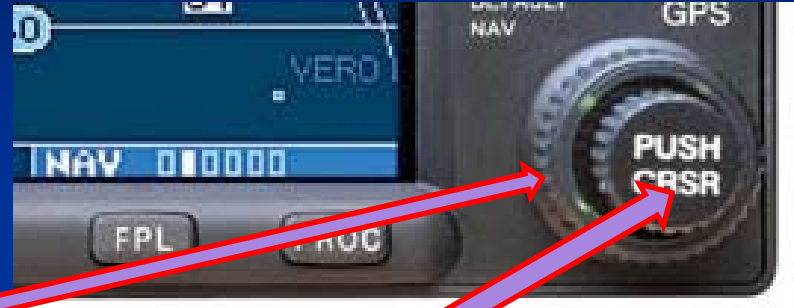
# Bottom Row Annunciators and Buttons and the “Blue Bar”



- The FPL and PROC buttons deal with navigation, and will be discussed later.
- The “Blue Bar” shows the different chapters and pages available in the GNS-430W.
- The white letters show you which chapter you are viewing.
- The white rectangles show you which page of the chapter you are viewing.
  - Currently, you are viewing Navigation chapter page 2, or NAV-2

# Chapters and Pages

- To change from one chapter to another, turn the large knob on the bottom right of the panel.
- To change between pages, turn the small knob.



# NAV-1 – CDI Page

- Digital CDI with scale info
- Which leg of a flight plan you are on
- Distance to go
- Desired track
- Bearing
- Groundspeed
- Track
- Estimated Time Enroute



The NAV-1 Page is the Default NAV page. If you ever get lost in any of the menus, press and hold the CLR button located on the right side of the panel for 2 seconds and you will go back to the NAV-1 page.

# NAV-2 – Moving Map Page

- Moving map of the area around the aircraft and the flight plan
- Shows airports, VOR's, NDB's, airspace, intersections, bodies of water, roads, and railroads.



This page features a “Declutter” function. There are three levels of “declutter”. To use this function, press CLR and one level of declutter will turn on. Repeat as necessary. If you press for two levels of declutter, next to the range value (50nm as depicted above), a -2 will appear, showing “50nm-2”.

# NAV-3 – Terrain and Obstacles

- Shows location and proximity of terrain and obstacles based on the track of the flight.
- If terrain is yellow, use caution in proceeding.
- If terrain is red, there is an imminent danger of impact.
  - Terrain/obstacle above or within 100 feet below current aircraft altitude will be shown in red.



Terrain/obstacle between 100 feet and 1000 feet below the aircraft altitude will be shown in yellow.

**WARNING: Terrain databases are NOT maintained for currency in Cape Air aircraft!**

# NAV-4 – Frequency Page

- Provides a list of all frequencies used at a specific airport
- This menu can be used to “auto-tune” the frequencies
  - To do this, turn to NAV-4
  - Activate the cursor by pressing in on the small right knob
  - Scroll down using the large knob
  - Press ENT and the freq. moves into COM STBY.

COM	ARRIVAL	KLYH	Public
132.725			
135.400	ATIS		119.800
VLOC	Approach	Info?	125.475
113.30	Approach	Info?	135.000
109.00	Tower		127.650
	Unicom		122.950
TERH			
GPS	NAV	000	000



# NAV-5 – Compass Page

- Provides a digital compass
- Track
- Groundspeed
- Altitude
- LAT / LONG position
- Time
- Position in radial and distance from a selected airport



# NAV-6 – Satellite Signal

- Shows the signal strength of satellites in bar graph form
- The status is important to take note of... good SA tool.



# NAV-7 – Vertical Navigation

- Provides descent planning information for the pilot based on criterion set by the pilot.



# WPT-1 – Airport Page

- Provides airport facility name
- Position – LAT/LONG
- Airport elevation
- Fuel available?
- Approach available and type?
- Radar available?
- Type of airspace?

COH	APT	KPHX  Public	
127.650	FACILITY & CITY NAME		
118.000	PHOENIX SKY HARBOR INTL		
VLOC	PHOENIX AZ		
109.00	POSITION	ELEV	FUEL
117.80	N 33°26.06'	1135'	Avgas
	W112°00.69'		Jet
ENR	APR	ILS	RADAR Yes ARSPC B
GPS	WPT 0000000000		

# WPT-2 – Runway Info

- Provides runway information
- Length and width
- Type of surface
- When is it available?
- Map showing runway layout



To select runway:

1. Select WPT-2 page
2. Activate cursor (press small right knob)
3. Turn left knob to put cursor on runway numbers
4. Scroll with small knob to select runway
5. Press ENT and small right knob to deactivate cursor.

# WPT-3 – Airport Frequency

- Provides frequency information
- Can also be used for “auto-tuning”
- Different from NAV-4 in that you can select any airport, not just the one you are travelling to.

APT KPHX Public

COH	118.000
VLOC	113.00
ENR	111.10
GPS	119.800
Unicom	122.950
FSS	122.200
FSS	122.600
Departure Info?	118.100
Departure Info?	119.200

GPS 119.800 APT 0000000000

# WPT-4 – Instrument Approach

- Provides a layout of the approach, including IAF, IF, FAF, and MAP.
- To select approach and transition, follow the same method for selecting runway on WPT-2
- To load into the active flight plan, press MENU and press ENT.



# WPT-5 – STARs and Arrivals

- Provides a layout of Instrument Arrival procedures, including the arrival, the transition, and the runway of intended landing.
- To load into active flight plan, press MENU and press ENT.





# WPT-6 – Instrument Departures

- Provides a layout of Instrument Departures from the selected airport, including the departure, runway, and transition.
- To load into the active flight plan, press MENU and press ENT.



# WPT-7 – Intersection Page

- Provides information about a selected intersection, including name, region, LAT/LONG position, as well as the nearest VOR identifier, and radial and distance from that VOR.



# WPT-8 – NDB Page

- Provides information about a selected NDB, including name, location, LAT/LONG position, frequency, and services (HIWAS, AWOS, ASOS, etc.)

CDN	NDB	AM	<00>
120.200	FACILITY, CITY & REGION		
69.100	PICNT		
WUC	TAMPA FL		
113.25	SE USA		
117.80	POSITION		FREQ
TERM	N 27°51.07'		300.0
	W082°32.75'		Max Brdcast
GPS	WPT 000000000000		

# WPT-9 – VOR Page

- Provides information about a selected VOR, including identifier, name, type of VOR (Term, Low, High), region, variation, LAT/LONG position, and frequency.



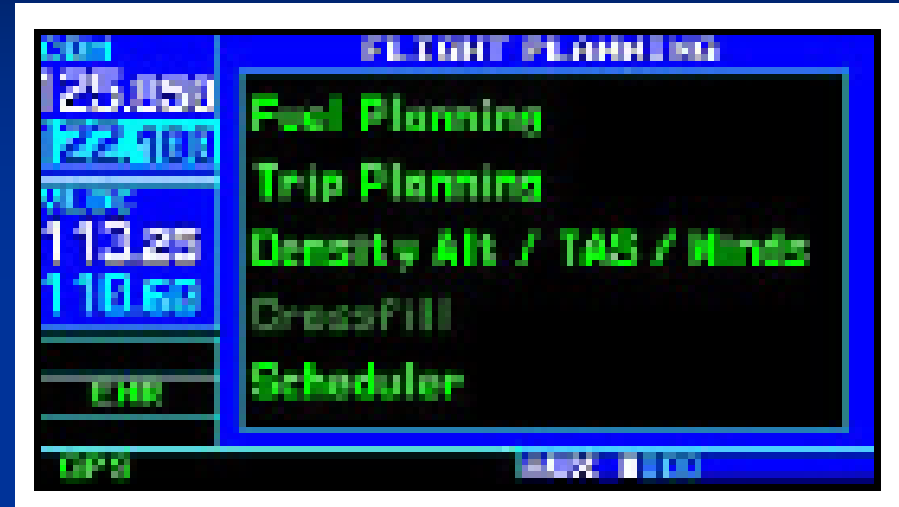
# WPT-10 – User-defined Waypoints

- Provides information about user-defined waypoints.

ECH	WPT H08SC		
123.000	REF LPT	RAD	DIS
122.950	BVDAM	160.00	7.00
116.40	RZC	071.40	
116.40	POSITION		
116.40	N 35°19.01'		Modify?
116.40	H08SC 40.00'		
116.40	WPT 116.40		

# AUX-1 – Flight Planning Menu

- Provides tools that can be used in flight planning, including fuel planning, trip planning, tools to determine winds aloft, TAS, and density altitude, scheduled reminders



# AUX-2 – Utility Page

- Provides utility-type options for use when required, including checklists, flight timers, trip statistics, RAIM prediction, and sunrise/sunset data.
- Eventually, abnormal checklists may be programmed in the GPS, but for now, **NO CHECKLISTS WILL BE LOADED!**



**NORMAL OPERATIONS  
FLOWS AND  
CHECKLISTS WILL NOT  
BE LOADED IN THE GPS**

# AUX-3, AUX-4 – General Options Menus

- These provide general options for programming the GPS
- THESE SETTINGS SHOULD NOT BE CHANGED BY THE FLIGHT CREW!



Setup 1



Setup 2



# NRST-1 – Nearest Airport

- Provides information about airports closest to the aircraft in flight, including identifier, bearing, distance, type of approach available, frequency, and runway length.

NEAREST AIRPORT			
APT	BEG	DIS	APP
K83	149%	9.0%	VFR
rel	122.900	rev	3100'
KPMB	875%	13.0%	RNA
uni	122.800	rev	3999'
90K	204%	15.7%	VFR
rel	122.900	rev	3375'

GPS

**NOTE:** In an emergency situation where travelling to the nearest airport is required, SPIN THE LARGE RIGHT KNOB ALL THE WAY TO THE RIGHT! That will bring you right to the NRST-1 Page!

# NRST-2 – Nearest Intersection

- Provides information about the nearest intersection, including bearing and distance.

The screenshot shows a navigation system interface. On the left, a vertical panel displays 'CDN 125.050', '122.470', 'VLOC 113.25', '110.60', and 'ENR'. The main display area is titled 'NEAREST INTERSECTION' and contains a table with three columns: 'INT', 'BRG', and 'DIS'. The table lists five intersections: KOSHO, CONUT, TAYUD, PINER, and VIBUT, each with an upward arrow icon, a bearing, and a distance. At the bottom, a status bar shows 'GPS' and 'HEADING 100.1'.

NEAREST INTERSECTION		
INT	BRG	DIS
KOSHO ↑	051°	12.3%
CONUT ↑	017°	15.6%
TAYUD ↑	095°	16.0%
PINER ↑	095°	16.1%
VIBUT ↑	121°	18.6%

GPS HEADING 100.1

# NRST-3 – Nearest NDB

- Provides information about the nearest NDB, including the identifier, bearing, distance, and frequency.



NEAREST NDB				
NDB	BKG	DLS	FREQ	
FNB	078°	13.7%	404.0	
AFK	358°	33.6%	347.0	
MYZ	248°	36.6%	341.0	
HMB	283°	42.4%	263.0	
AZW	098°	45.9%	233.0	

# NRST-4 – Nearest VOR

- Provides information about the nearest VOR, type of VOR (VOR, TACAN, VORTAC), including identifier, bearing, distance, and frequency.

CON	NEAREST VOR			
125.850	VOR	BKG	BIS	FREQ
122.100	PWE +	298°	17.1%	112.40
FLC	RBA ⊖	115°	24.7%	108.20
113.25	BIE ⊖	287°	42.5%	110.00
110.00	STJ +	090°	44.0%	115.50
	TOP +	160°	57.0%	117.00
END				
OFF				

# NRST-5 – Nearest User-defined WPT

- Provides information about the nearest user-defined waypoint.

NEAREST WAYPOINT		
WPT	RNG	DIS
STPRV	125	4.3
-----	-----	-----
-----	-----	-----
-----	-----	-----
-----	-----	-----

# NRST-6 – Nearest ARTCC

- Provides information about the nearest ARTCC, including frequency, bearing, and distance.



# NRST-7 – Nearest FSS

- Provides information about the nearest FSS, including transmit and receive frequency, bearing, and distance.



# NRST-8 – Nearest Airspace

- Provides information about the nearest airspace, including name, location relative to the aircraft, and time to the airspace.





# Right Side Buttons

- The RNG (Range) key increases or decreases the distance covered on the NAV-2 and NAV-3 pages.
  - Range values from 500 feet to 2000 miles are available.
- The MENU button selects a menu of context applicable options for the active page.



# Right Side Buttons

- The ENT button works to select or acknowledge a question or prompt in the GPS.
- The CLR button works to “go back” one screen
  - Also, press and hold for 2 seconds and the NAV-1 page will appear.



# Right Side Buttons

- The large knob allows you to move between chapters, to scroll down a menu, or to move from one character to another.
- The small knob allows you to move between pages and to select letters.
- To activate or deactivate a cursor, press the small knob.



# Direct-to Navigation

- Direct-to navigation allows the user to proceed direct to a waypoint from the present position.
- To use direct-to navigation, press the direct-to button.



# Direct-to Navigation

- The Select Direct-to Waypoint page will appear.
- Use the right-side knobs to select your waypoint
  - You must put a “K” before an airport code in the continental 48 states or ICAO identifier, as applicable
  - Otherwise, it may display a VOR with the same three-letter identifier
  - This is not necessary with alpha-numeric codes (9G3, 4V4, etc.)



# Direct-to Navigation

- Press ENT
- A cursor will activate in the bottom right of the screen asking “Activate?”
- Press ENT again.



# Direct-to Navigation

- Whichever NAV page was previously selected will appear (usually NAV-1 or NAV-2)
- The DTK (Desired Track) should be selected on the HSI
- The magenta line shows the course over the map
  - Do not follow this line as your primary source of navigation! Always use the HSI!



# Flight Plan Navigation

- Allows the user to define a route of flight by using many different waypoints over a wide area.
- Flight plans can include Inst. Departures, enroute waypoints, STARs, and approaches.
- You can plan your entire flight in the GPS!

ACTIVE FLIGHT PLAN			
KMCI / KSLE			
WAYPOINT	DTK	DIS	
KMCI			
KRAP	303°	319°	
KBIL	287°	257°	
KGEK	277°	387°	



# Flight Plan Navigation

## ■ To use Flight Plan

- Press FPL button
  - Active Flight Plan screen will display (will be empty)
- Activate cursor
- Input your point of origin (KBOS, KACK, KHYA, etc.)
- Press ENT twice
- Input your next waypoint
- Press ENT twice
- Repeat as necessary



ACTIVE FLIGHT PLAN

WAYPOINT	DTK	DIS
KMCI		
KRAP	303°	319°
KBIL	287°	257°
KGEG	277°	387°

GPS FPL 00

NOTE: When flying along a Victor airway, input the identifiers of each beginning and end point. For example, "BOS-ACK". The GPS will not recognize "V141" if put into the GNS-430W.

# Flight Plan Navigation

- When the flight plan is set up as desired, press the FPL button and you will return to the previous screen viewed.
- Turn to the NAV-2 page and verify that the route is pointing you in the right general direction.
  - Make sure it is not taking you to Nebraska when you want to go to SLK!

CDN		ACTIVE FLIGHT PLAN		
125.850	122.100	00	KNCI / KSLE	
VLOC		WAYPOINT	DTK	DIS
113.25	110.60	KNCI		
		KRAP	303°	319°
		KBIL	287°	257°
		KEGG	277°	387°
ENR				
GPS		IFPL 00		

# Flight Plan Navigation – Stored Routes

- Eventually, some flight plans may be stored in the GNS-430W Flight Plan Catalog.
- These routes will typically be the longer routes (BOS-SLK, BOS-RUT, ALB-OGS, etc.)



If these routes are available to you, **USE THEM ONLY IF ATC CLEARS YOU “AS FILED”!!!!!!** If you receive a different clearance, **make a new flight plan!**

# Flight Plan Navigation – Stored Routes

- To access the Flight Plan Catalog, press FPL and turn the small right knob once to the right.
- Activate the cursor and scroll down to the desired flight plan
- Press MENU and scroll to select “Activate Flight Plan?”
- Press ENT



**DO NOT MAKE ANY CHANGES TO THE STORED ROUTES!** Also, before activating for use, always verify that no changes have been made to the stored routes!

# STARs

- To select a STAR from the Active Flight Plan Page
  - Press MENU, scroll down to “Select Arrival?”, press ENT and follow through the menus
- To select a STAR from elsewhere
  - Select WPT-5 page and follow through the menus



# Approaches

- To select an approach
  - Press PROC (Procedure) button
  - Press ENT to select “Select Approach?”
  - Scroll down to the desired approach
    - Some will have a small “GPS” next to them – you can use the GPS as the primary source of navigation for these
  - Press ENT



# Approaches

- Select your desired transition (IAF) or “VECTORS” if receiving vectors to final
- Press ENT
- A cursor will ask you if you want to “Load?” or “Activate?”
  - Load the approach if you have not yet been cleared for the approach or have not been given a vector.



If you have been cleared for the approach, then select “Activate?”. This will provide a direct-to line to the IAF selected, or if VECTORS was selected, an infinite magenta line will appear from the FAF outbound along the final approach course on NAV-2.



# Approaches

- To activate an approach once it has been loaded, press PROC and scroll to select “Activate Approach?” or “Activate Vector-to-Final?”
- Press ENT



**IF THE APPROACH SELECTED IS A GPS APPROACH, MAKE SURE THAT THE CDI BUTTON IS SELECTED TO “GPS”!!!!**



# Approaches

- While on the approach nearing a turn (IAF to IF on a standard “T” GPS approach), the GPS will provide turn assistance instructions over the “blue bar”
- In the same space, the GPS will give holding assistance on a GPS hold (missed approach waypoint on a GPS approach)

# Approaches – GPS

- As you proceed inbound on the approach, you should check the following items
  - Within 2 nm of the FAF, the GPS Flight Phase Indicator should cycle into an approach mode (LNAV, LNAV+V, L/VNAV, LPV)
  - The GPS does not have any RAIM warnings
  - Check the scale of the CDI on NAV-1

# Approaches – Flight Phase Indicator

- LNAV – Lateral NAVigation – use LNAV mins.
- LNAV+V – Lateral NAVigation with some Vertical guidance – USE LNAV MINS!!!
- L/VNAV – Lateral and Vertical NAVigation – use L/VNAV mins.
- LPV – Localizer Precision with Vertical navigation – use LPV mins.
  - LPV approaches will get you the lowest of any GPS approach. Sometimes however, ILS approaches can get you lower, so please refer to your approach charts.

# Approaches – GPS

- If at anytime during the approach, the GPS loses RAIM, IMMEDIATELY EXECUTE A MISSED APPROACH!
- Once a GPS tells the pilot that RAIM has been lost, RAIM has been lost for 5 minutes!
  - This is programmed in so that if RAIM was lost inside of the FAF, the approach could be continued with reasonable assurance of location.

# Approaches – GPS

- If you execute a missed approach (for any reason), proceed to the missed approach point and complete the first direction of the textual missed approach procedure on the approach chart.
- At the missed approach point, a “SUSP” annunciator will appear above the OBS button. Press the OBS button to resume automatic waypoint sequencing.
- The GPS will navigate you along the missed approach procedure.

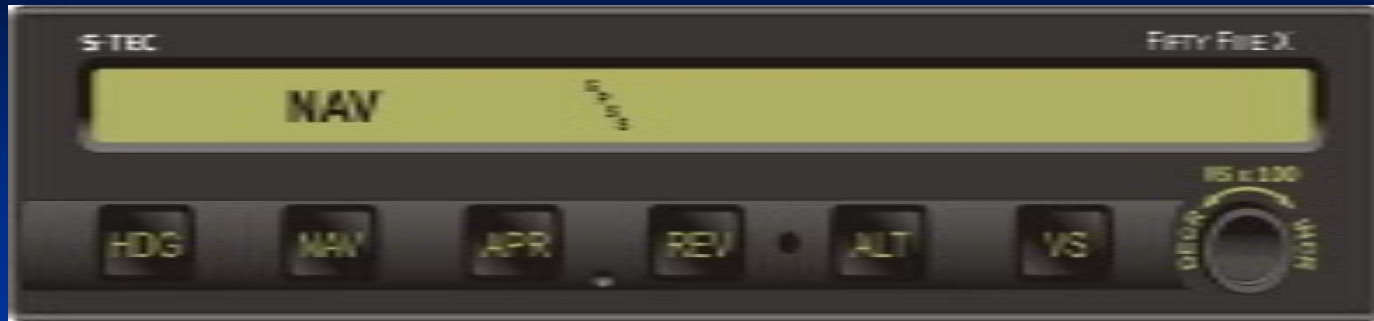
# Approaches – non-GPS

- Non-GPS approaches can be loaded in the GPS, but these can only be used for supplemental navigation and situational awareness purposes.
- If you are going to load a non-GPS approach, make sure that the CDI button is selected to “VLOC”
- Non-GPS approaches are best utilized with the NAV-2 page open on full declutter

# Use of the GNS-430W with Autopilots

- Cape Air has 5 different types of autopilots, each of which can be combined with the GNS-430W.
- For the most part, the use of autopilots with the GPS is straight-forward.
- For the Cessna 400B and 400IFCS, King KFC-200, and the STEC-55, set the autopilot in NAV mode and verify that the CDI annunciator says “GPS”. If it does not, press the CDI button and you will be navigating based on the GPS.

# Use of the GNS-430W with Autopilots



- For the STEC-55X, procedures are a little different due to an extra feature of the 55X
- The 55X features a “GPS Steer” mode, where the autopilot receives its course correction information straight from satellites, not the CDI.
- To activate GPSS, simply press NAV twice.
- One great use is the autopilot will fly a GPS hold for you if in GPSS mode!



THANK YOU FOR YOUR ATTENTION!

Any questions can be directed to the  
Cape Air Training Department!