Cessna FITS Accepted Training Program

Cessna/Garmin G1000 Integrated Cockpit System

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Welcome

- **Thank You** for flying a new Cessna Aircraft!
- You are now members of the Cessna Family!
  - Largest manufacturer of general aviation aircraft in the world
  - 80 years producing over 175,000 airplanes
  - Superior Product Support
- We are committed to your total satisfaction!

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Introductions

- Name
- Home Airport
- Background and Experience

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Ground Training

Module I

Classroom

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Agenda

- Classroom
  - Training Approach
  - Display Overview
  - Operational Basics
  - Flight Director/Autopilot Introduction
- Lab
  - System Configuration
  - Flight Scenario 1

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Training Overview

- Ground Training: Modules I and II
  - Guided discussions in classroom environment
  - Interactive demonstrations and exercises in lab environment
- Flight Training:
  - VFR Flight
  - IFR Flight (appropriately rated)
  - Abnormal Procedures Flight
  - All flights will follow FITS philosophy

(Optional High Altitude training can be incorporated during the flight training for turbo-charged aircraft customers.)

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What is FITS?

- FAA/Industry Training Standards (FITS)
  - This program is a partnership between the FAA and the Industry.
  - FITS training is non-regulatory.

- FITS is focused on the redesign of general aviation training.
  - FITS prepares pilots to better use all of the airplane's capabilities in day-to-day operations.
  - Instead of training pilots to pass a practical test, FITS will use scenario-based training to expertly manage real-world challenges.
  - Accomplished without compromising basic stick and rudder skills.
    - There is still relevance to task-based training.

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FITS Course Certificate

Presented to

Name Here

attended the TAA transition course for the CE-182 Skylane*

15th day of June 2004

Ground/Flight Instructors

Single Engine Pilot Training Supervisor

*TAA – Technically Advanced Aircraft

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Agenda

- Classroom
  - Training Approach
  - Display Overview
    - Flight Instruments
    - PFD
    - MFD
  - Operational Basics
  - Flight Director/Autopilot Introduction
- Lab
  - System Configuration
  - Flight scenario 1

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Flight Instruments

Traditional Panel Layout vs. G1000 Display

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Airspeed Display – Current Airspeed

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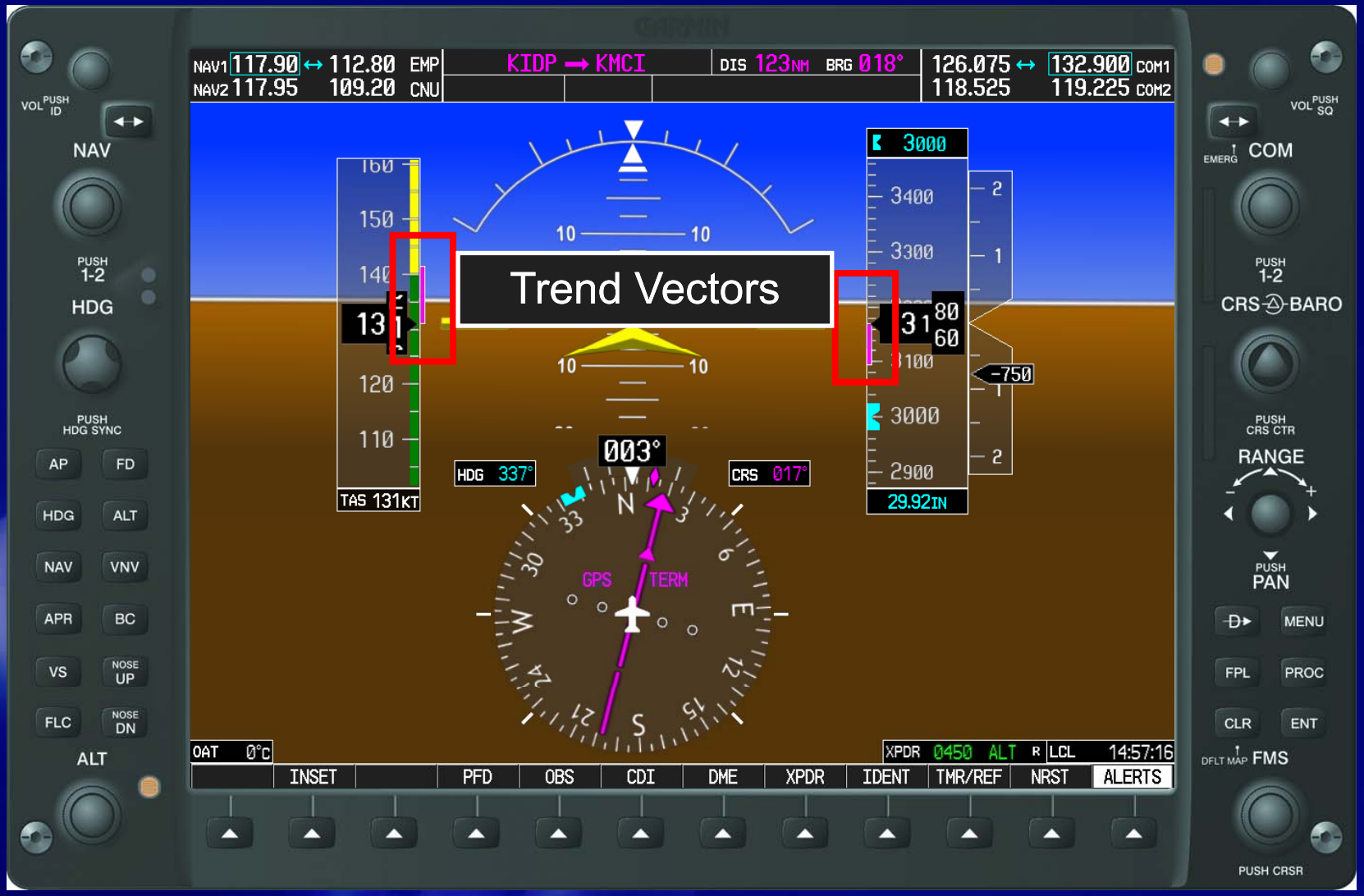
Airspeed Display – Trend Vectors



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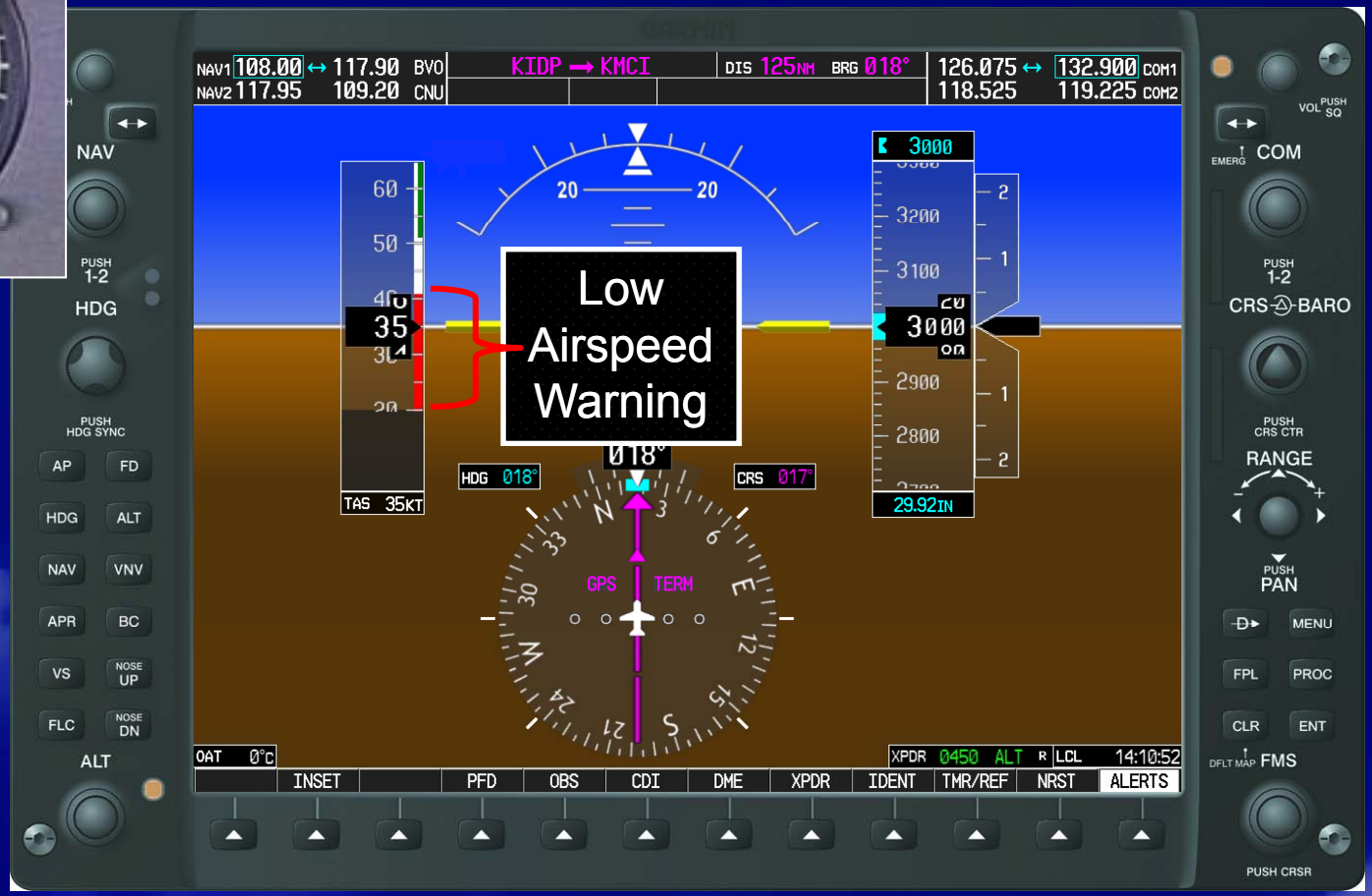
Airspeed Display – Color Markings



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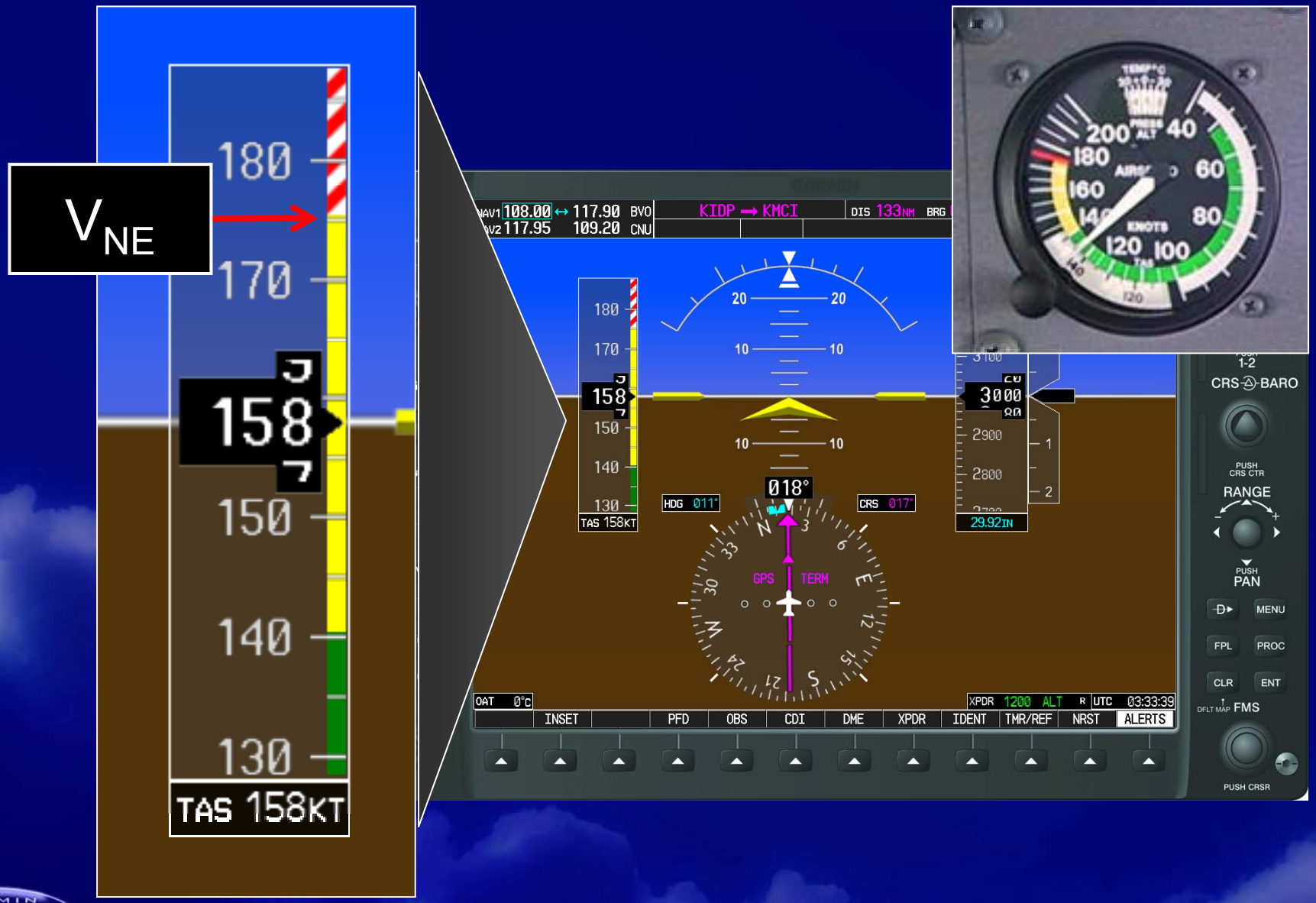

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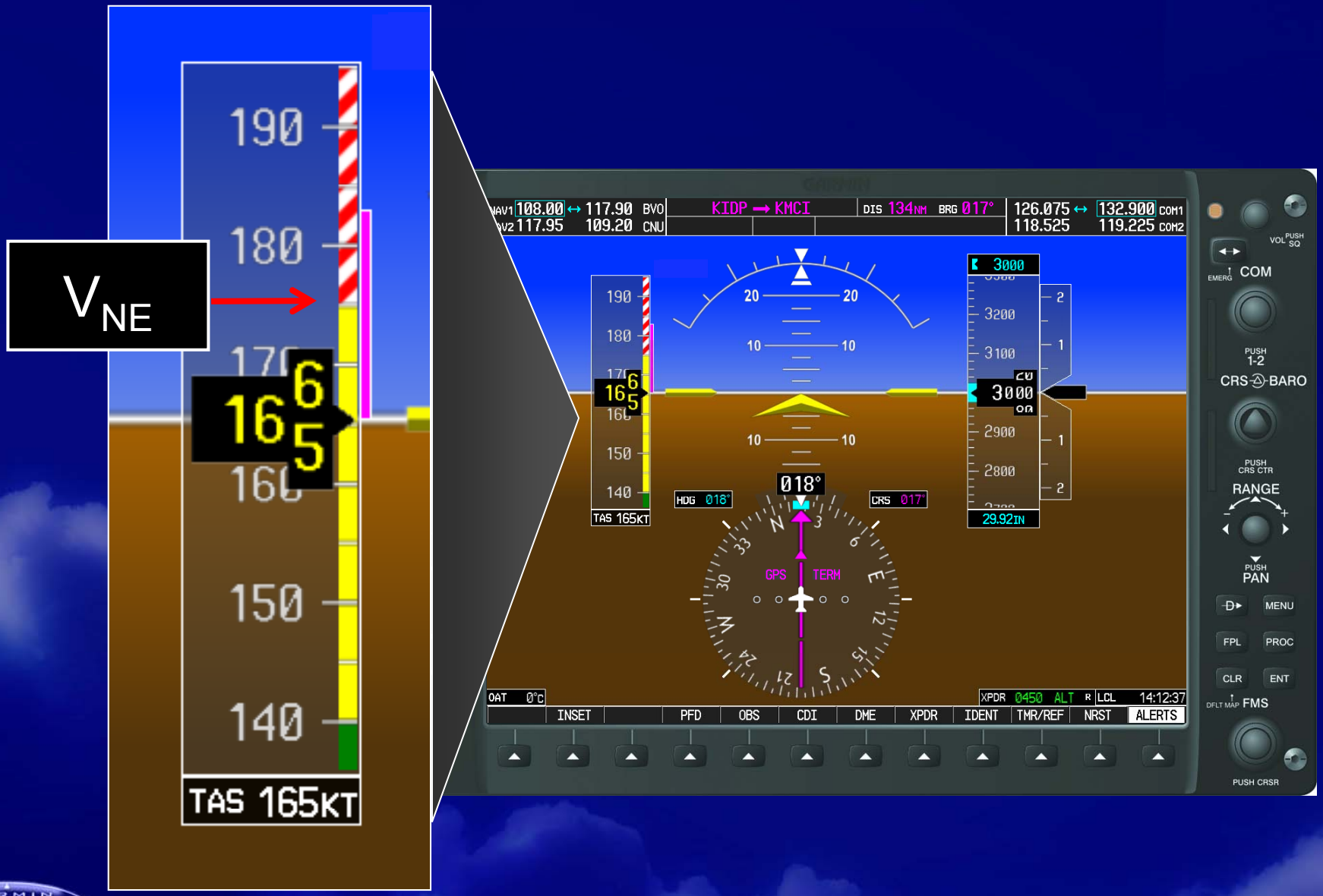

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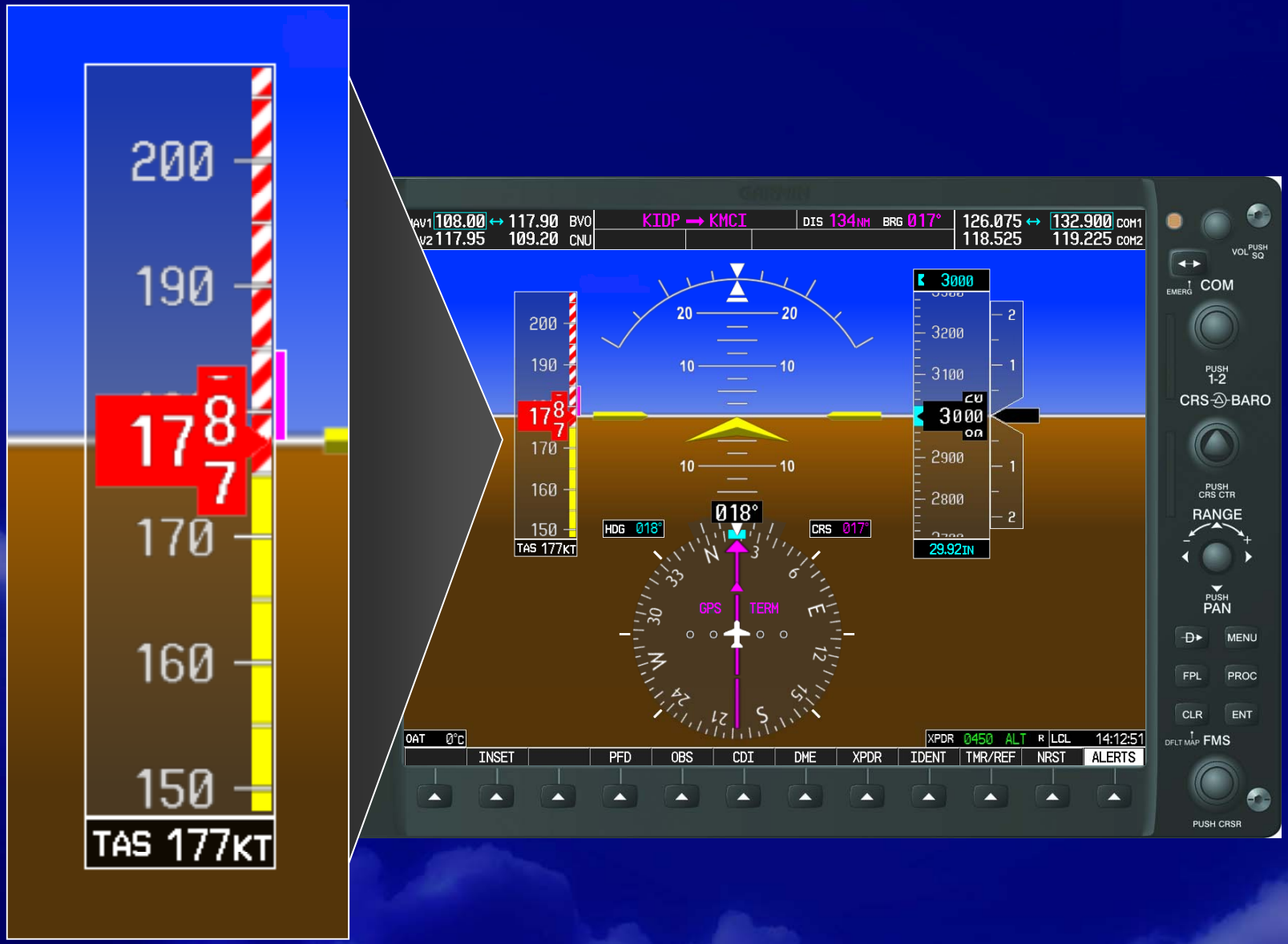

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Airspeed Display – Vspeed References

Vspeed References

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Airspeed Display – Vspeed References

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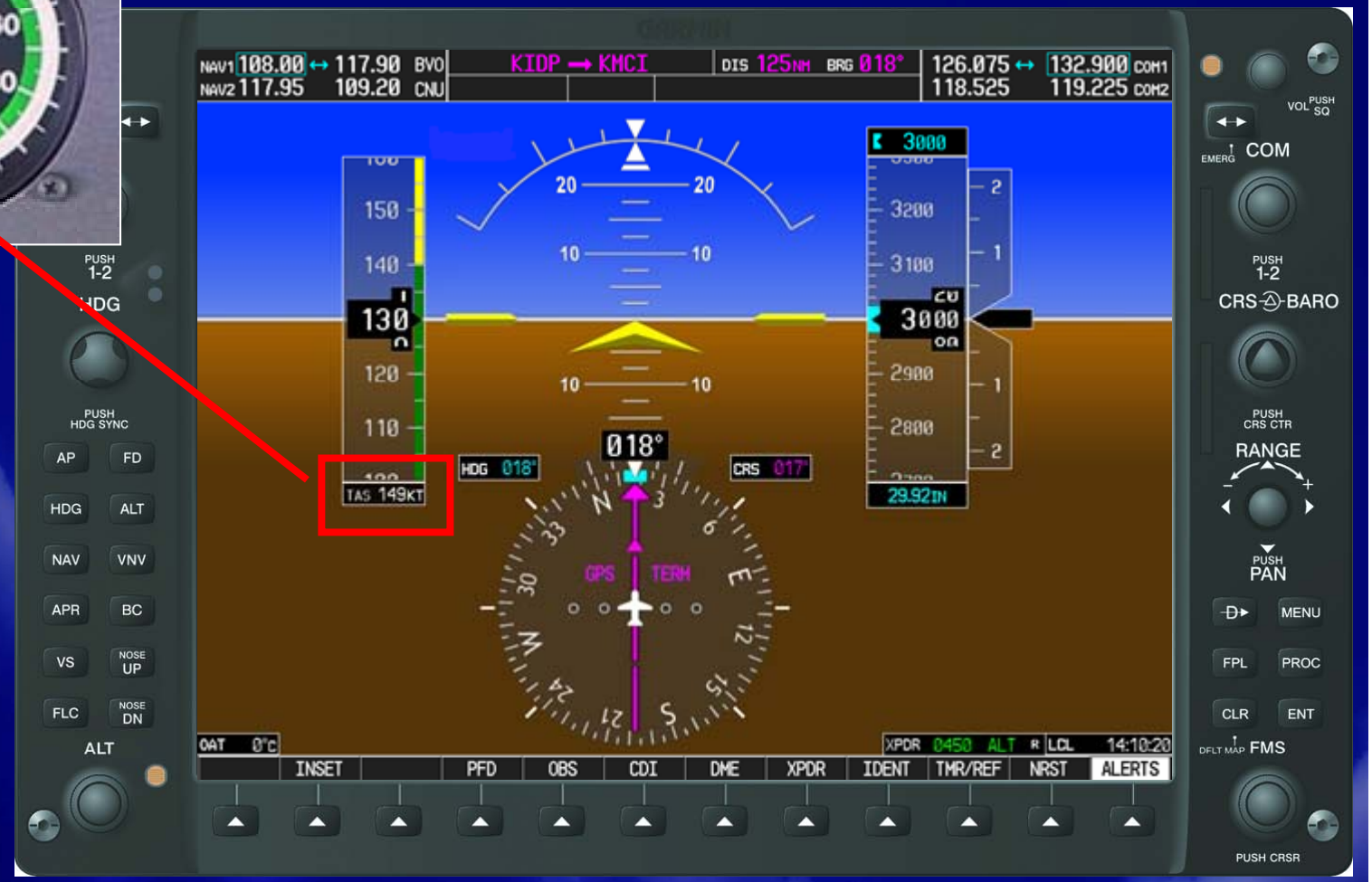
Airspeed Display – TAS Indication



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Altitude Display

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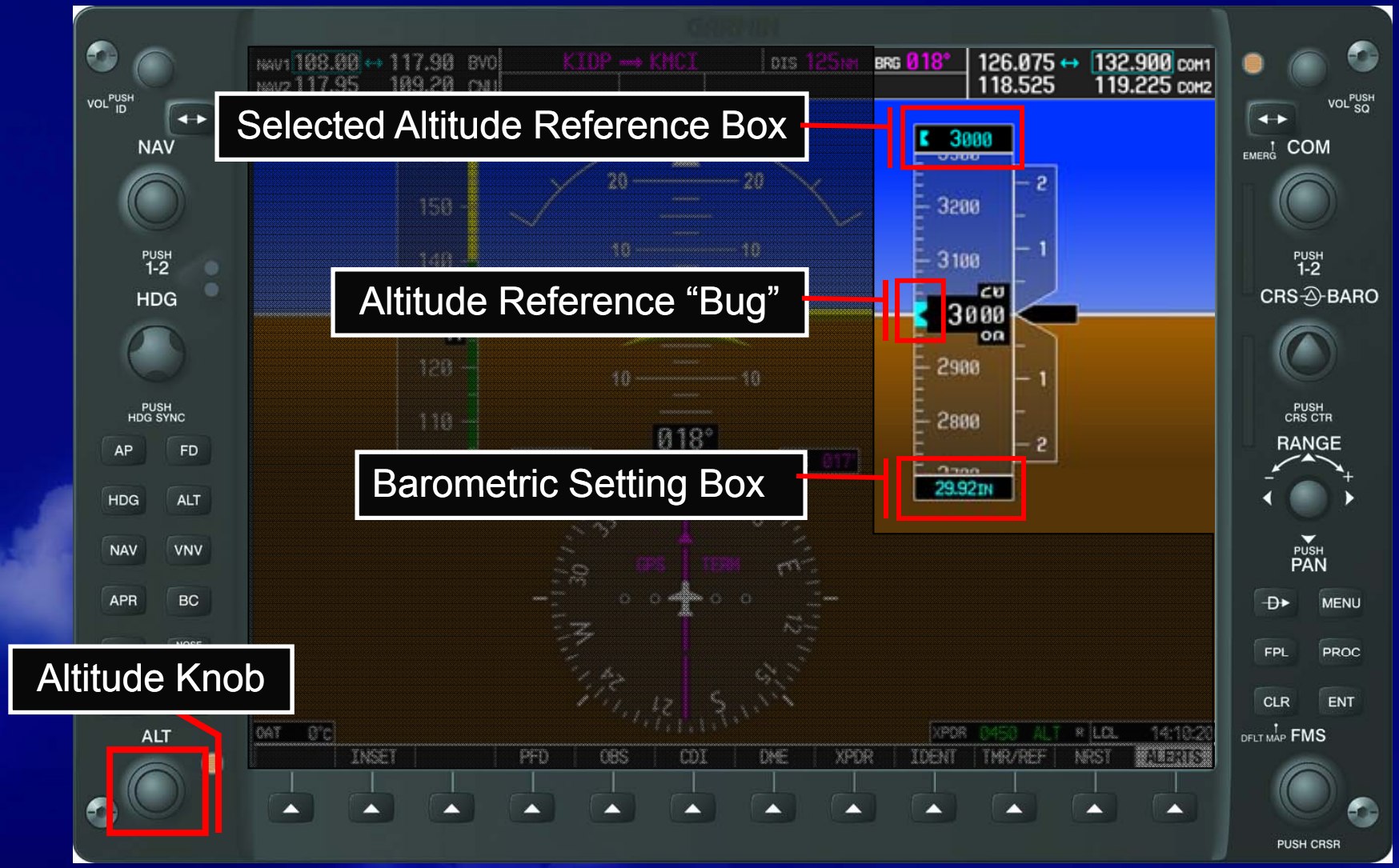
Altitude Display



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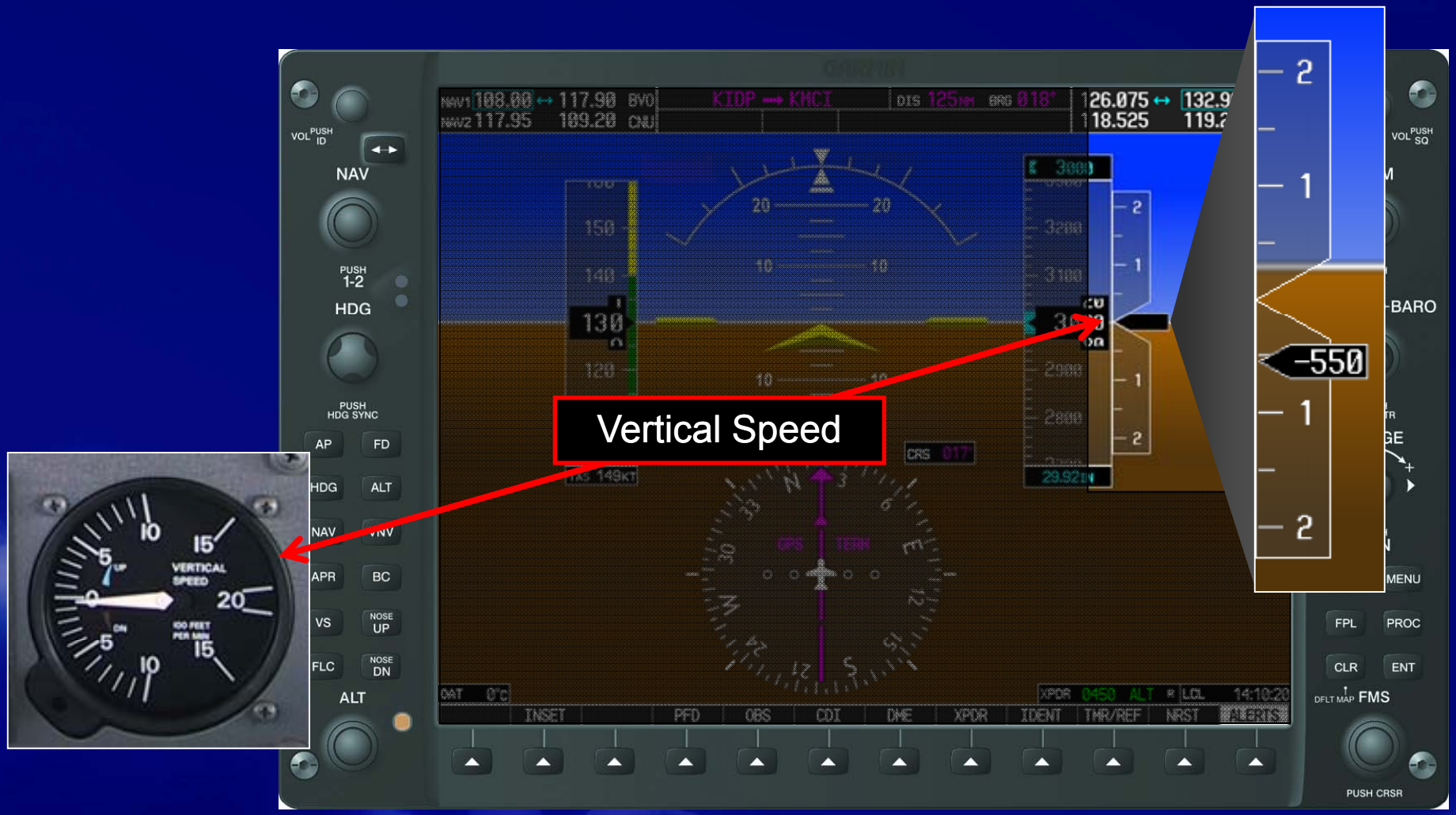
Vertical Speed Display



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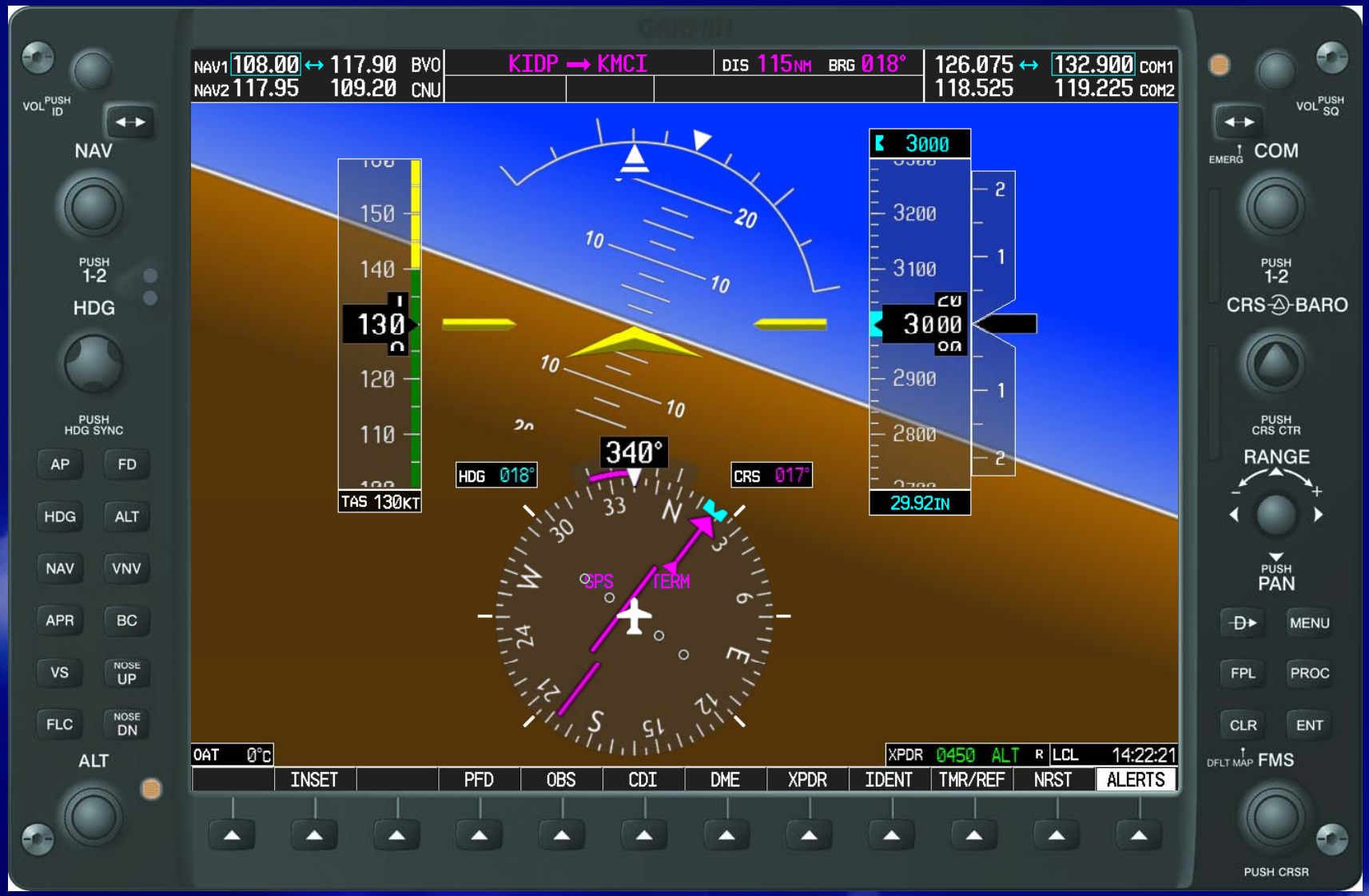
Primary Attitude Display



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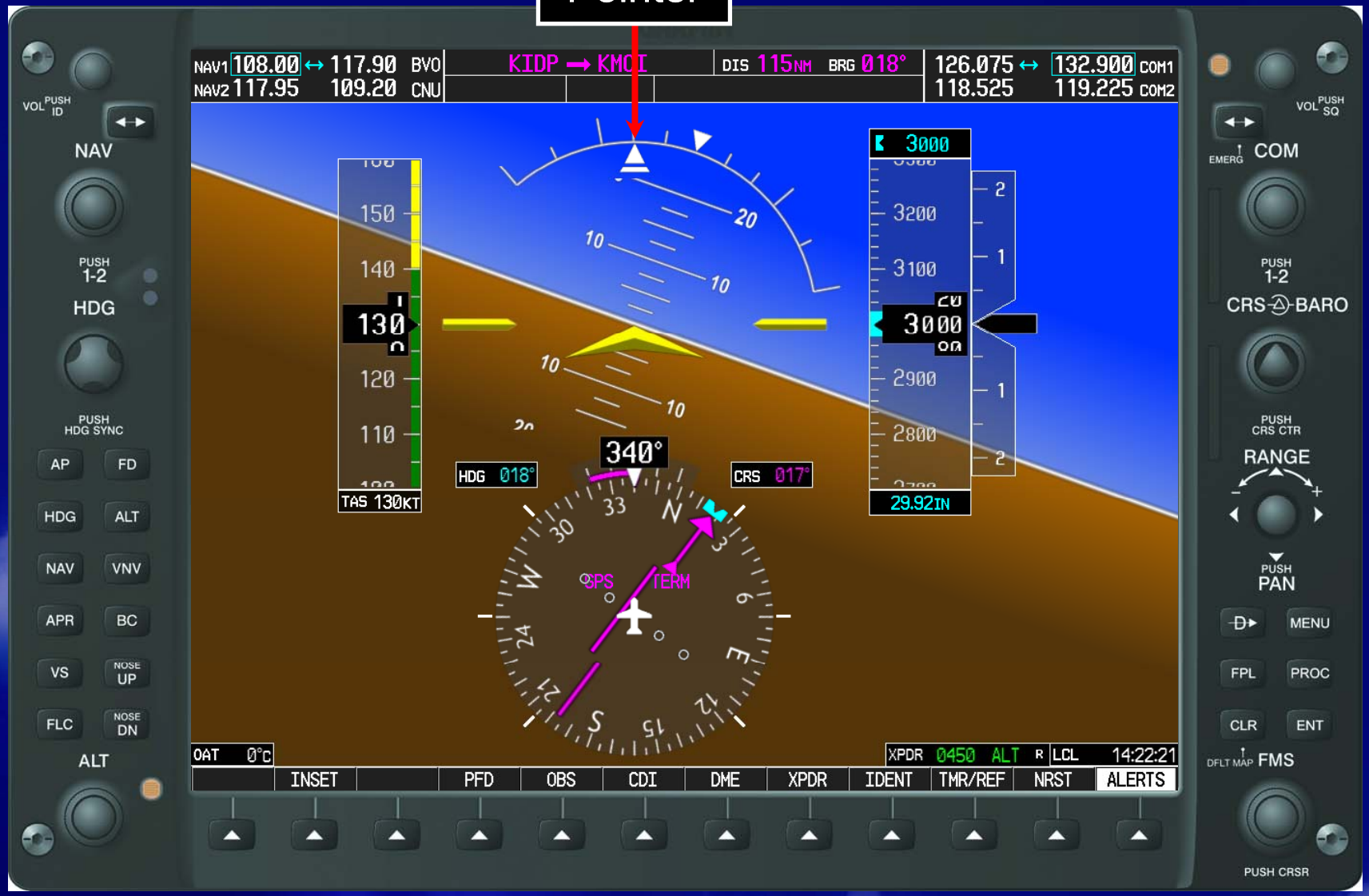
Pointer



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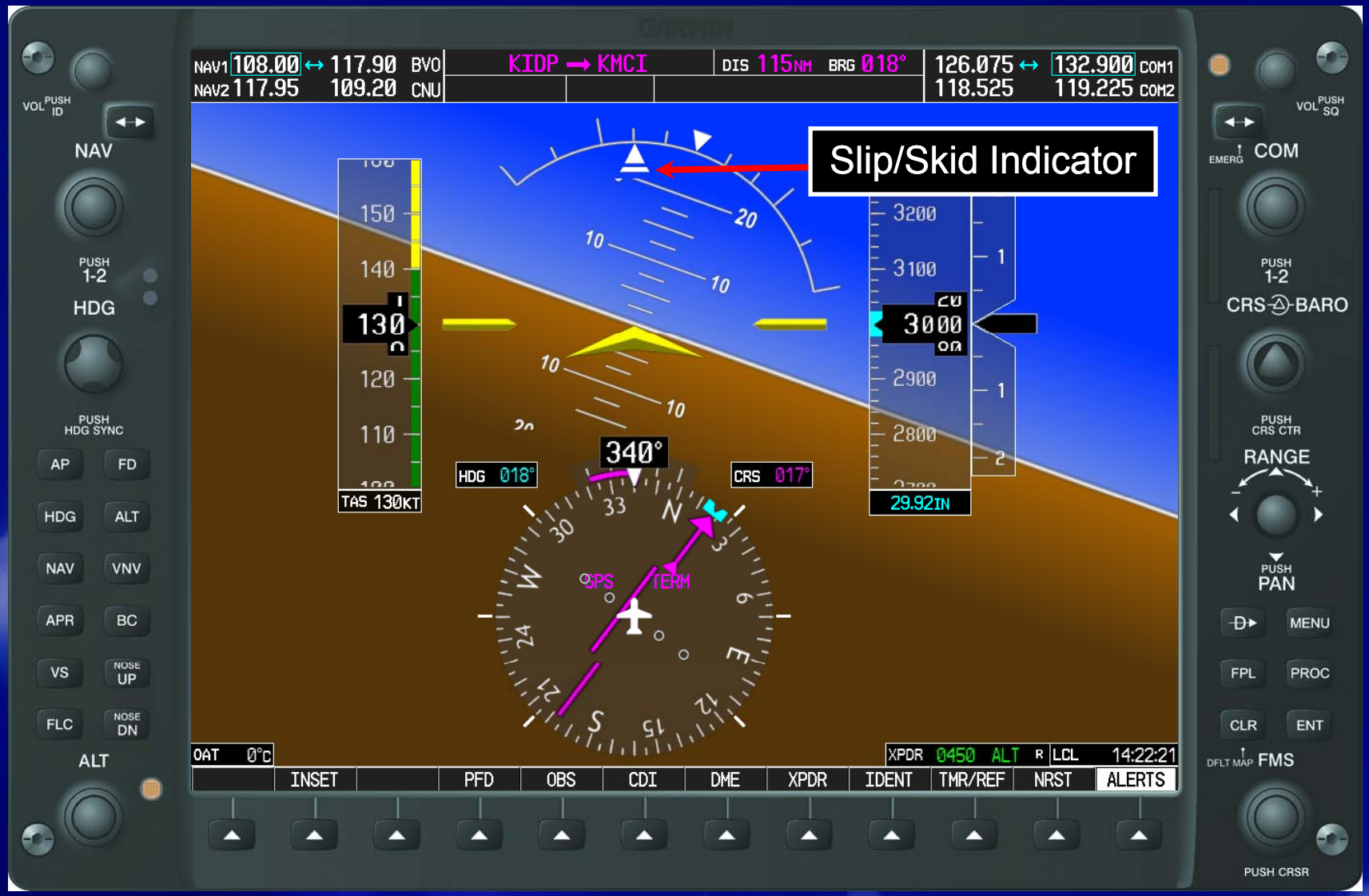

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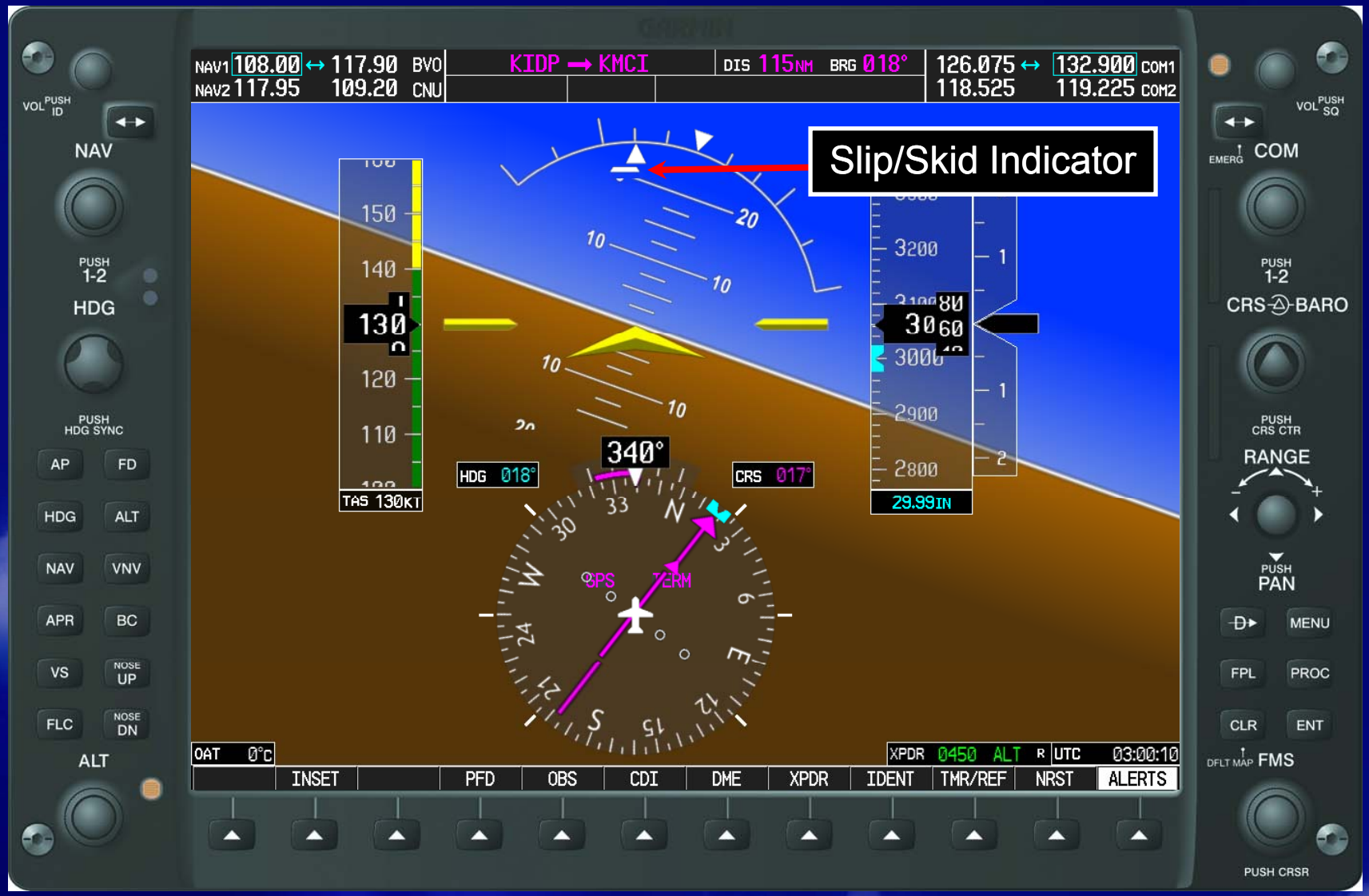

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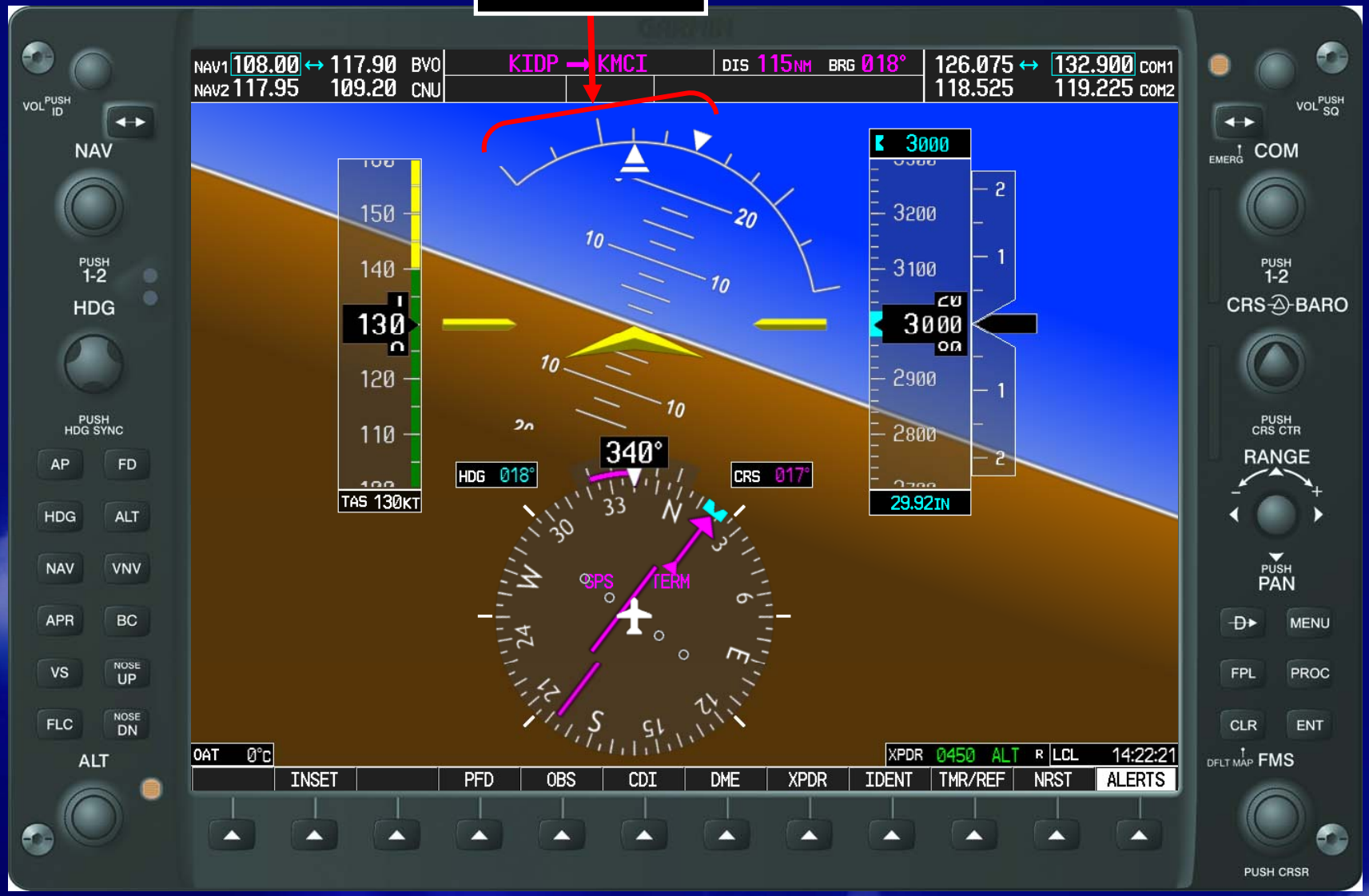
Roll Scale



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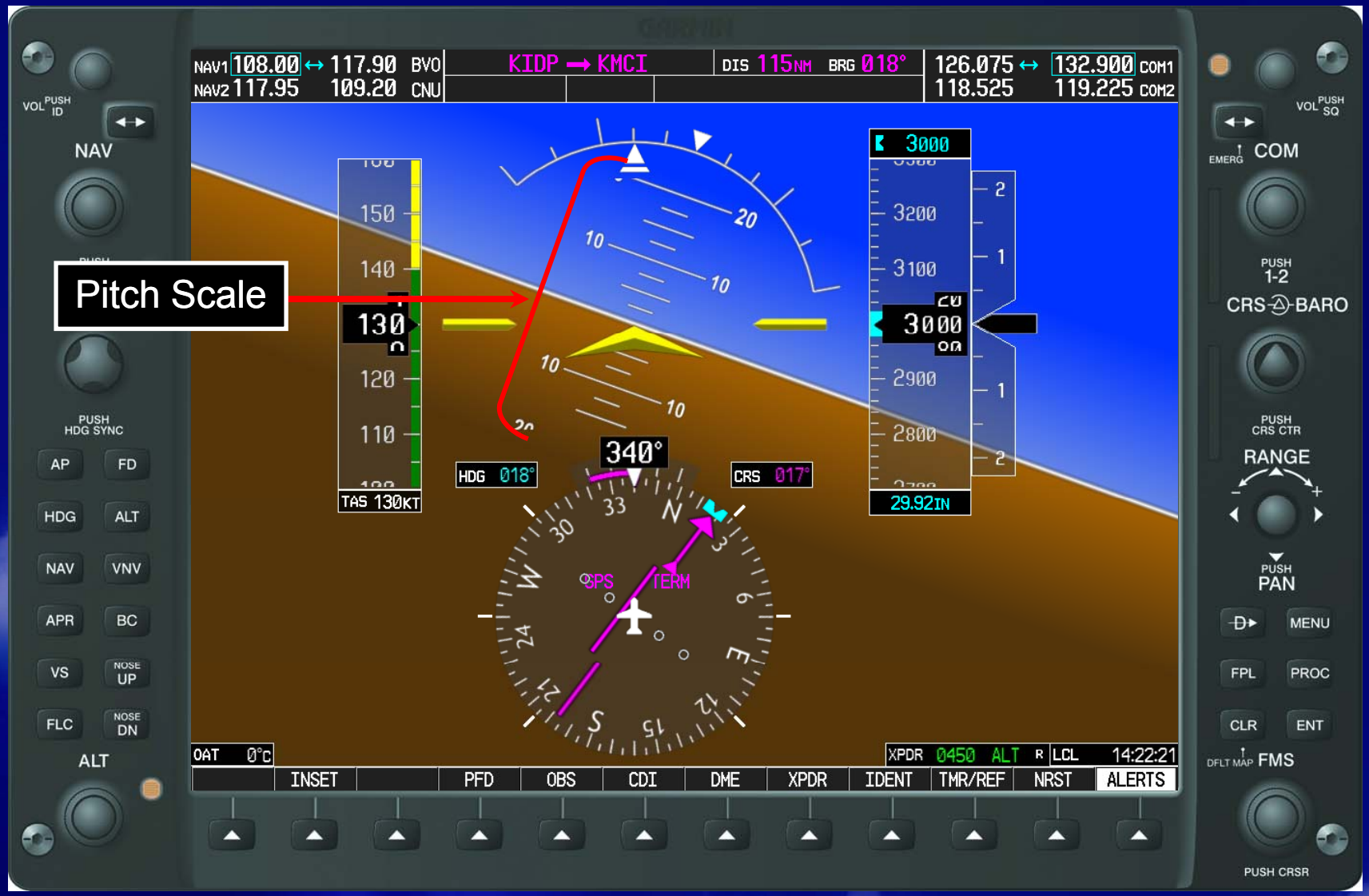

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Chevron for Nose Low Attitude

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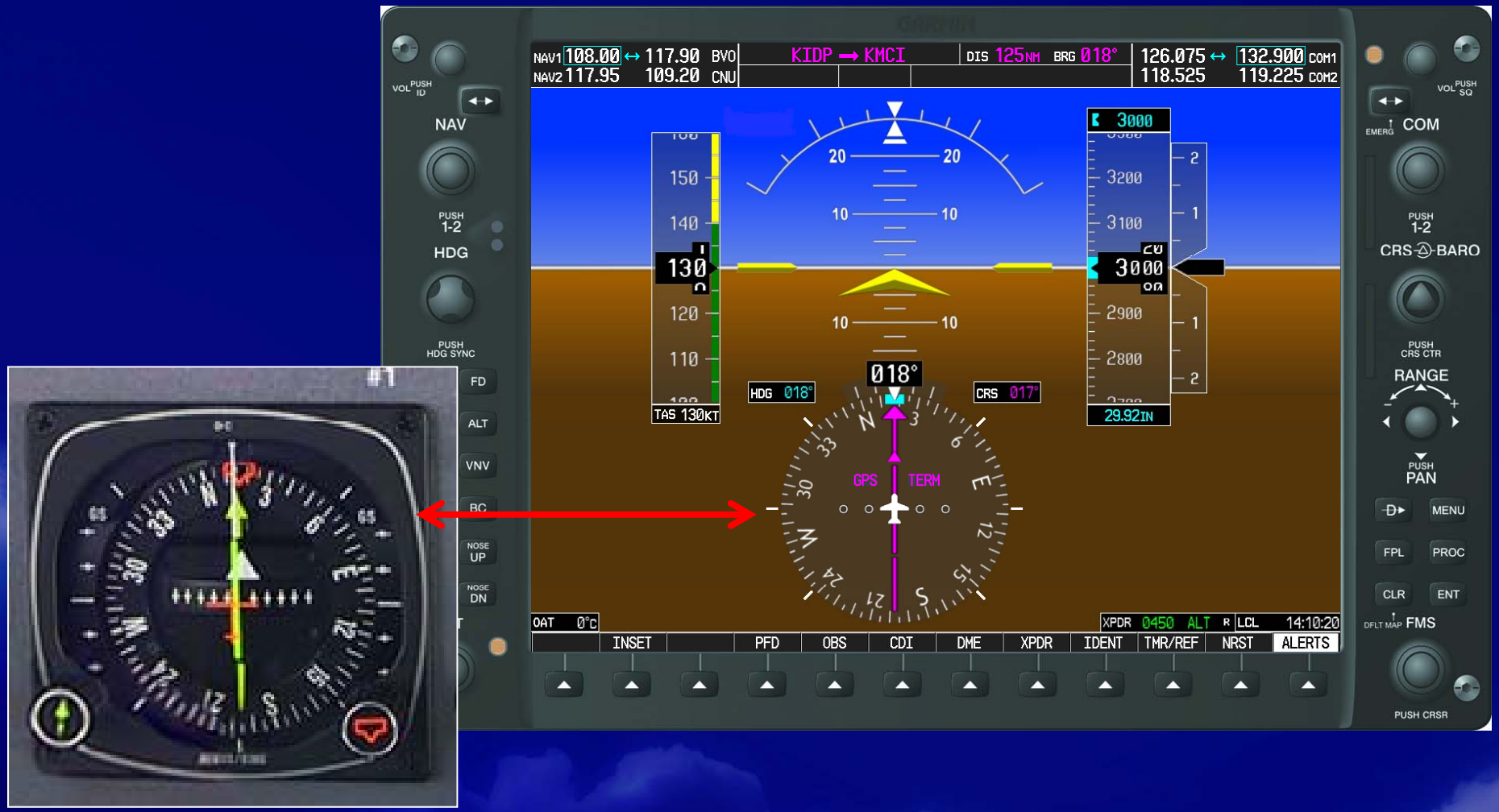
Horizontal Situation Indicator - HSI



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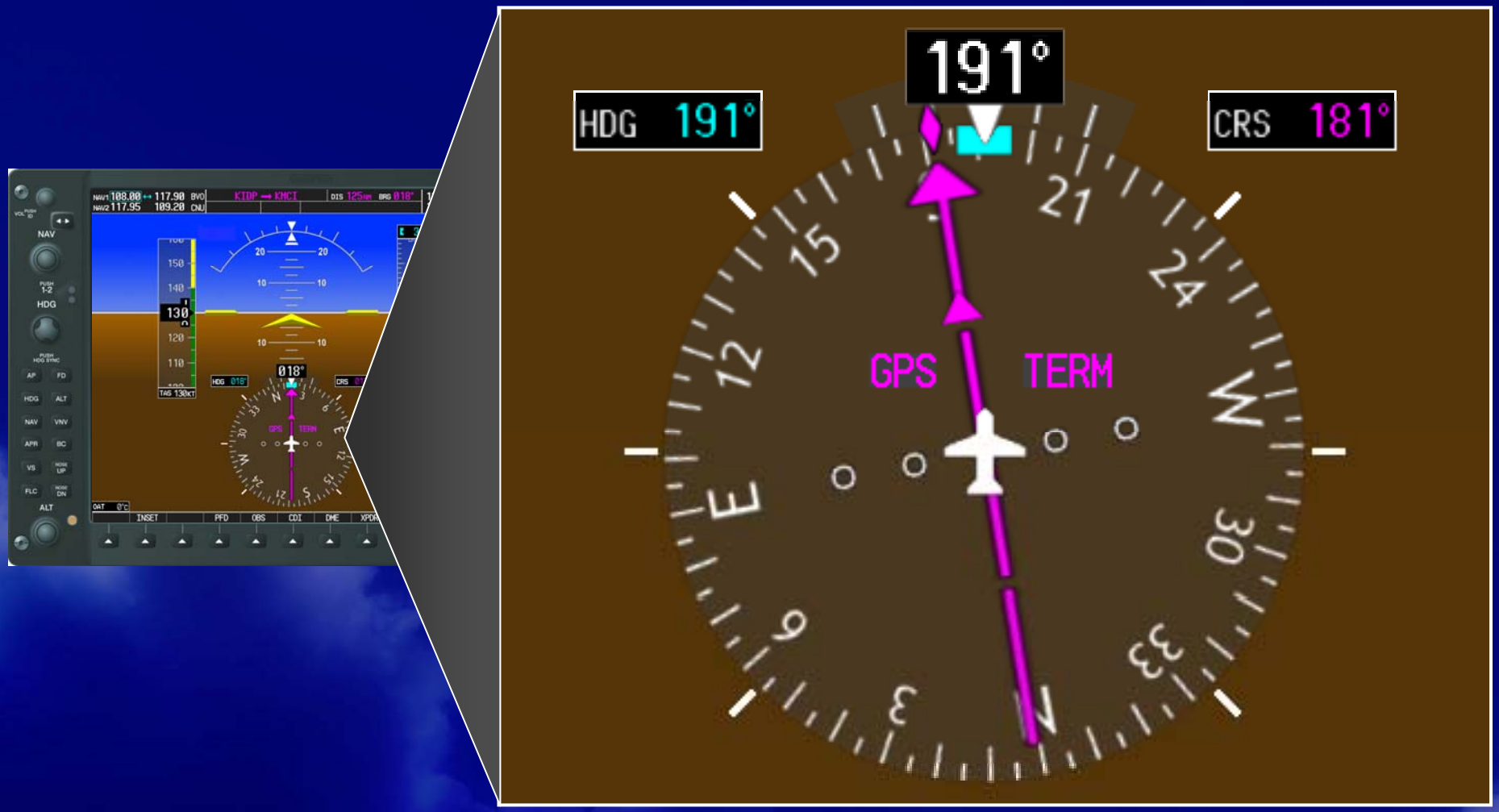
Horizontal Situation Indicator - HSI



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Bearing 1 Information Window

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Bearing 2 Information Window

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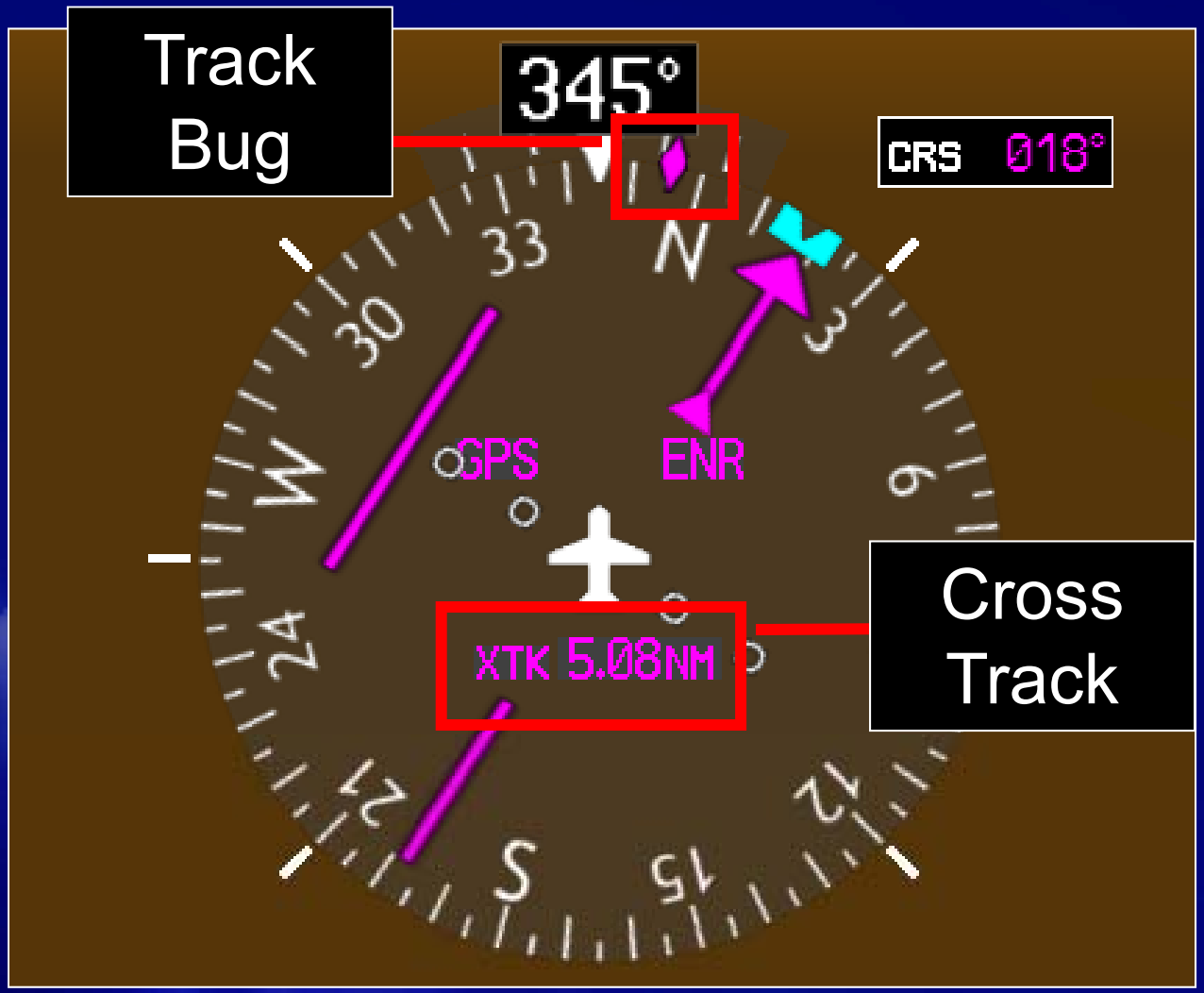
Track Bug & Cross Track (XTK)



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Standard Rate

½ Standard Rate

The circular segment scale below the heading window at the top of the HSI indicates:

1. A prediction of what the heading will be in 6 seconds at the present turn rate.
2. Half and Standard Rates-of-Turn - **based on the length of the magenta turn vector.**

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Turn Rate > 4°/sec

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PFD during ILS approach

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Wind Data Box

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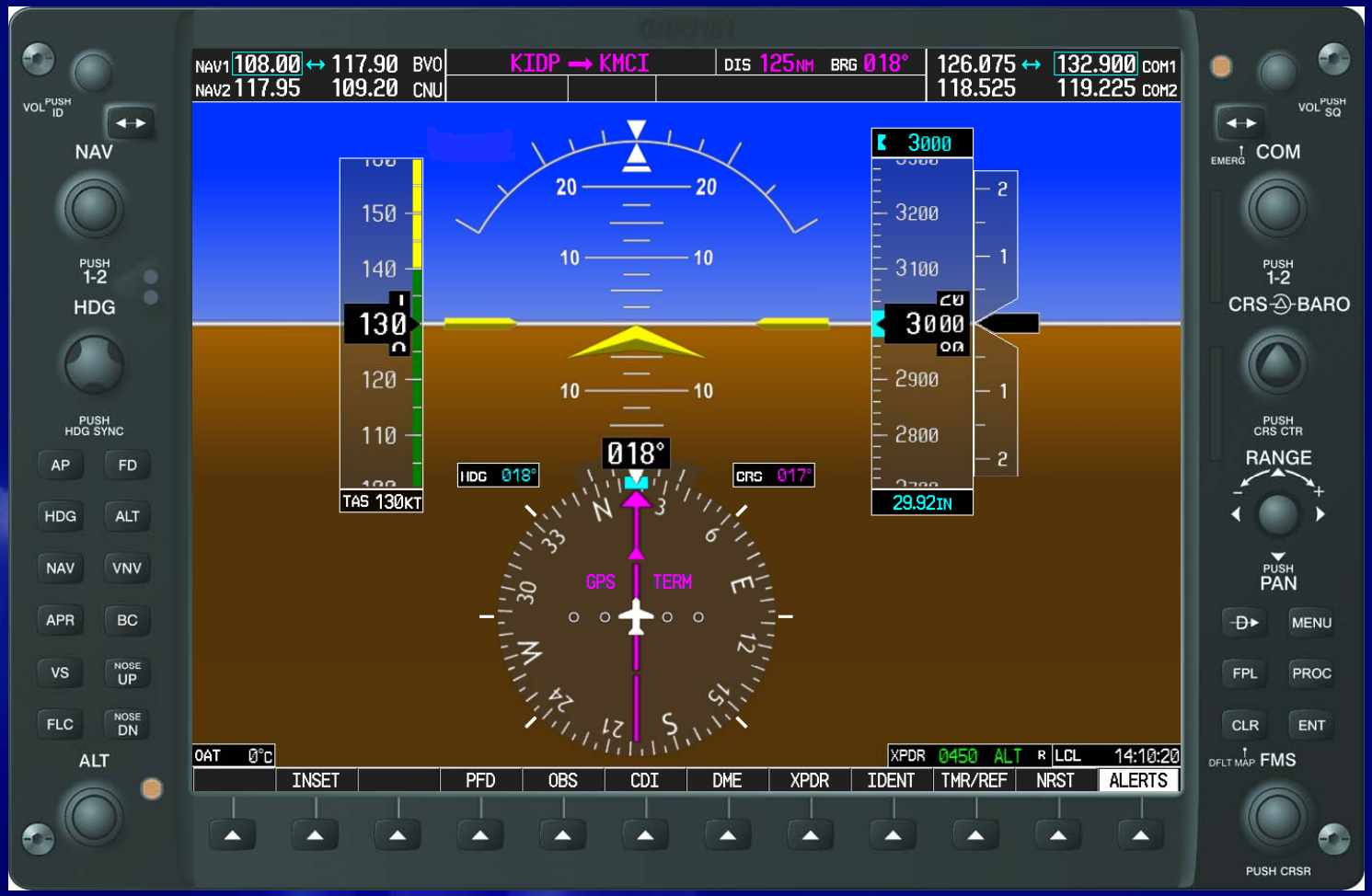
Primary Flight Display



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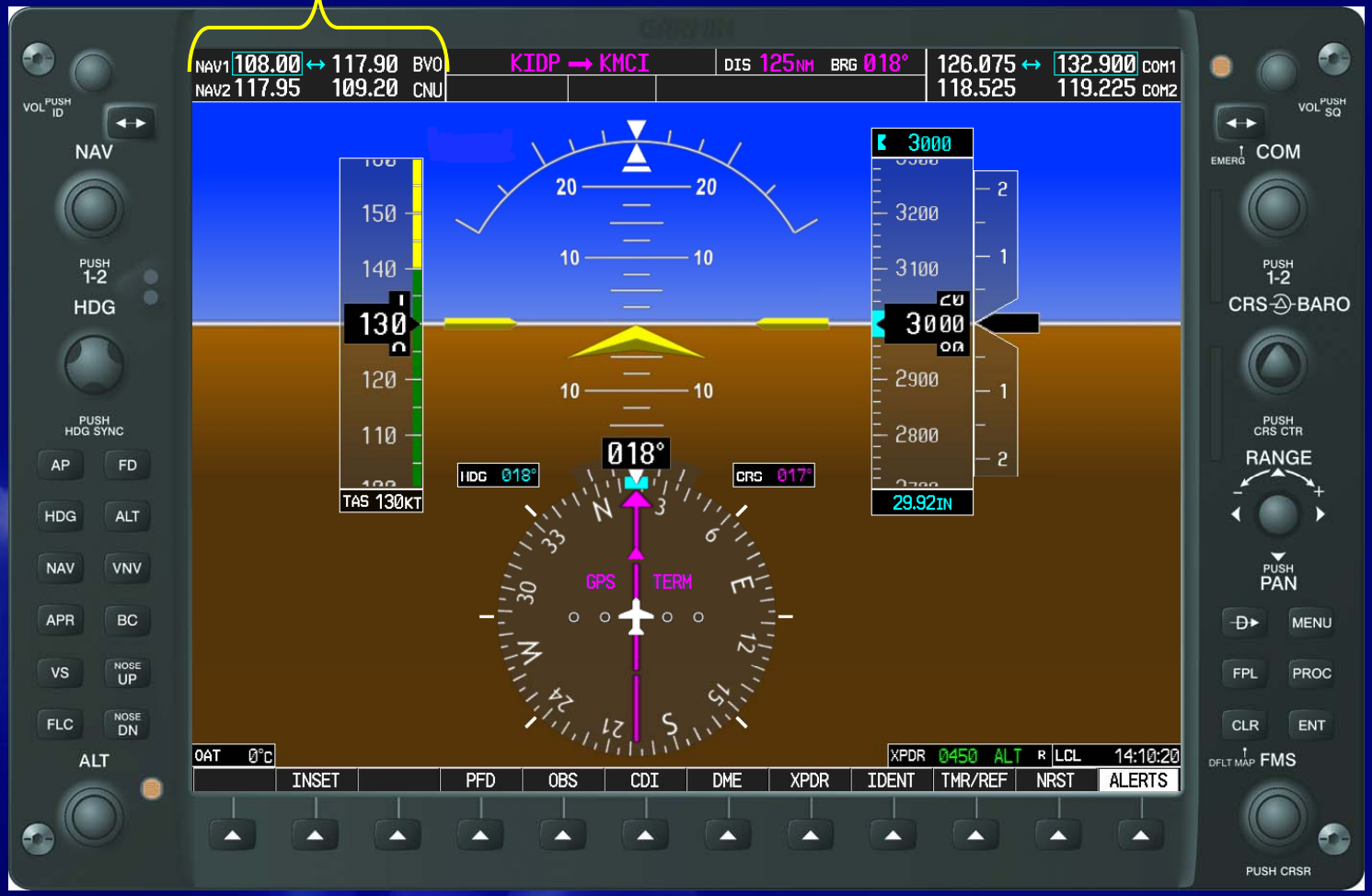
NAV



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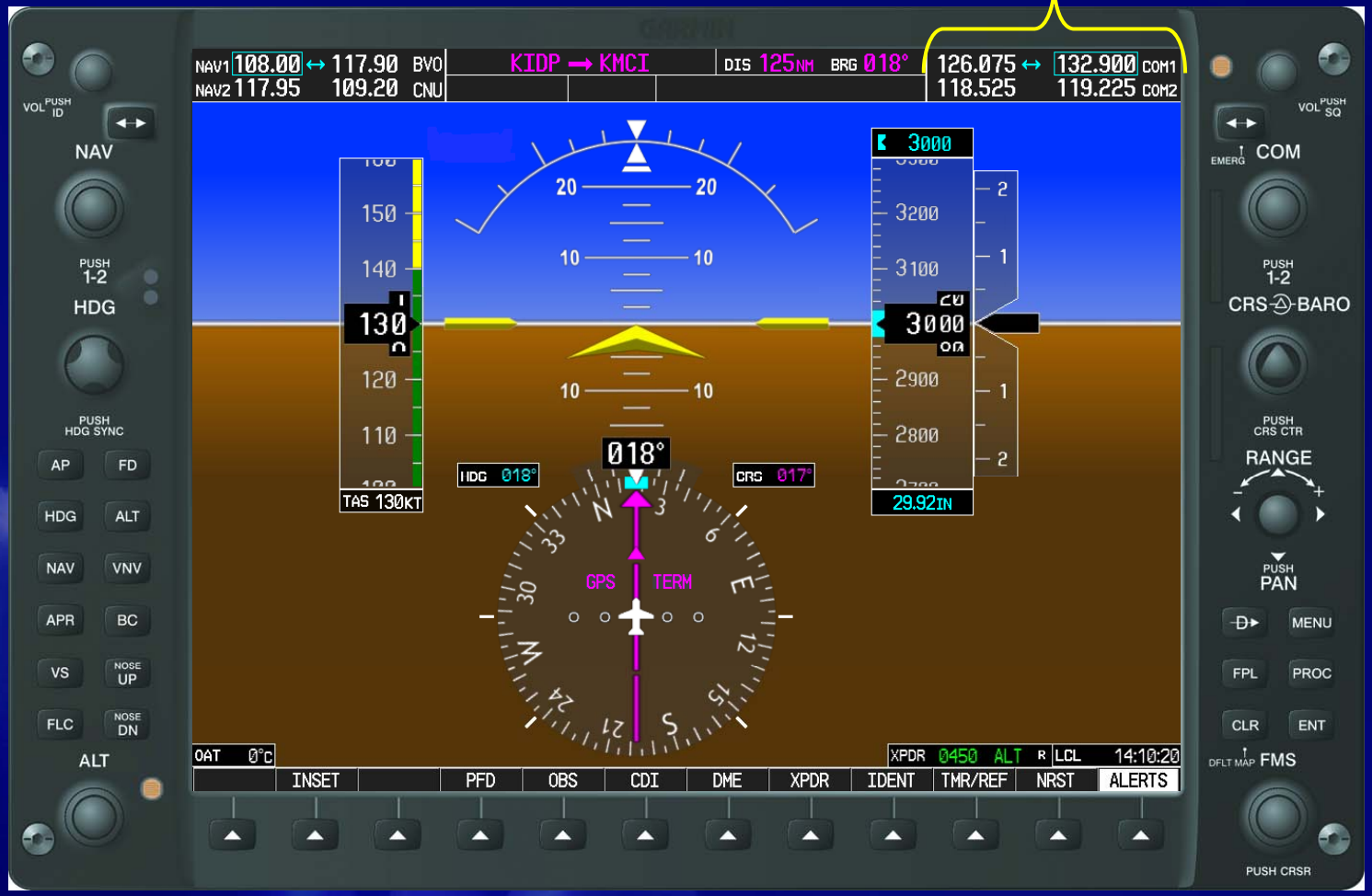
COM



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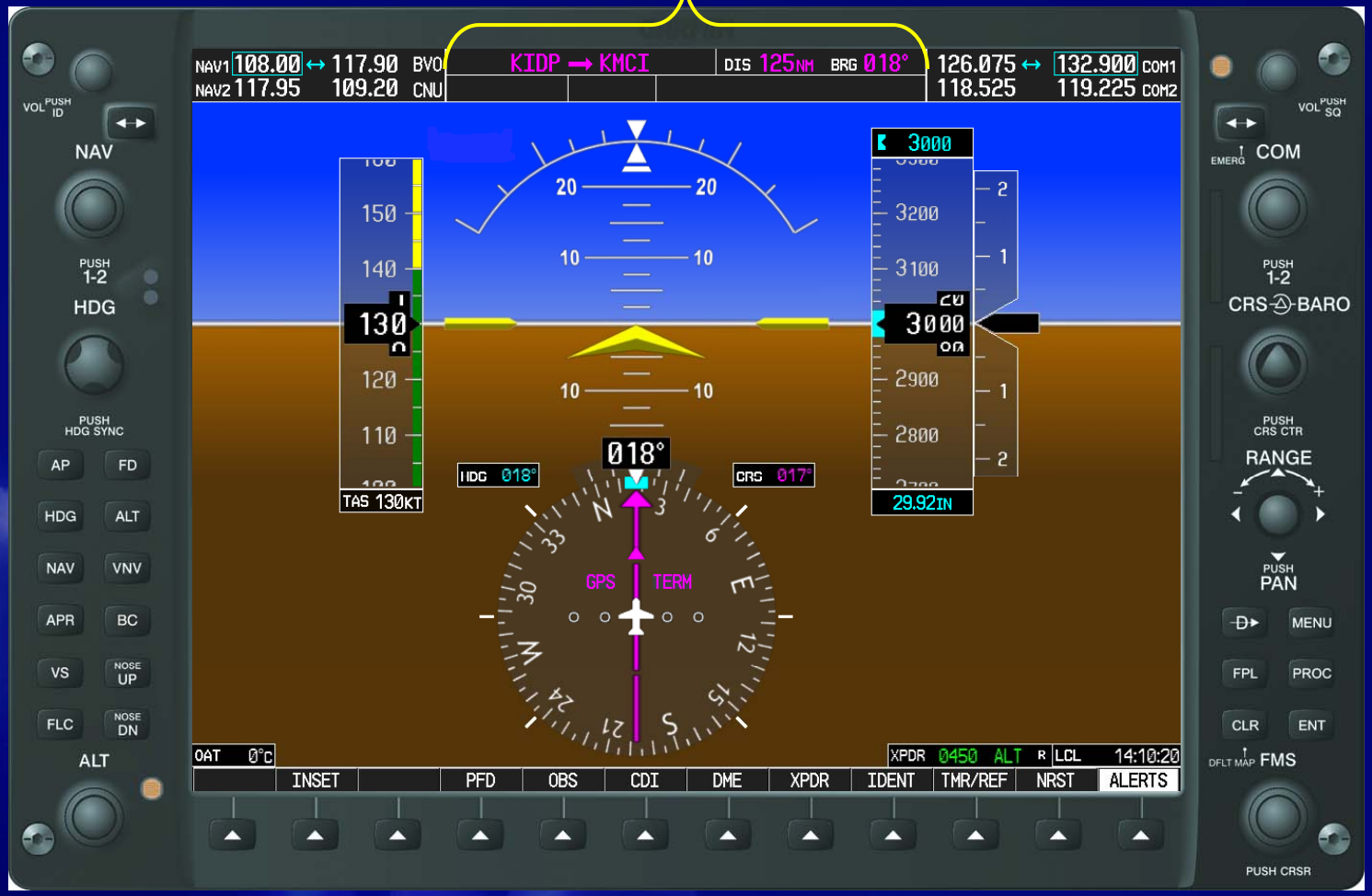
Navigation Status Window



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OAT

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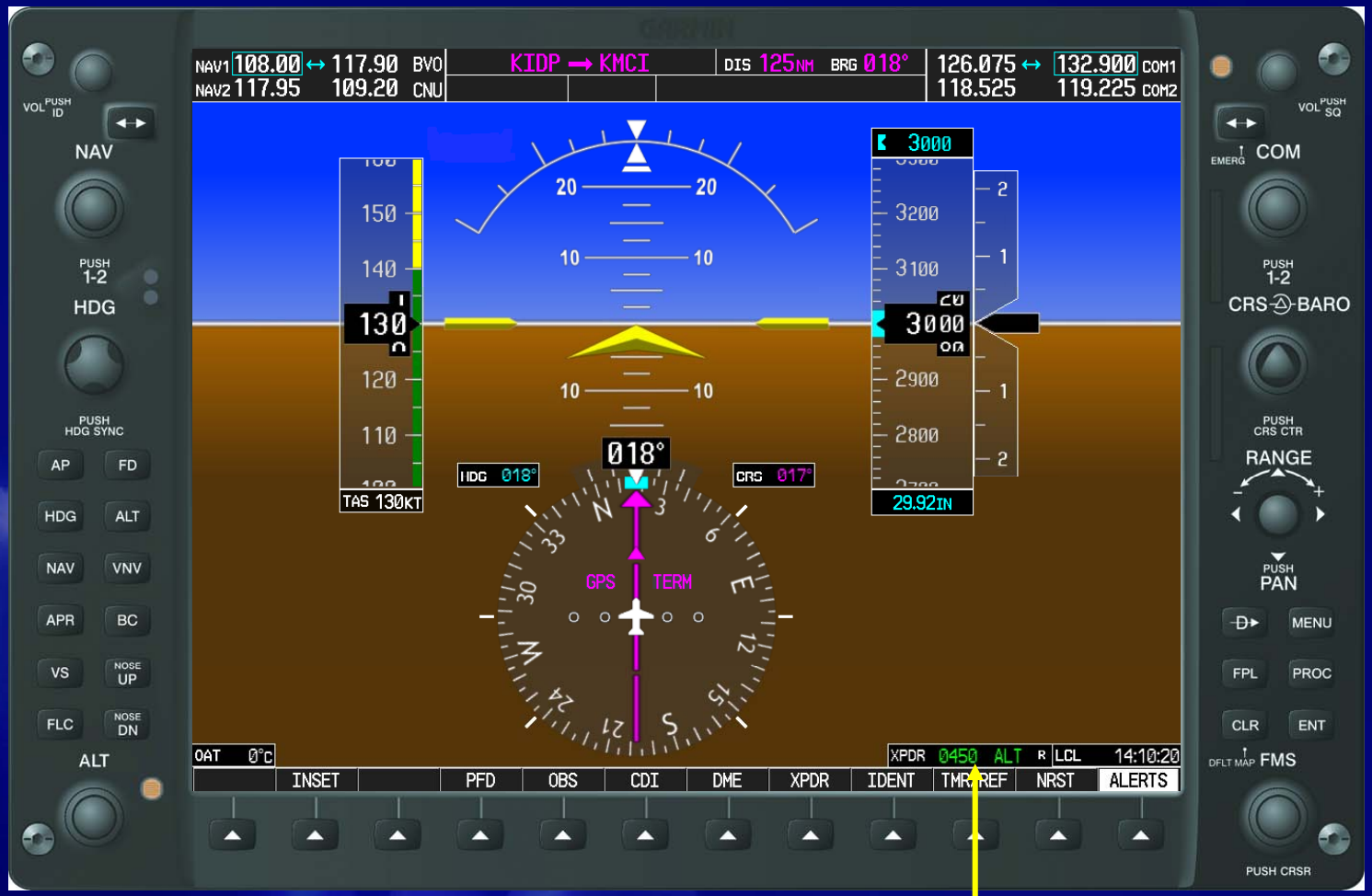

Transponder

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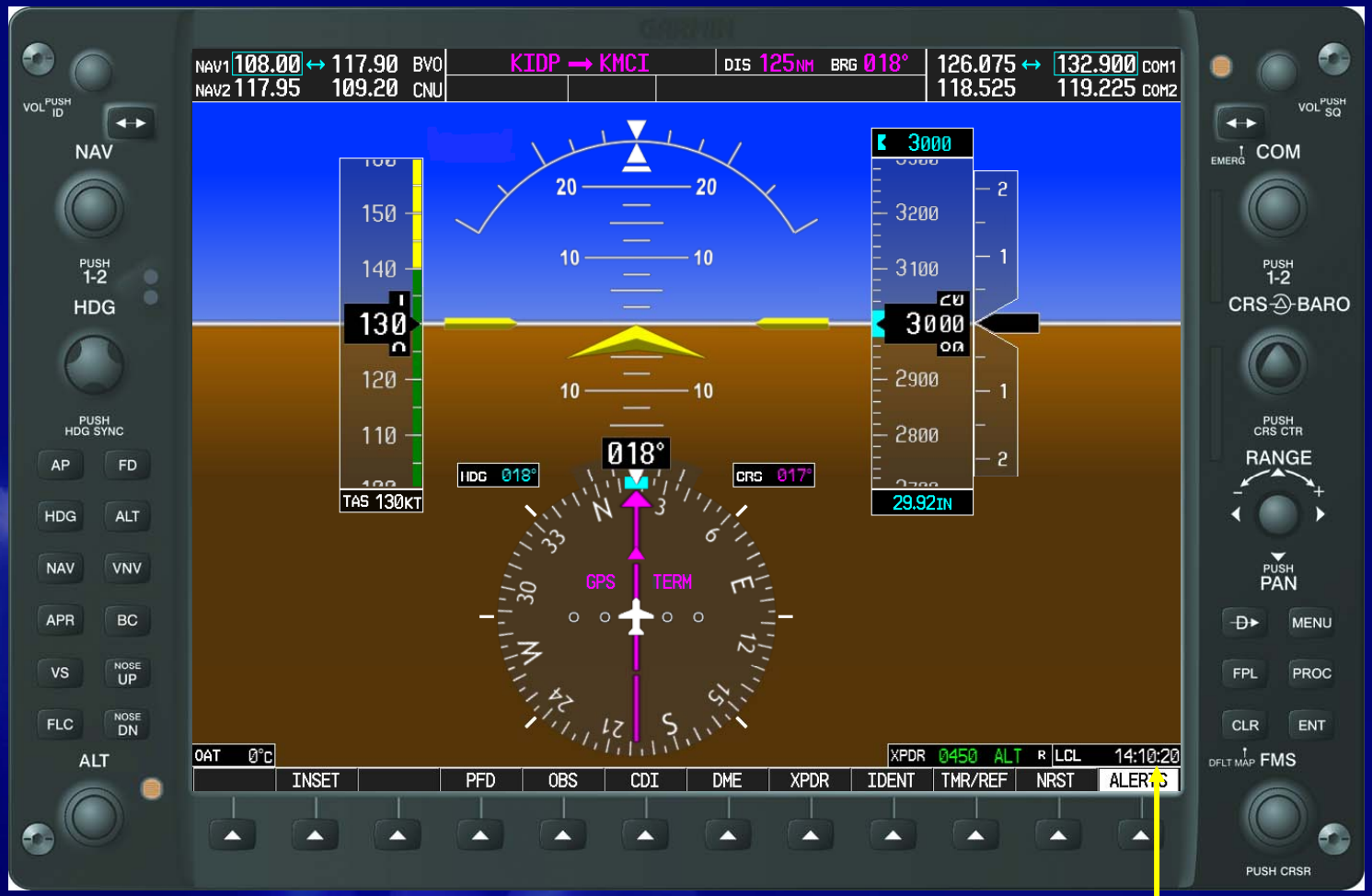

System Time

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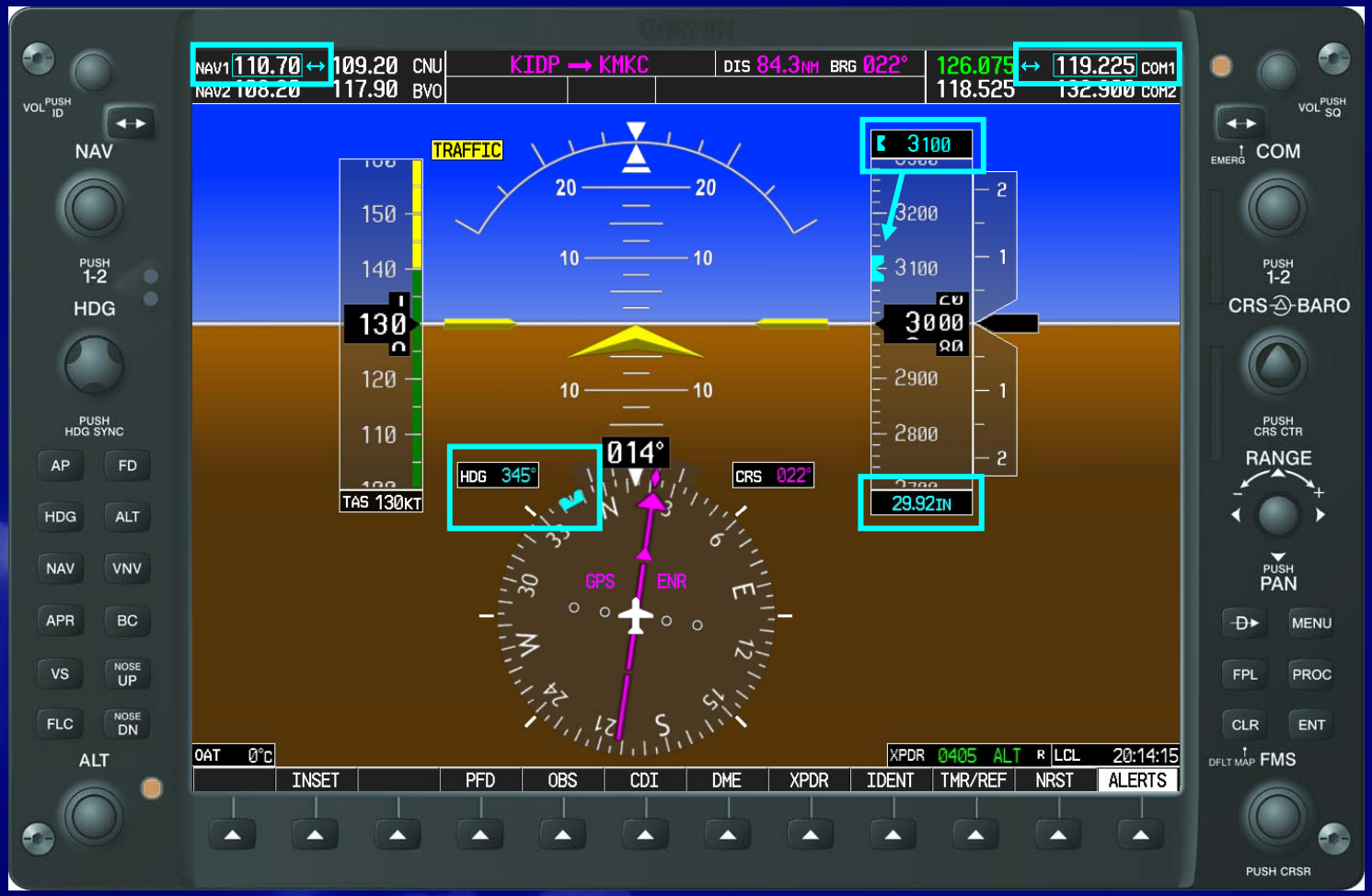
LIGHT BLUE - Pilot Adjustable



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GREEN – Active/VHF

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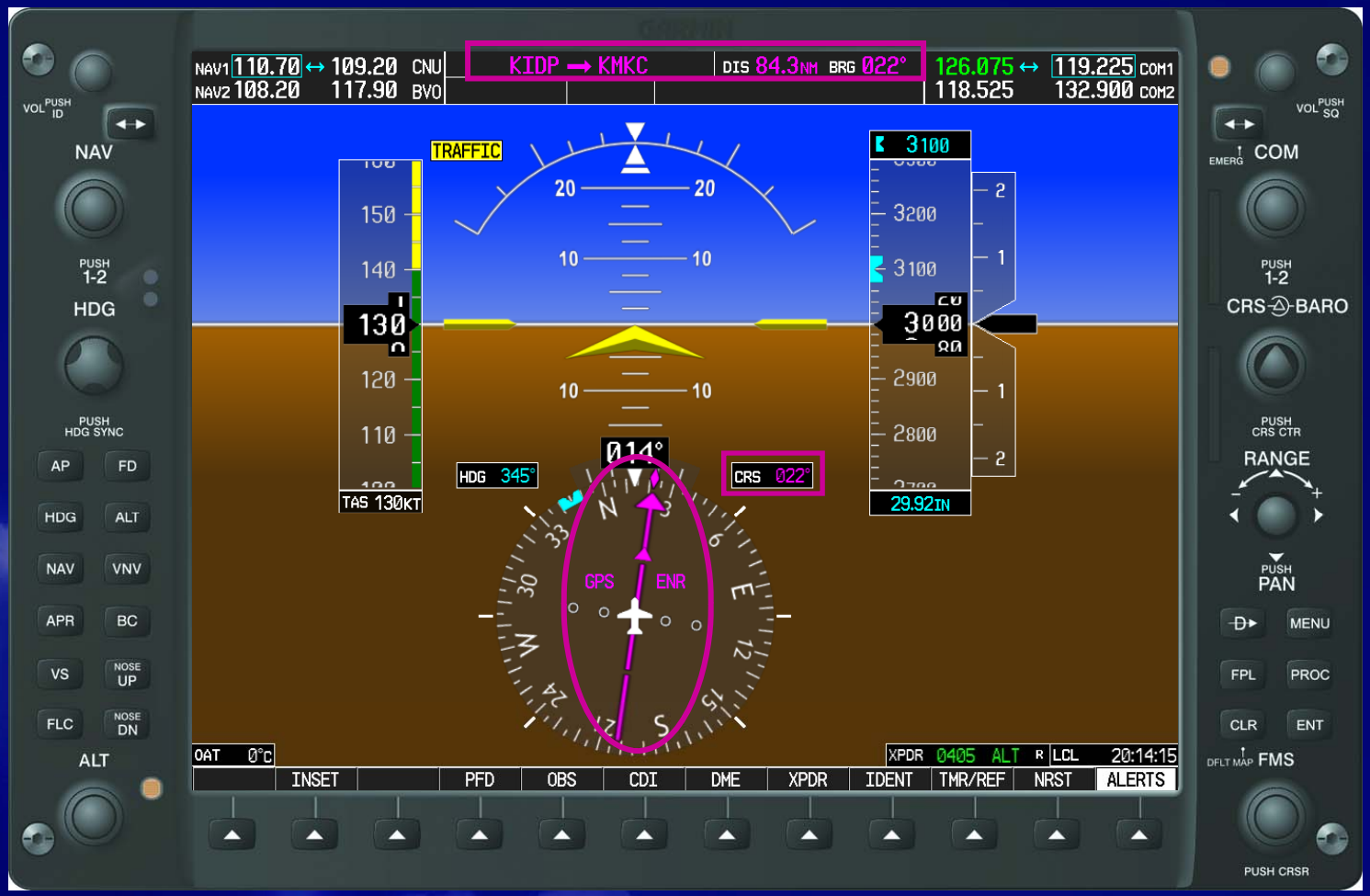
MAGENTA – GPS



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YELLOW – Caution

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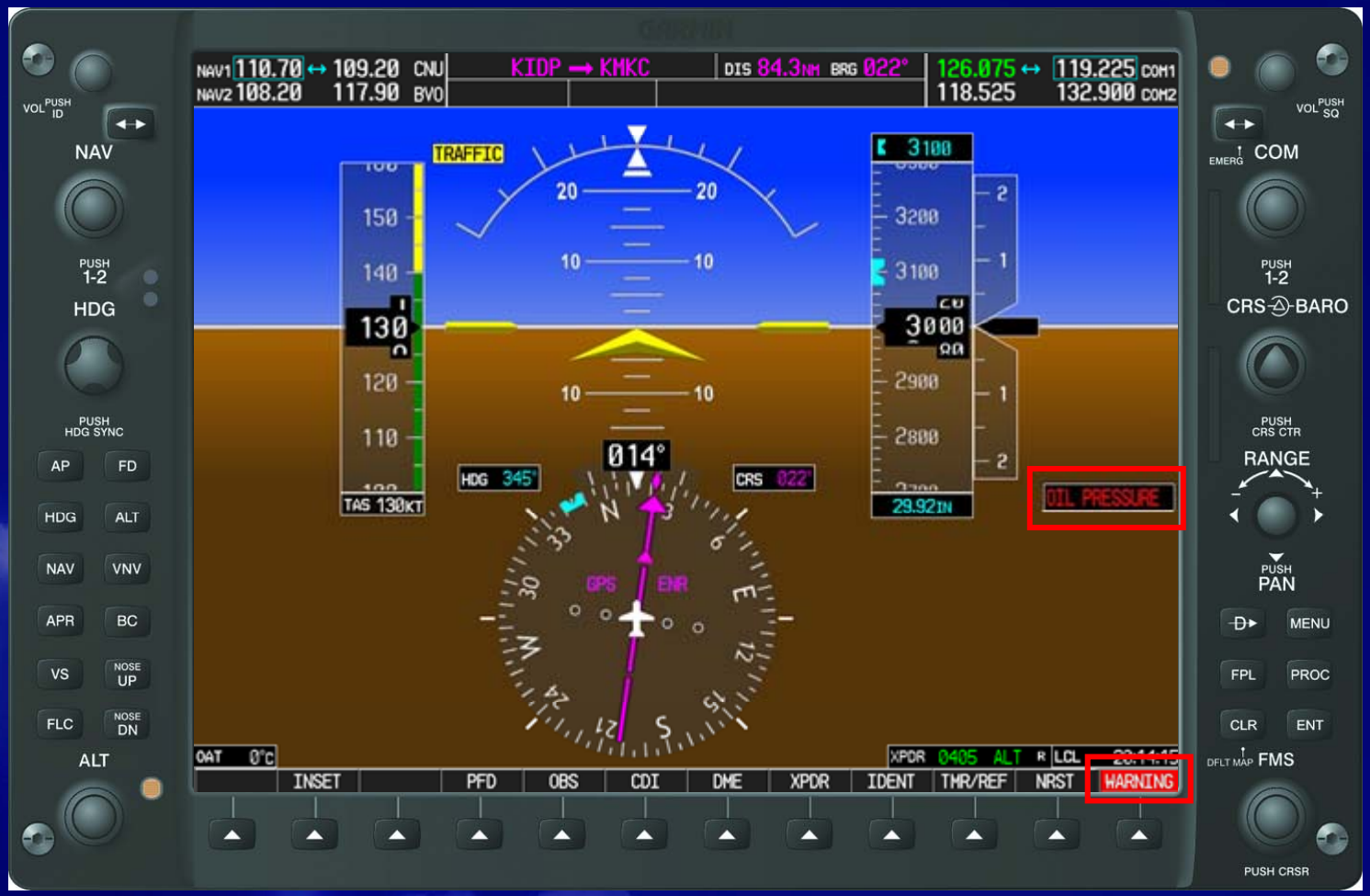
RED – Warning



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Primary Flight Display

LIGHT BLUE - Pilot Adjustable

GREEN – Active/VHF

MAGENTA – GPS

YELLOW – Caution

RED – Warning

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MFD Overview

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COM

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Navigation Status Window

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Press the ENGINE Softkey to reveal additional Engine Pages

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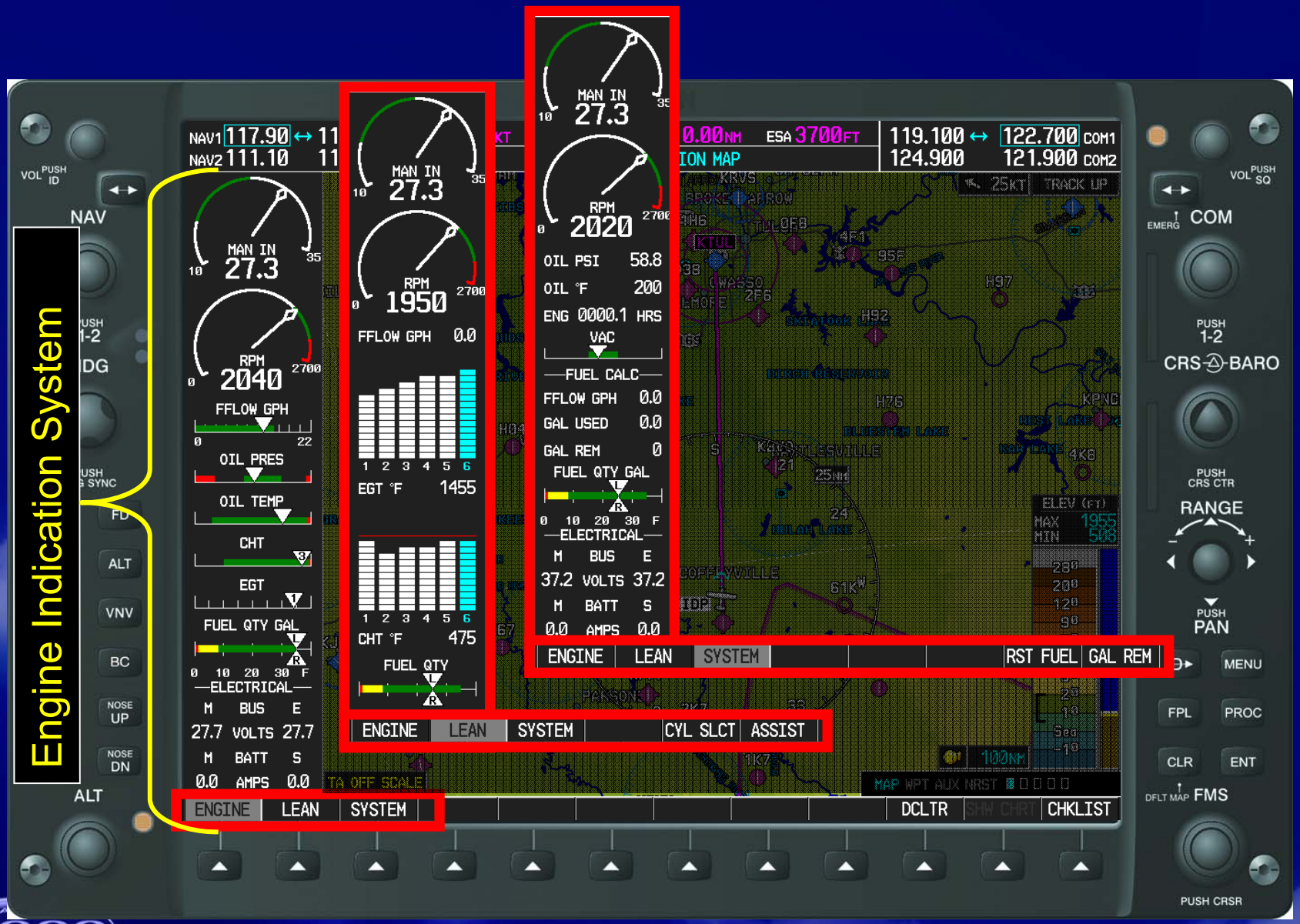
Engine Indication System



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Agenda

- Classroom
  - Training Approach
  - Display Overview
  - Operational Basics
    - Bezel Controls
    - NAV / COM Tuning
    - Data Entry
    - MFD Navigation
  - Flight Director/Autopilot Introduction
- Lab
  - System Configuration
  - Flight scenario 1

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Bezel Controls

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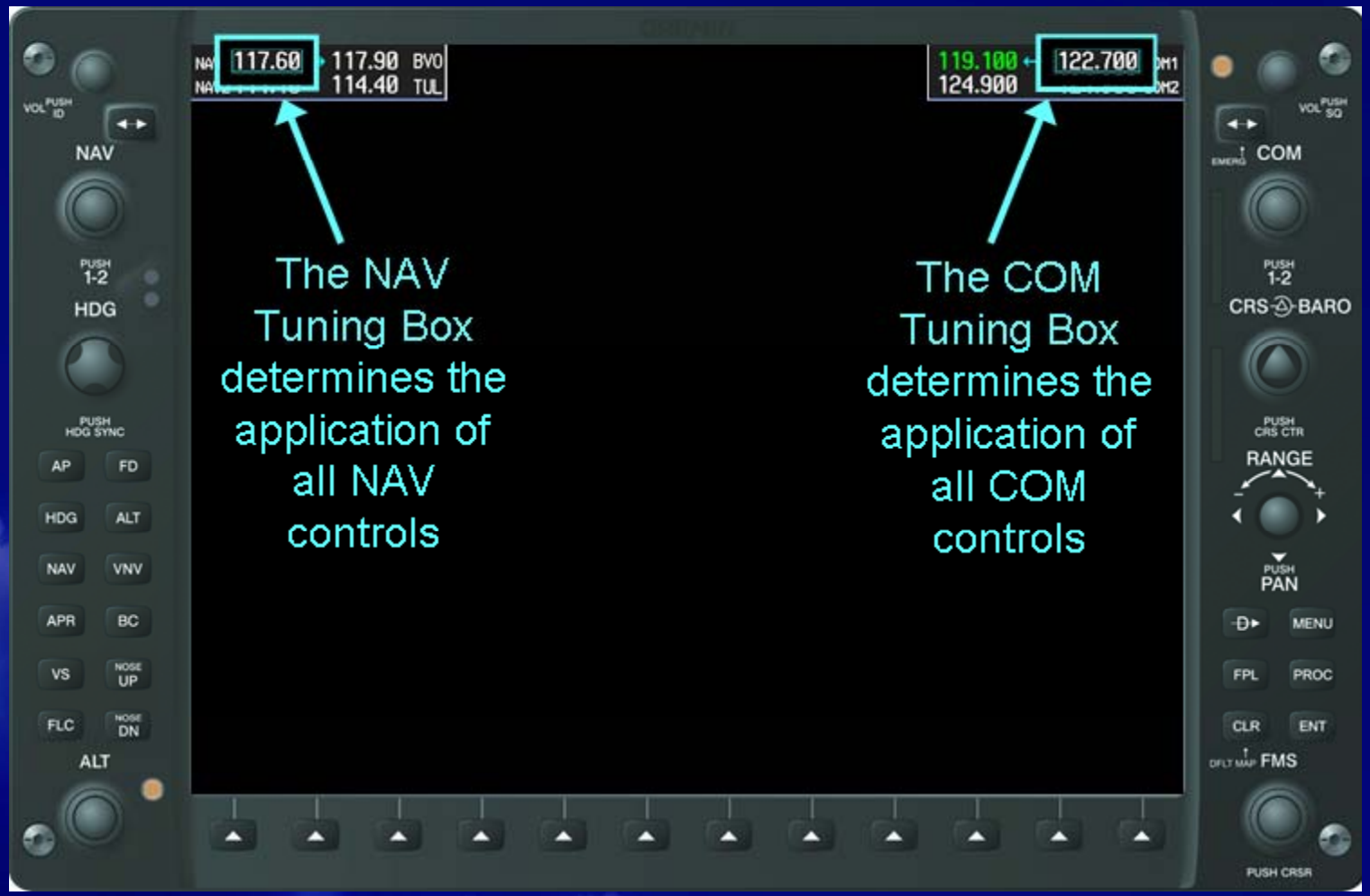
NAV/COM Tuning



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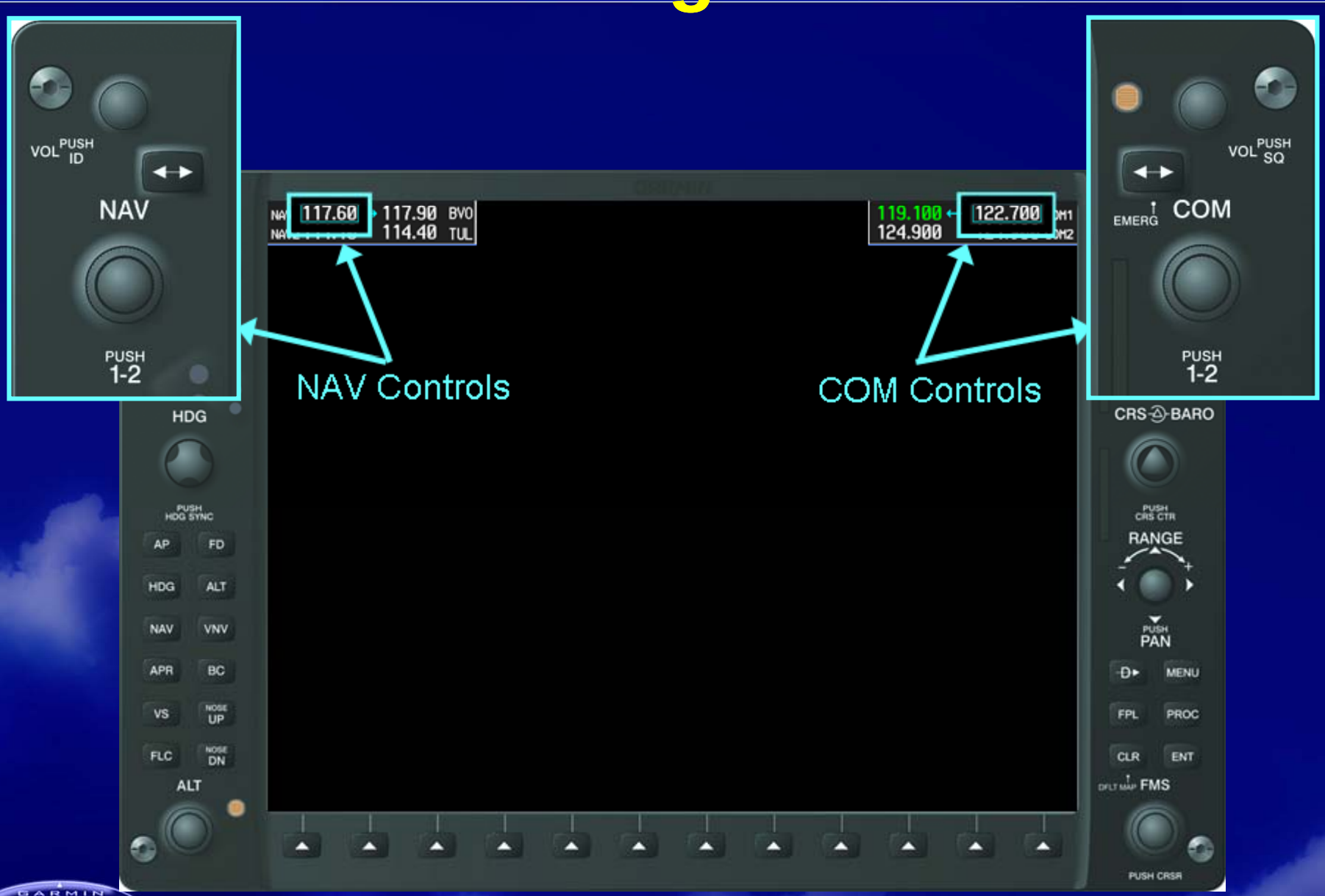
NAV/COM Tuning



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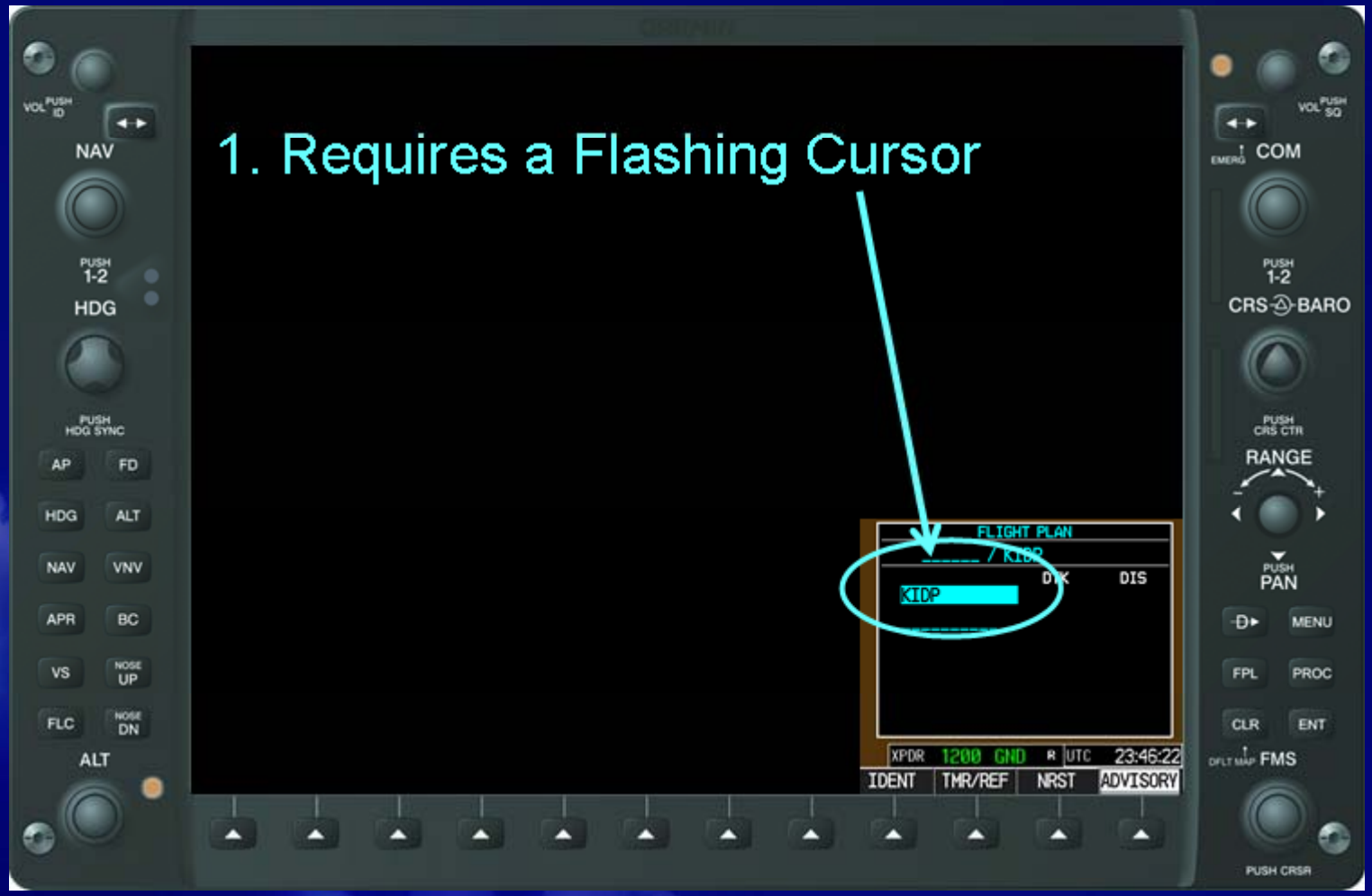
Data Entry



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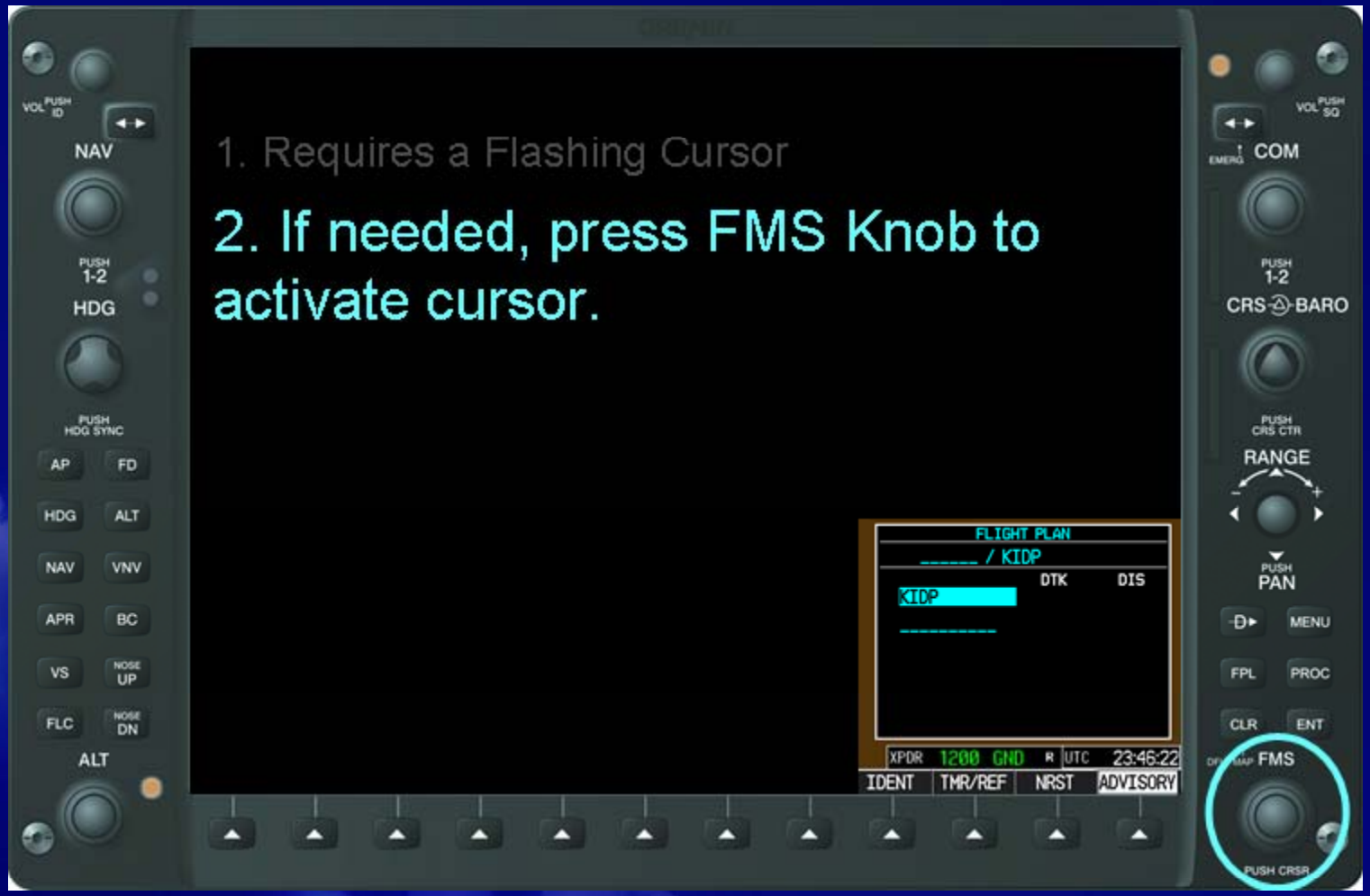

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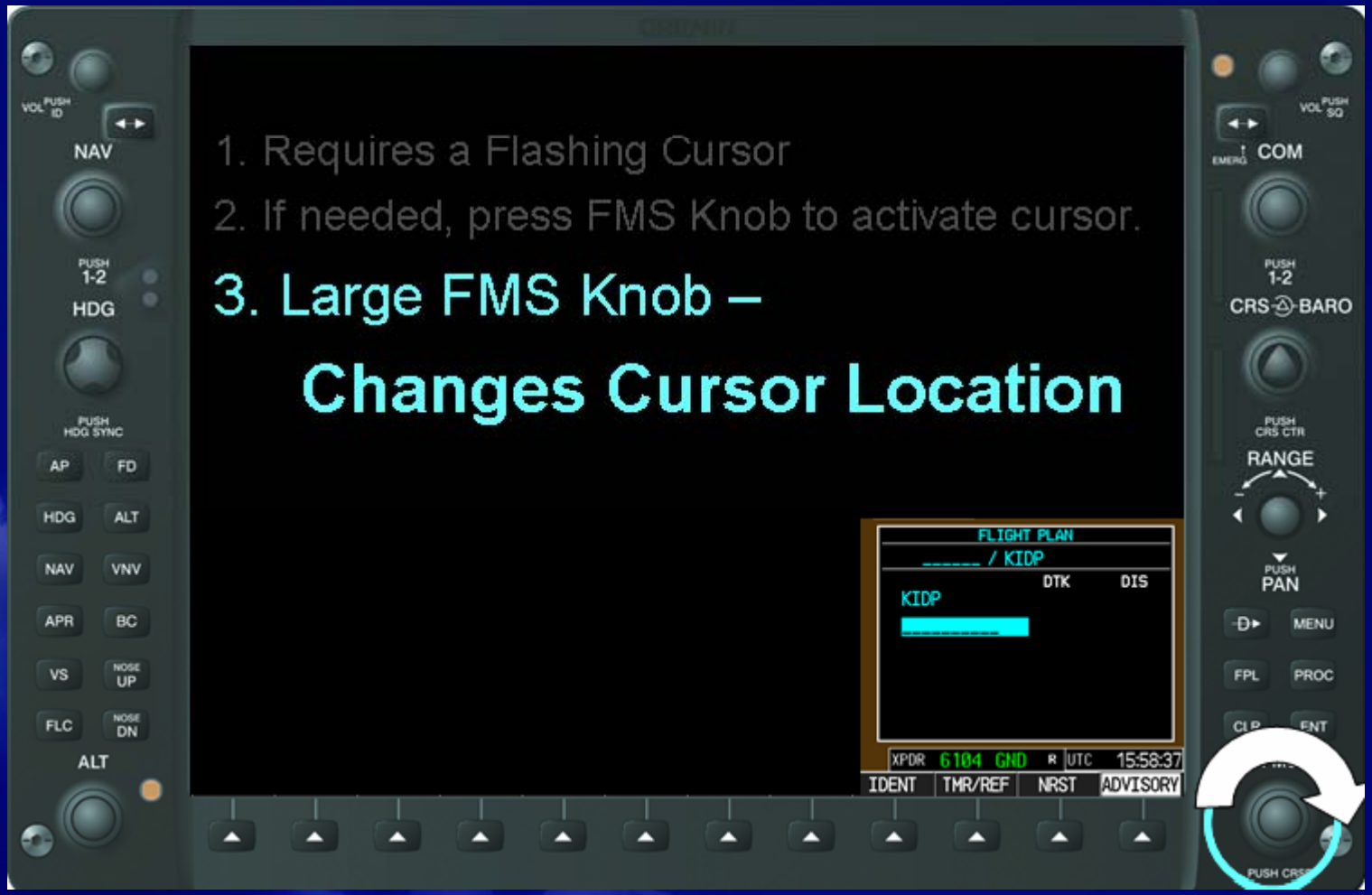

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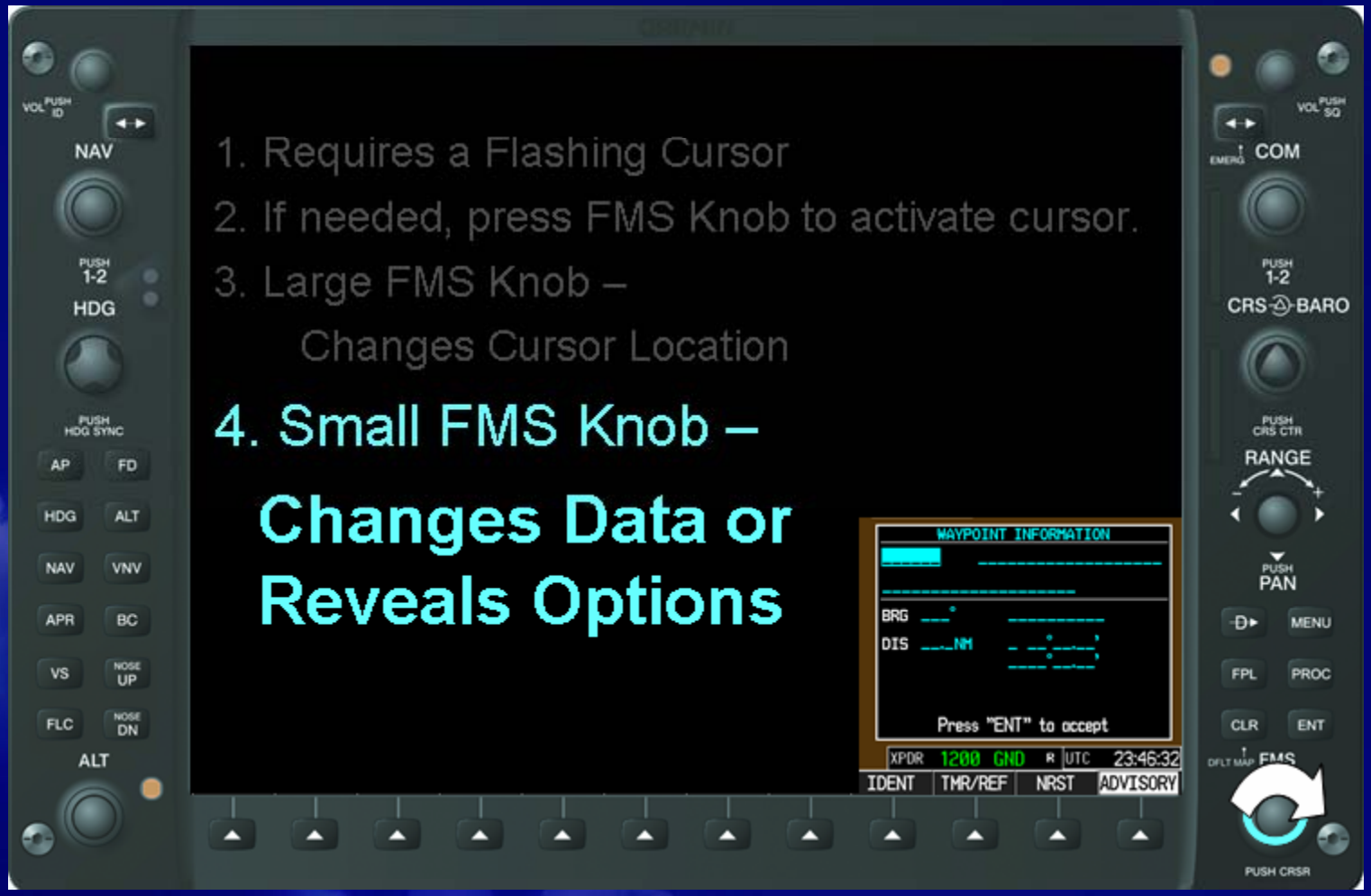

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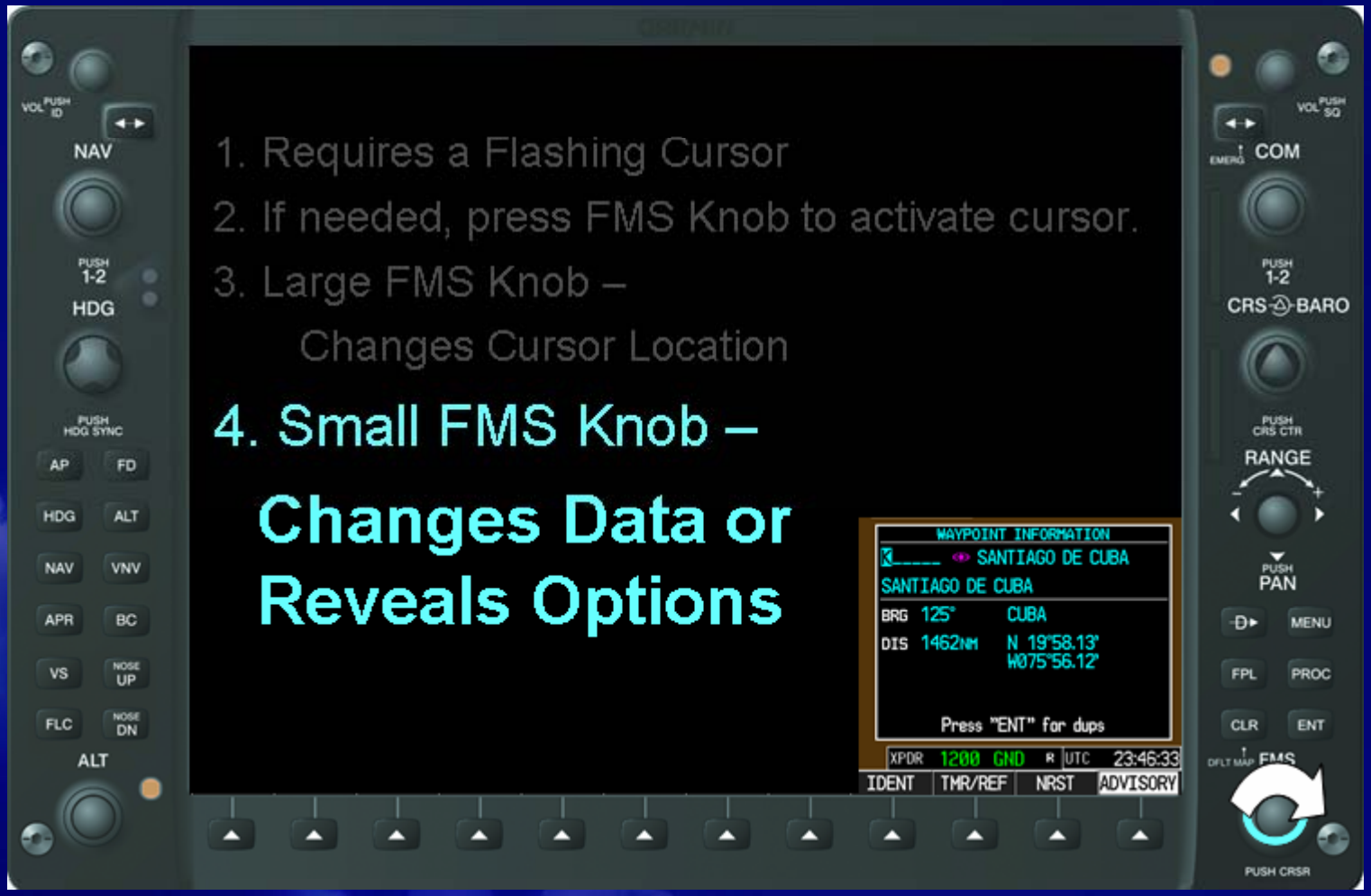

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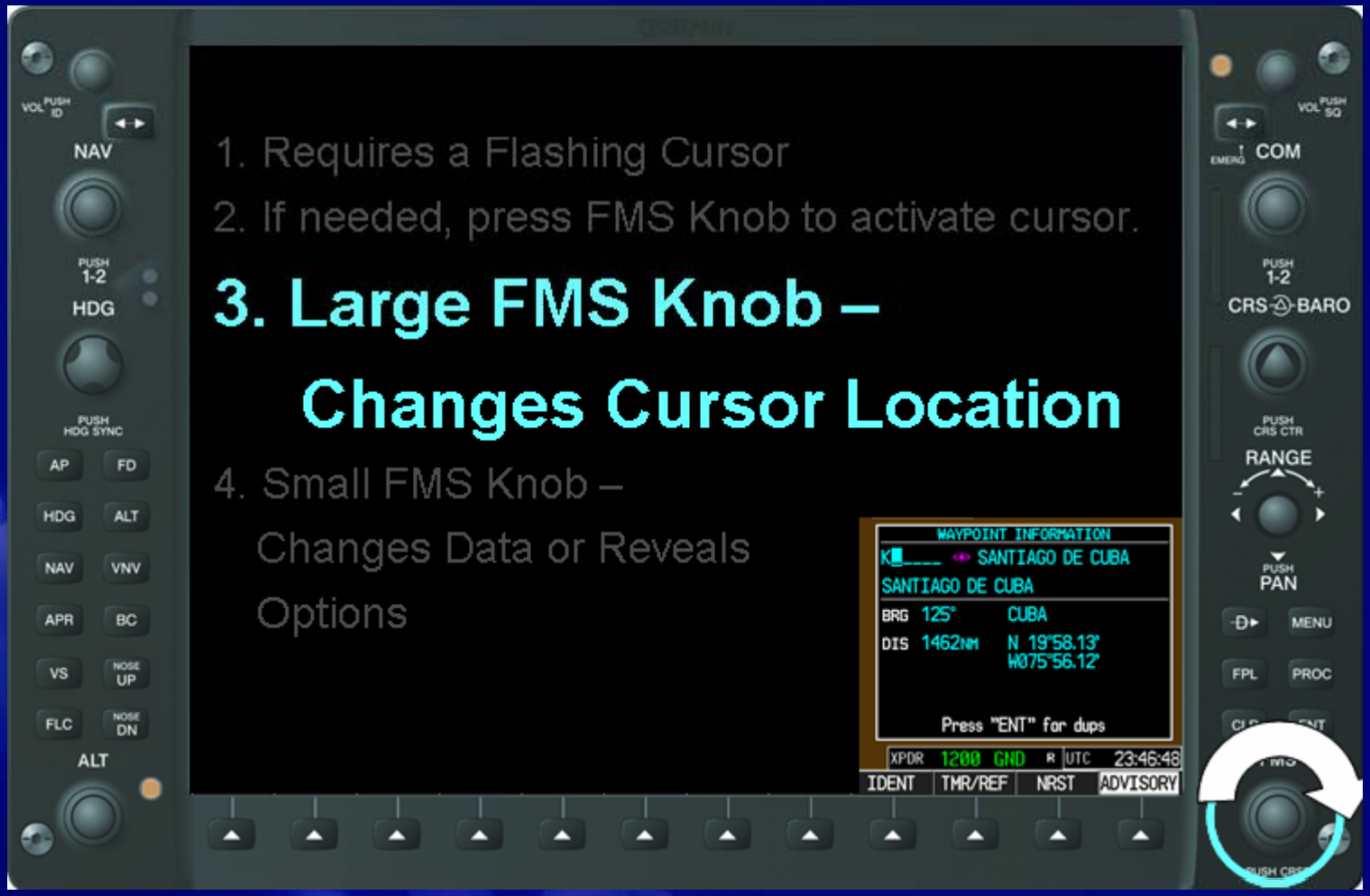

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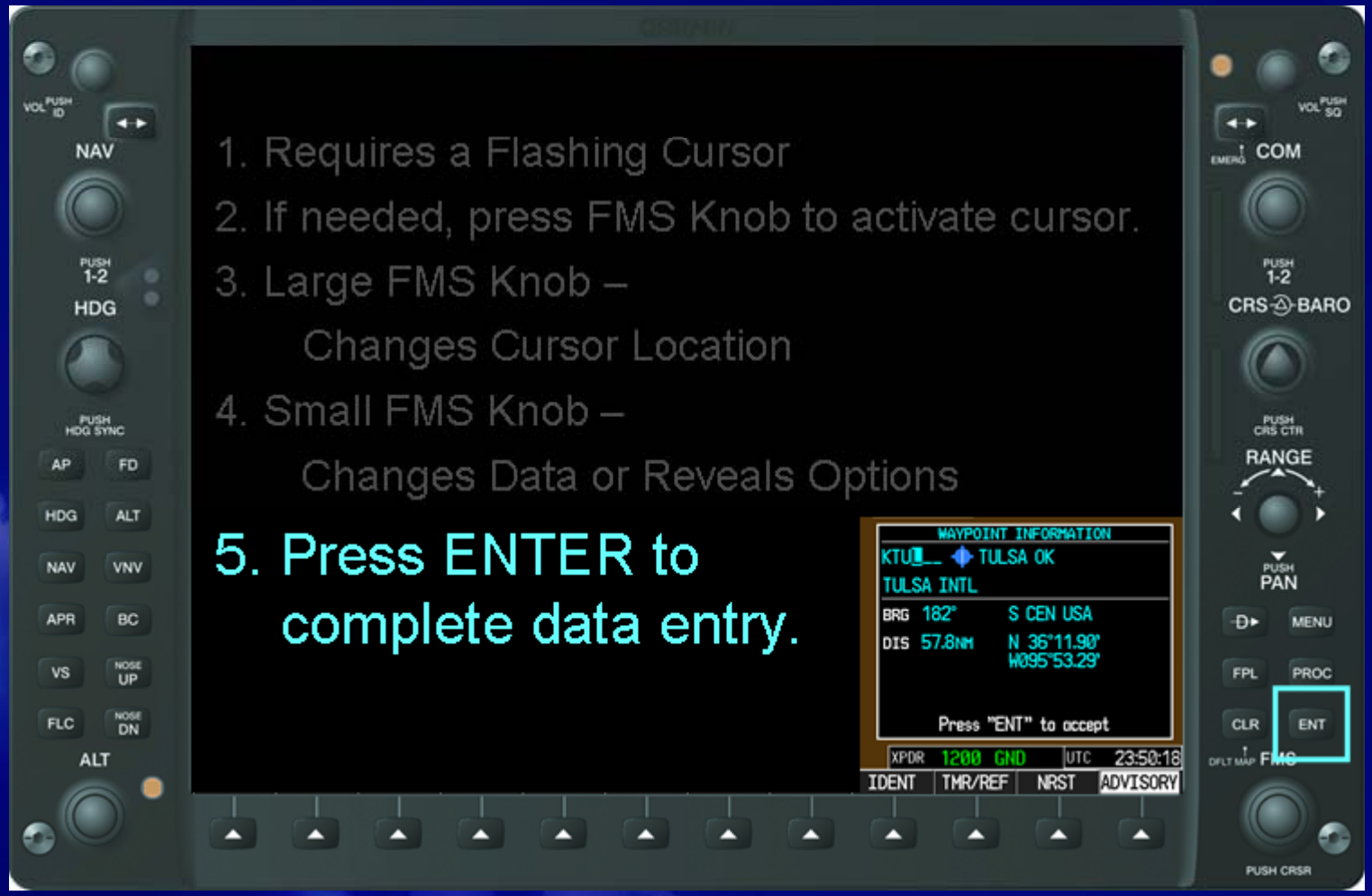

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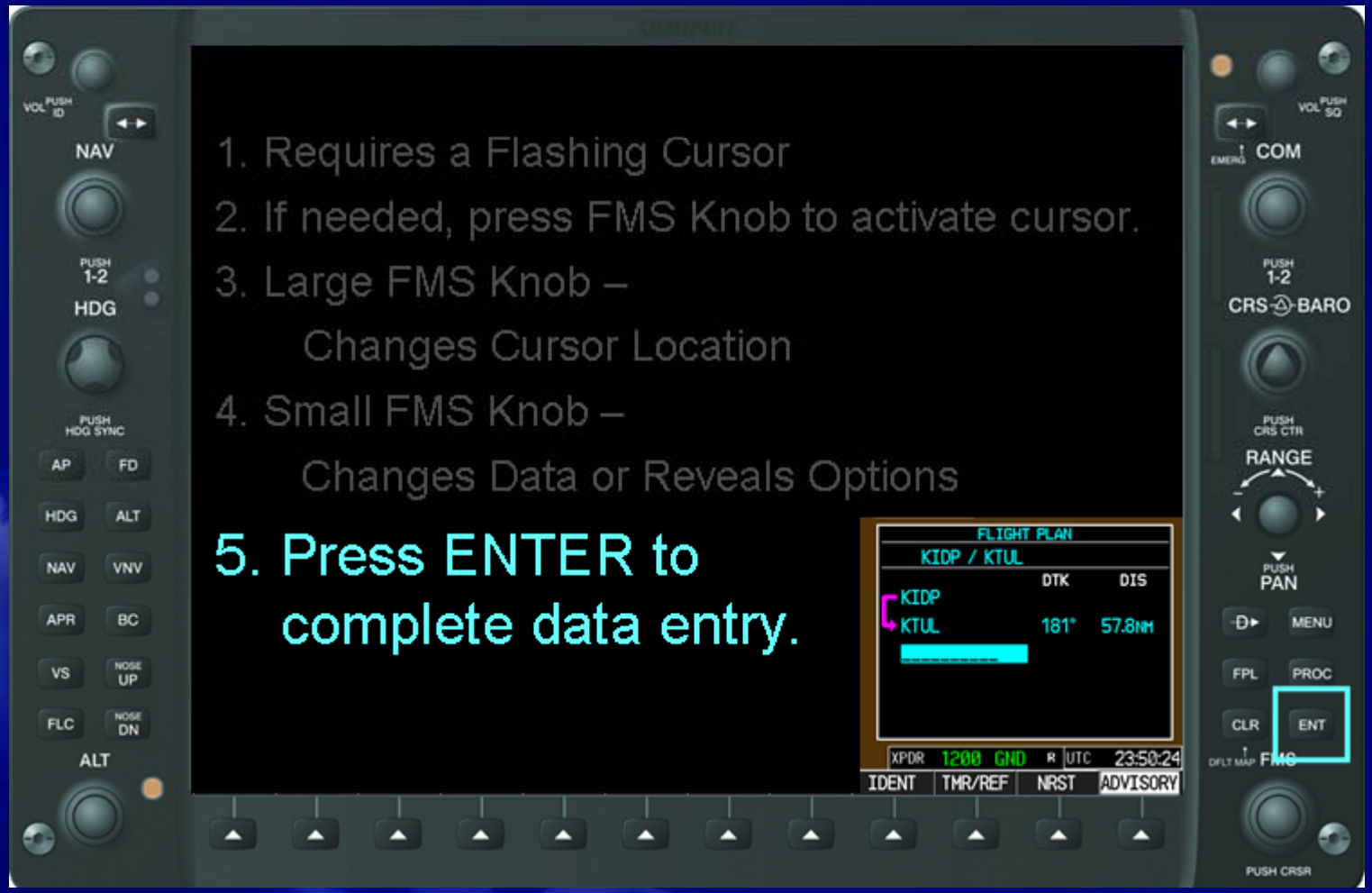

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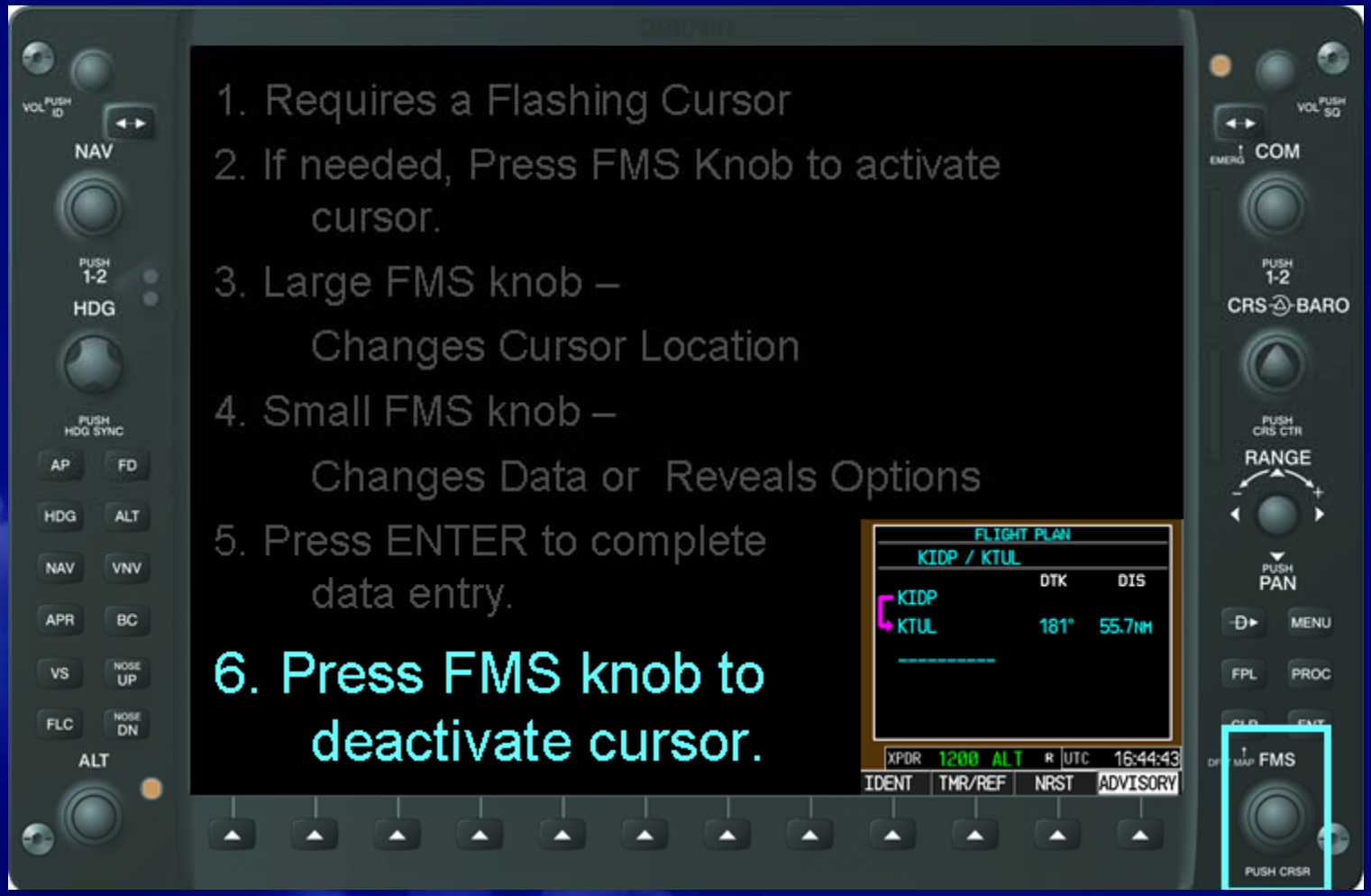

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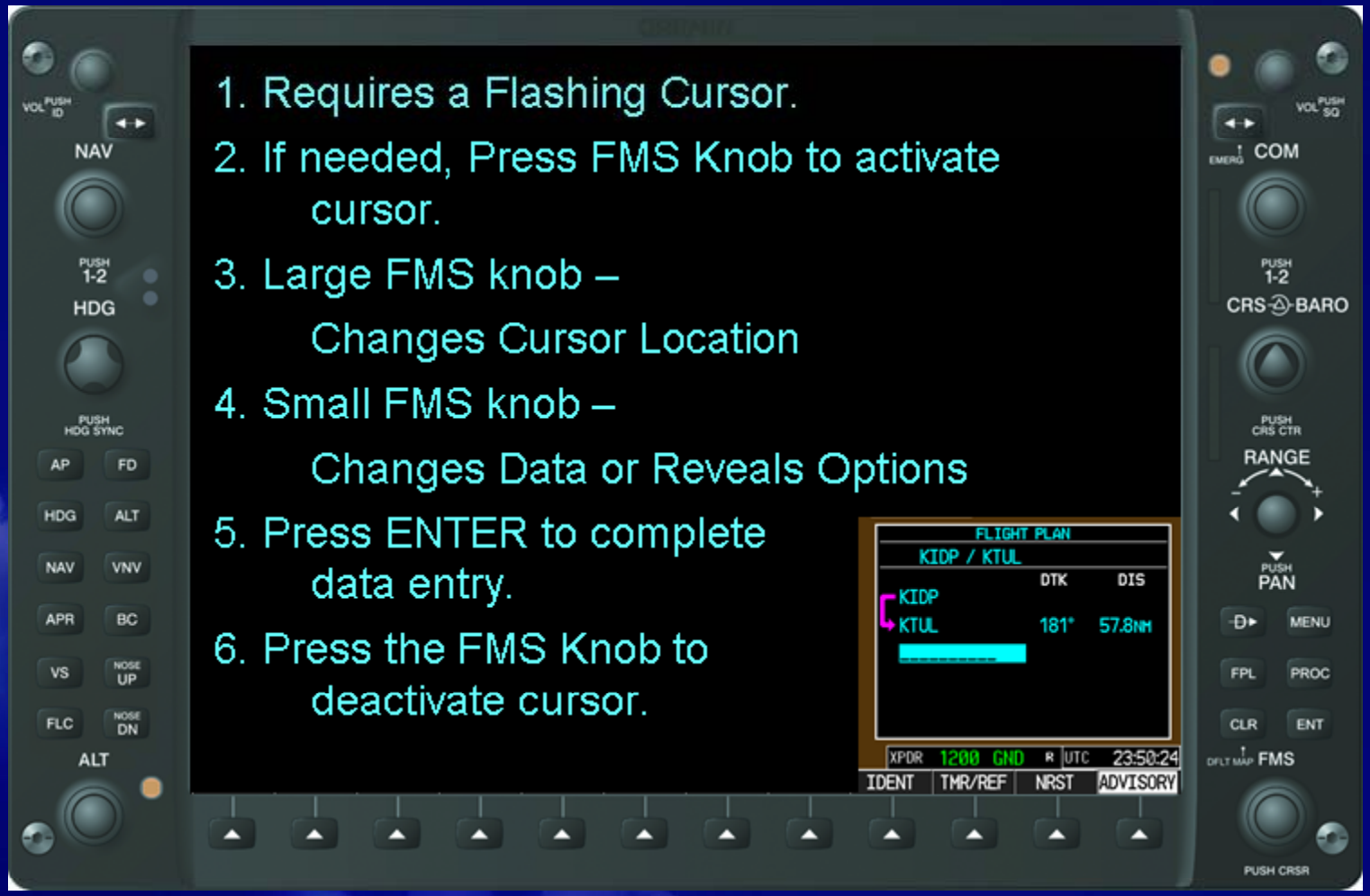
Data Entry

1. Requires a Flashing Cursor.
2. If needed, Press FMS Knob to activate cursor.
3. Large FMS knob –
   Changes Cursor Location
4. Small FMS knob –
   Changes Data or Reveals Options
5. Press ENTER to complete data entry.
6. Press the FMS Knob to deactivate cursor.



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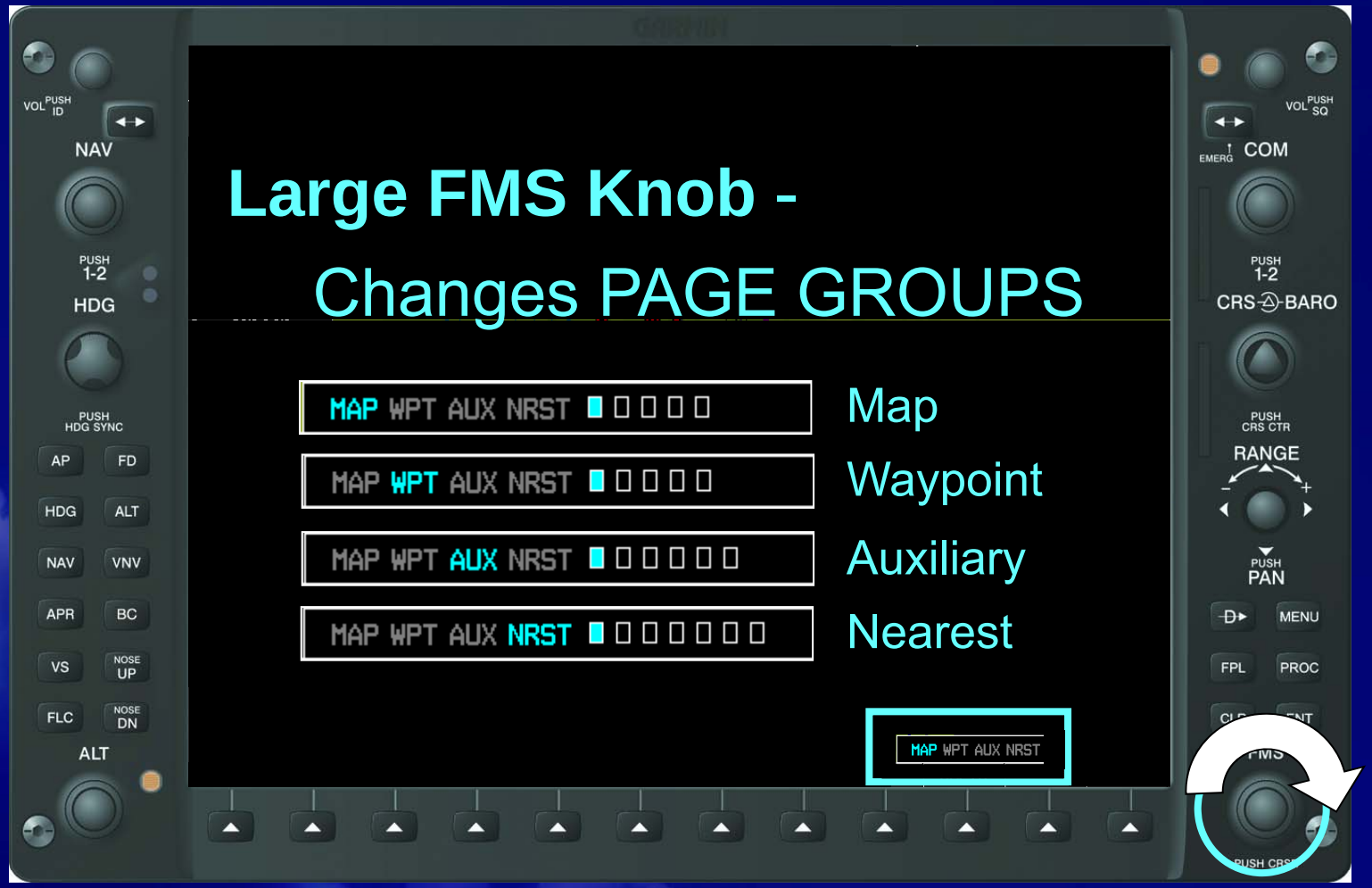
MFD Navigation



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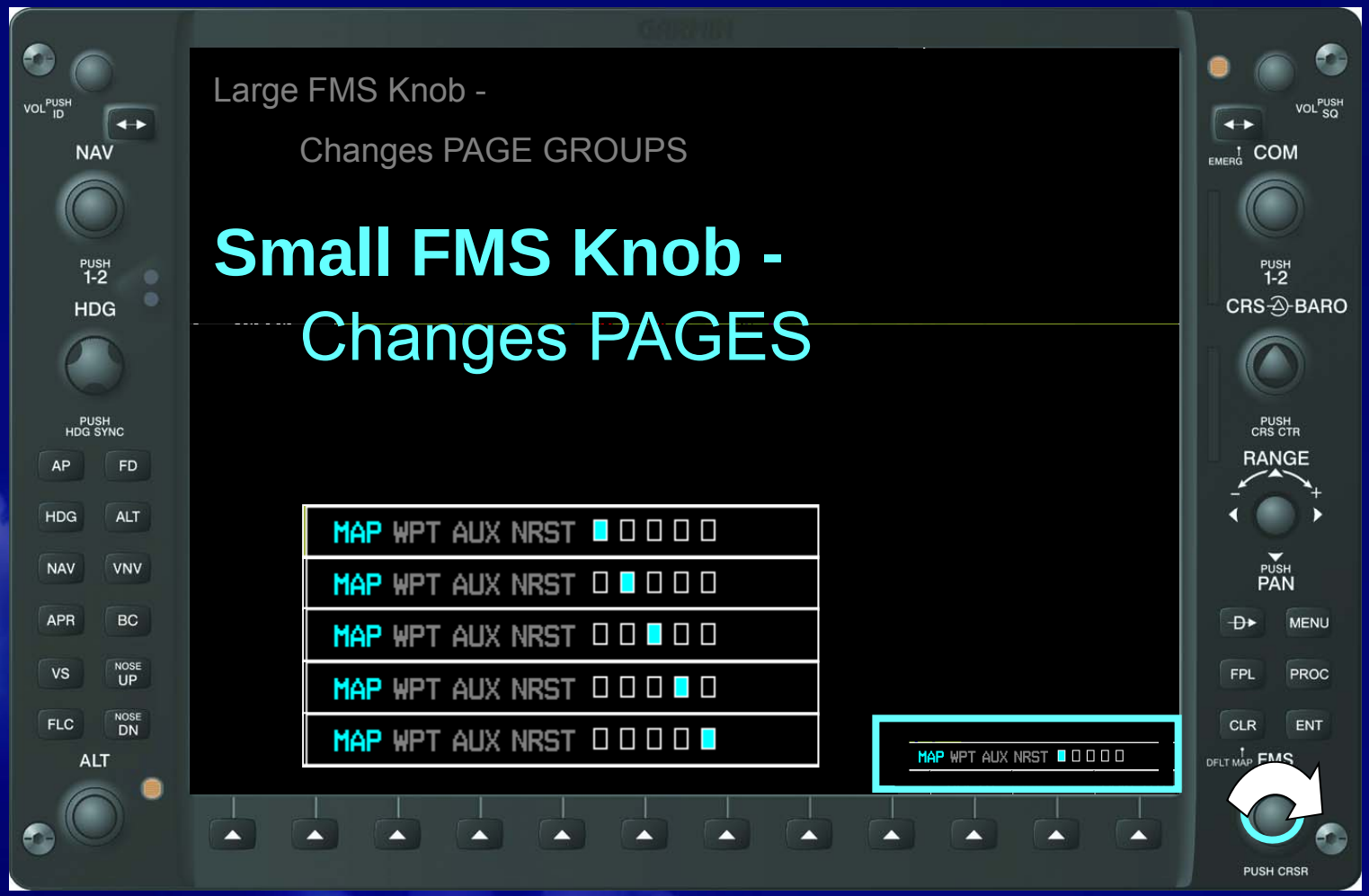
MFD Navigation



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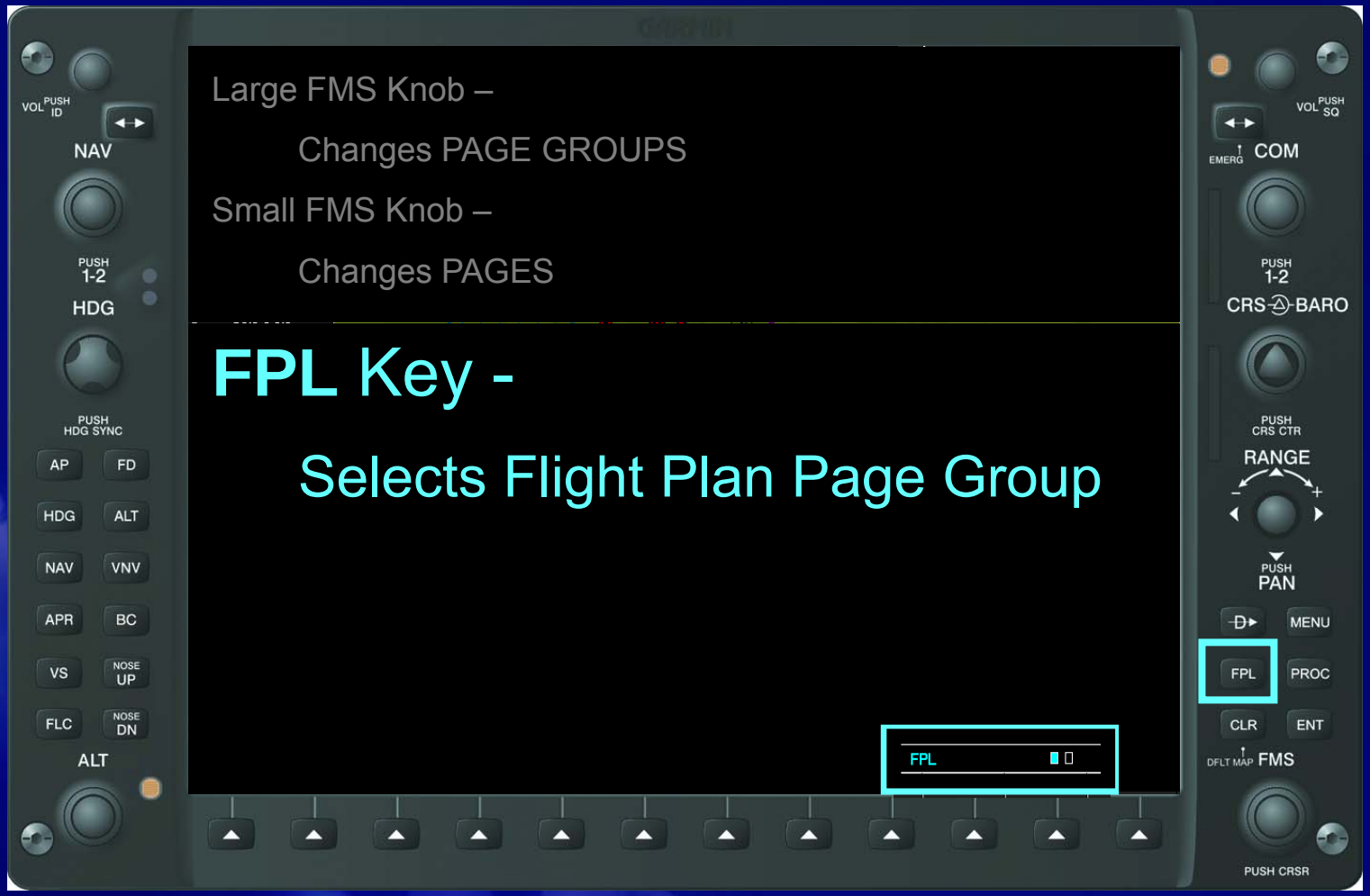
MFD Navigation



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MFD Navigation

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MFD Navigation

Large FMS Knob –

Changes PAGE GROUPS

Small FMS Knob –

Changes PAGES

FPL Key –

Selects Flight Plan Page Group

Press & Hold CLR Key

Returns Display to “Navigation Map”

(Map Group / Page 1)

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MFD Navigation

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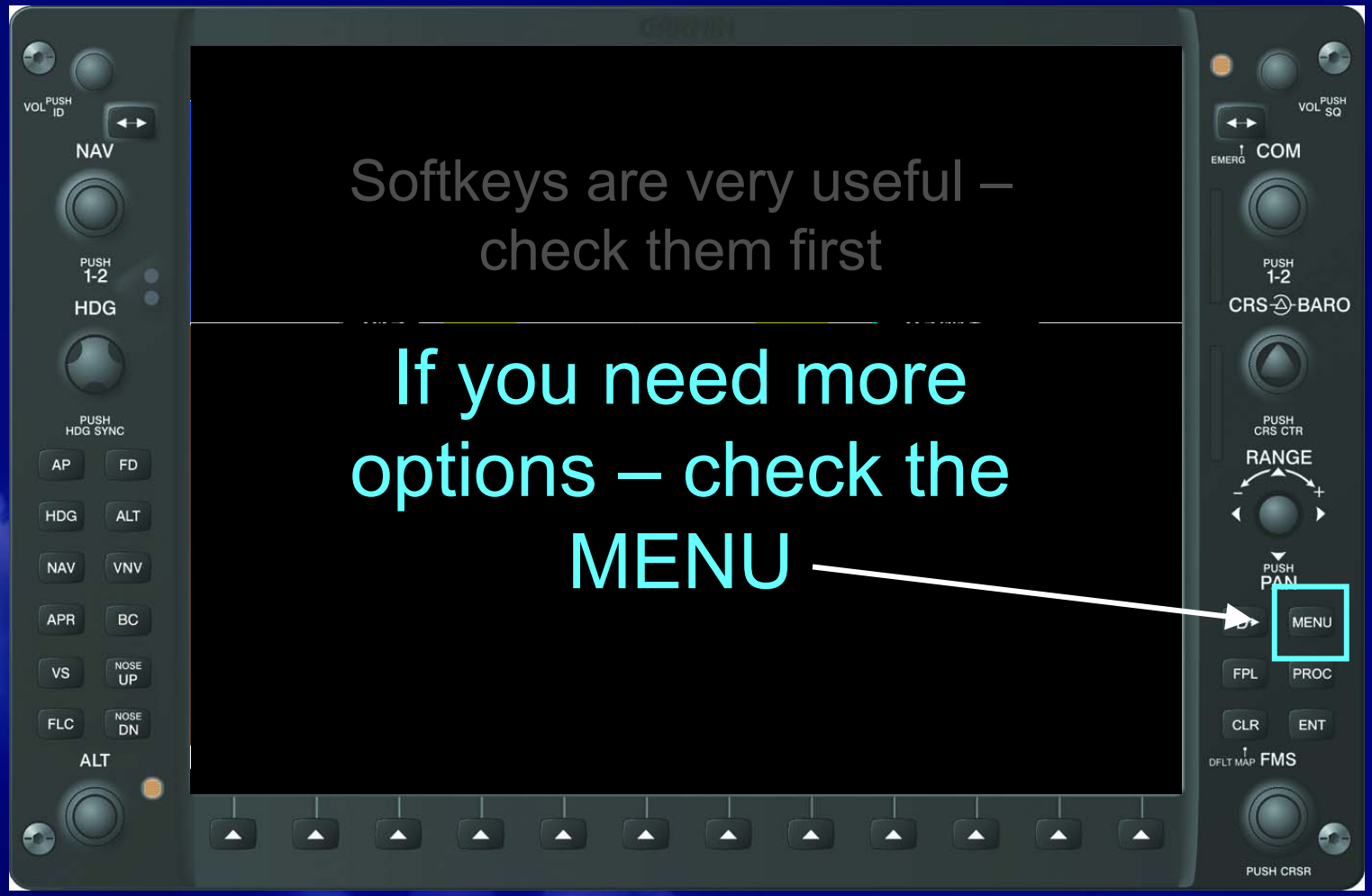
MFD Navigation



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Agenda

- Classroom
  - Training Approach
  - Display Overview
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- Lab
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KAP 140 Autopilot

- 2 Axis (Pitch and Roll)
- Vertical Commands:
  - Vertical Speed
  - Altitude Hold
  - Altitude Pre-select
  - Glide Slope Coupling
- Lateral Commands:
  - Roll (wings level)
  - Heading Select
  - Navigation Track
  - Approach Coupling
  - Reverse (Back-Course)

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KAP 140 Autopilot

Skylane/StationAir

- DC-powered Turn Coordinator supplies the autopilot with rate information
- Failure of Attitude Indicator has no effect on Autopilot
- Failure of AHRS, Autopilot will function in ROL mode only

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Autopilot Limitations

- The preflight test procedure must be successfully completed before each flight.
- Autopilot must be **OFF** during takeoff and landing.
- A pilot must be in the left pilot position with seat belt fastened during autopilot operation.
- Approved for Category 1 operation only.
- Autopilot maximum airspeed limitation:
  172 - **140 KIAS**
  182/206 - **160KIAS**
- Autopilot minimum airspeed limitation:
  172 **- 70 KIAS (80 KIAS APR mode)**
  182 - **80 KIAS**
  206 - **90 KIAS**

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Autopilot Limitations

- Maximum Flap Extension – **10°**
- Max. fuel imbalance with autopilot engaged:
  172/182 - **90 lbs.**
  206 - **100 lbs.**
- The autopilot must be disengaged below **200** feet AGL during approach operations and below **800** feet AGL for all other phases of flight.
- Operation of the KAP 140 is prohibited when the GMA 1347 Audio Panel is inoperative.

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Autopilot Operation

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- MET Test
  - Refer to Supplement 3 for complete test.
    - Autopilot - ENGAGE
      - Flight Controls - MOVE
      - AP disconnect/trim int. switch – PUSH
      - FEEL, SEE and HEAR the disconnect

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Ground Training

Module I

Lab

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Agenda

- Classroom
  - Training Approach
  - Display Overview
  - Operational Basics
  - Flight Director/Autopilot Introduction
- Lab
  - System Configuration
  - Flight scenario 1

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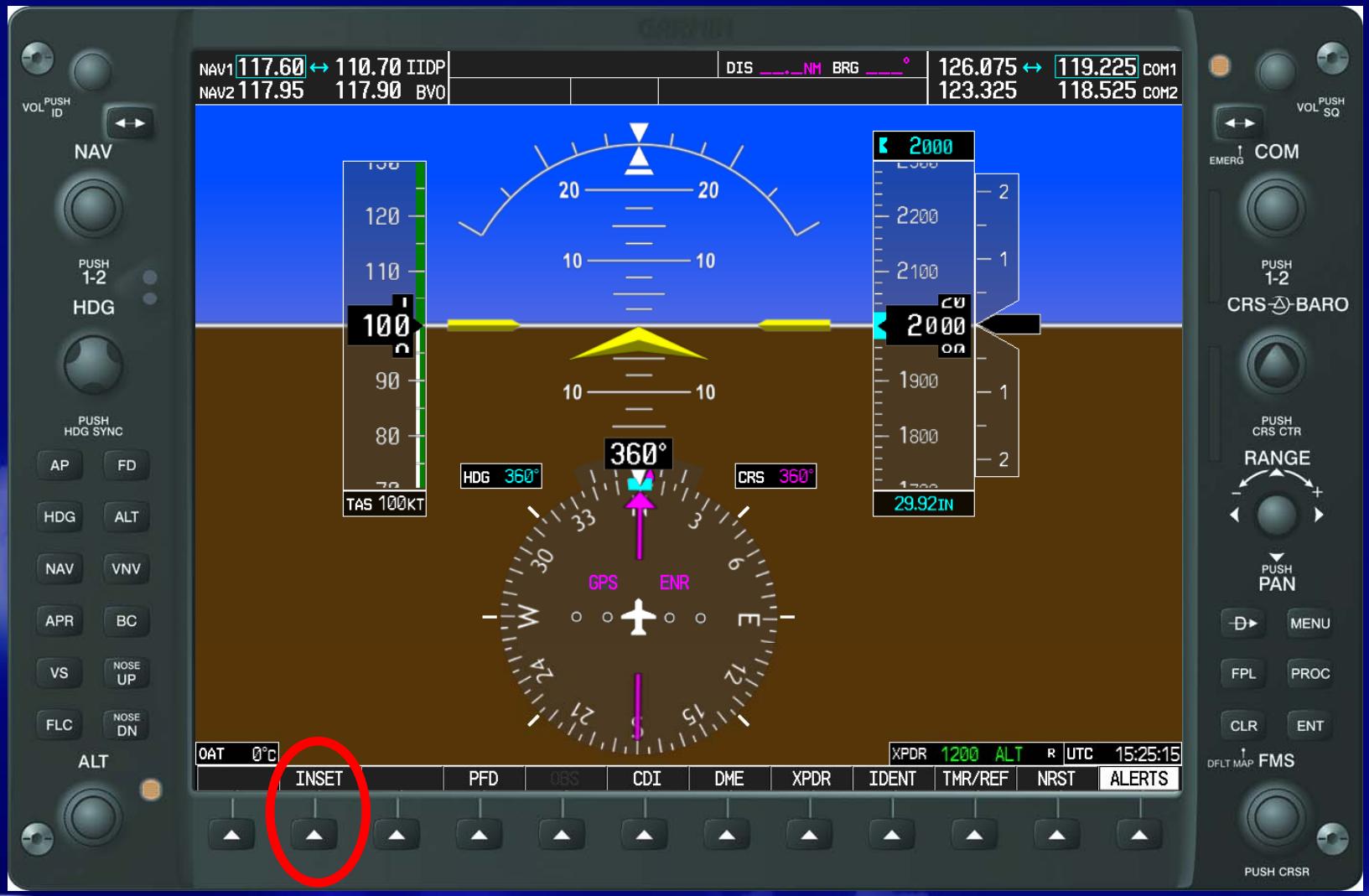
Suggested System Configuration - PFD

Press the "INSET" Softkey



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Suggested System Configuration - PFD

To Display the INSET Map

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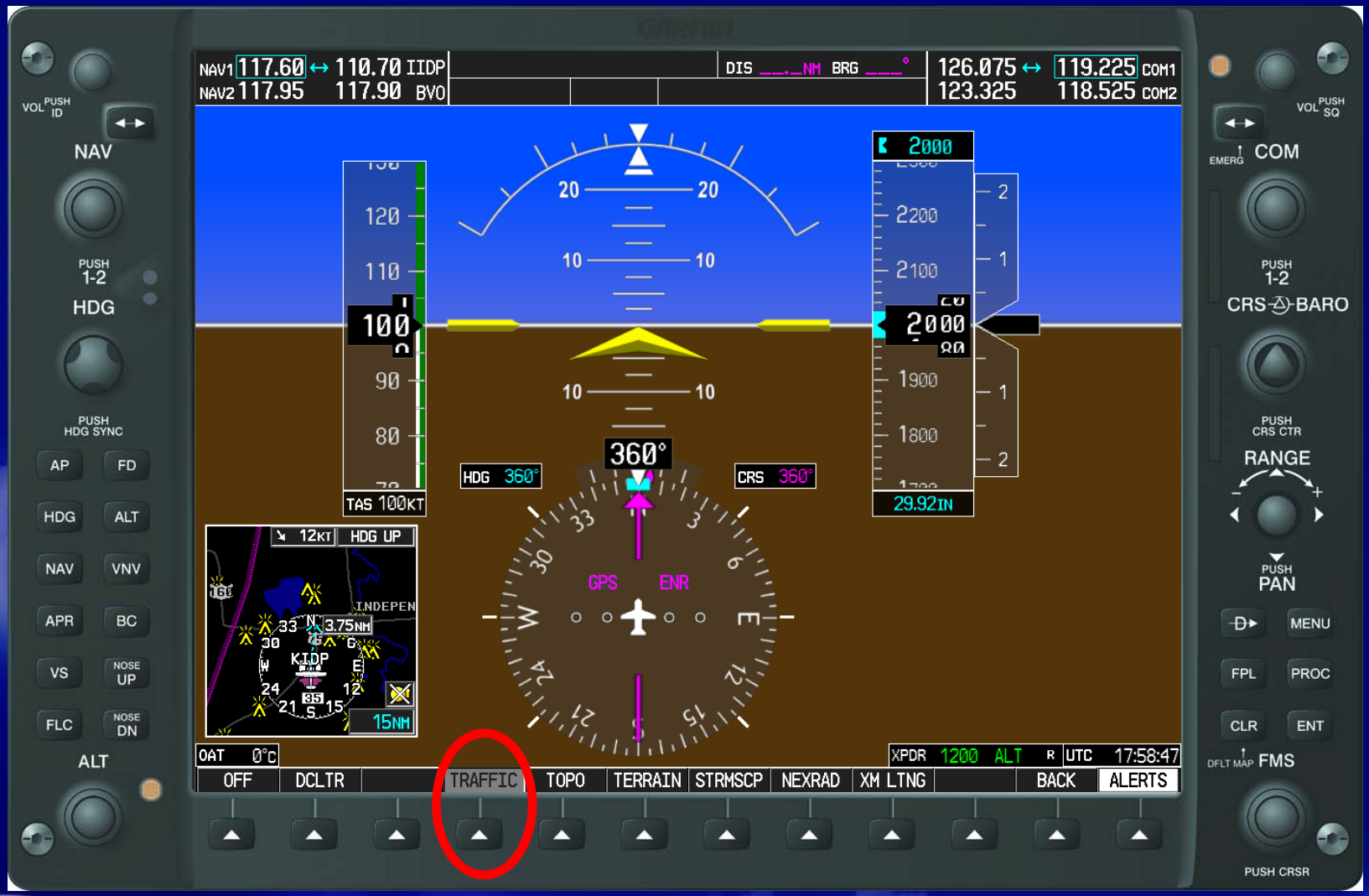
Suggested System Configuration - PFD

Add TRAFFIC



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Suggested System Configuration - PFD

Add TRAFFIC, TOPO

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Suggested System Configuration - PFD

Add, TRAFFIC, TOPO, and TERRAIN

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Suggested System Configuration - PFD

Press the BACK Softkey

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Suggested System Configuration - PFD

Press the “PFD” Softkey

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Suggested System Configuration - PFD

Press the “WIND” Softkey

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Suggested System Configuration - PFD

Select “OPTN 1”

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Suggested System Configuration - PFD

Press the BACK Softkey

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Suggested System Configuration - PFD

Select “NRST”

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Suggested System Configuration - PFD

To Display the NEAREST AIRPORTS Window

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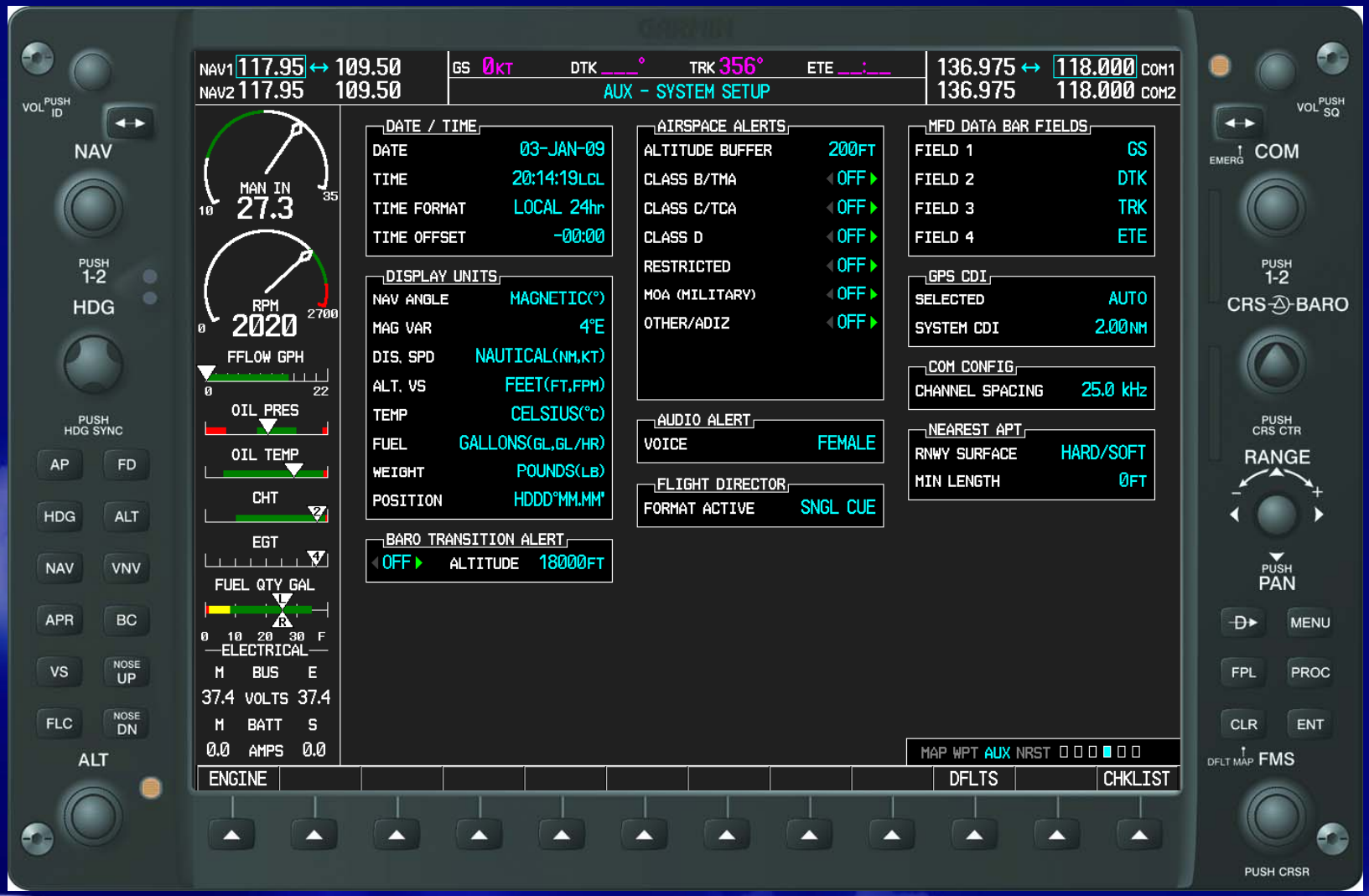
Suggested System Configuration - MFD

Defaults - System Setup



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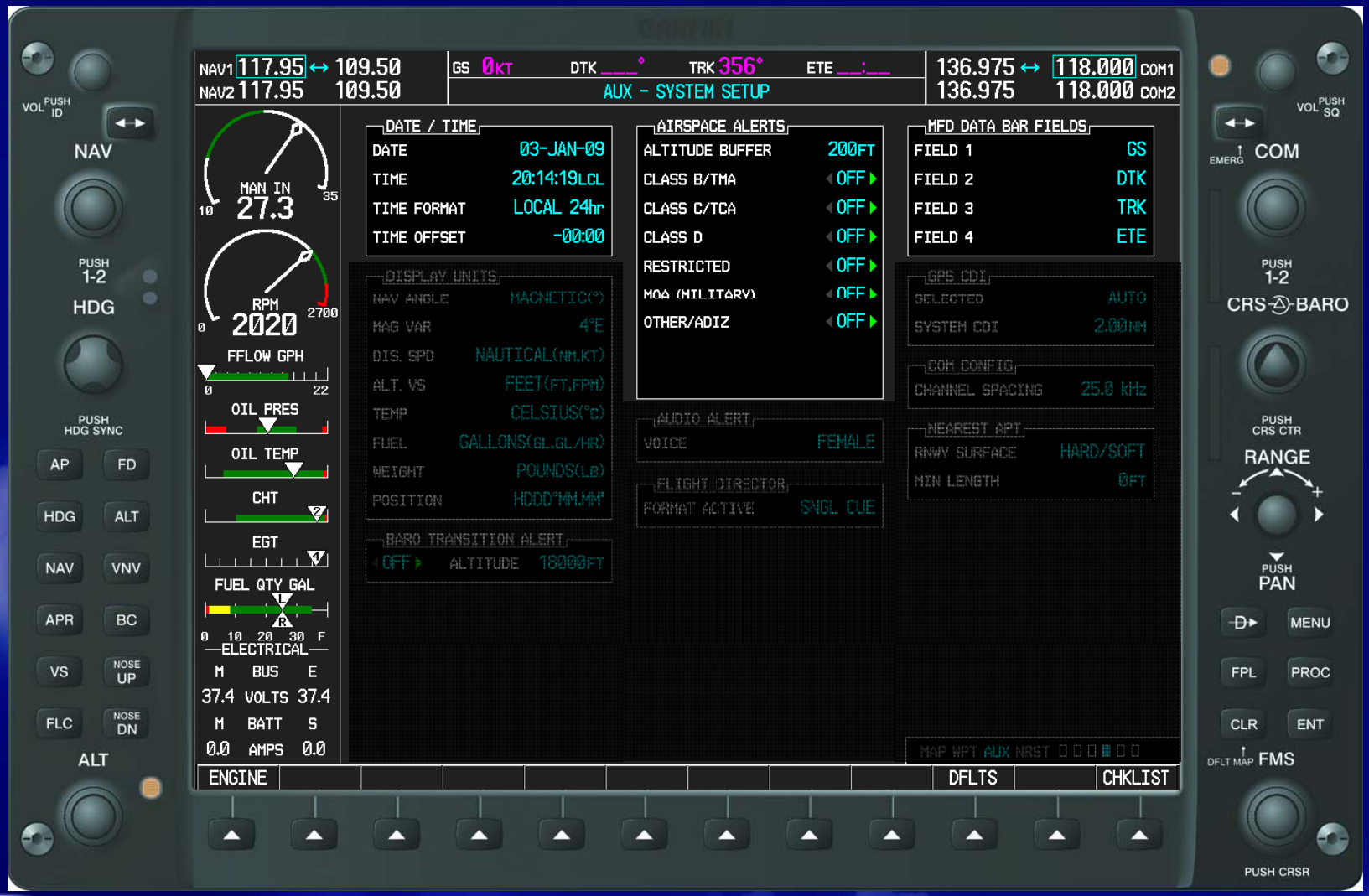
Suggested System Configuration - MFD

Defaults - System Setup



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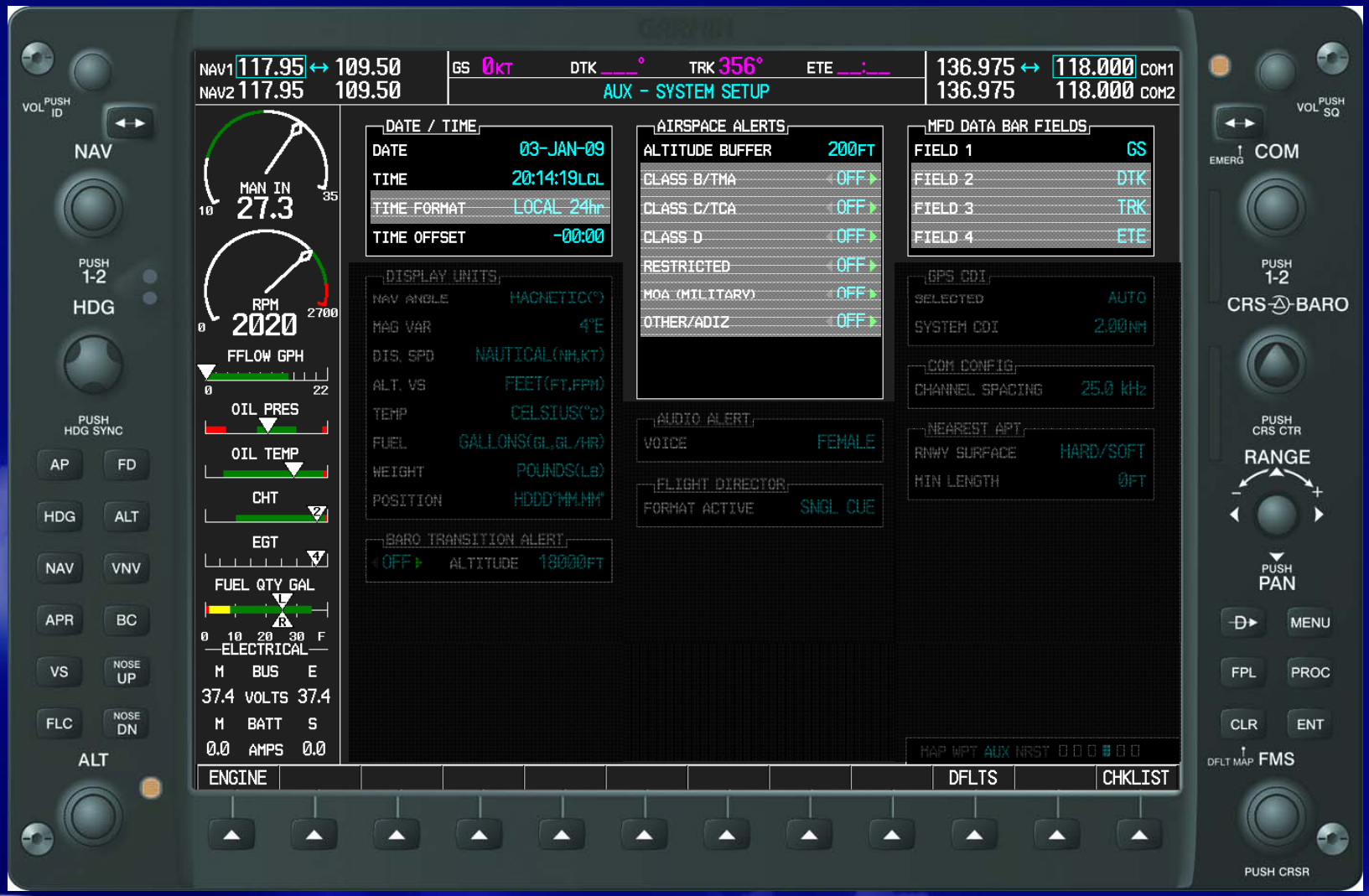
Suggested System Configuration - MFD

Defaults - System Setup



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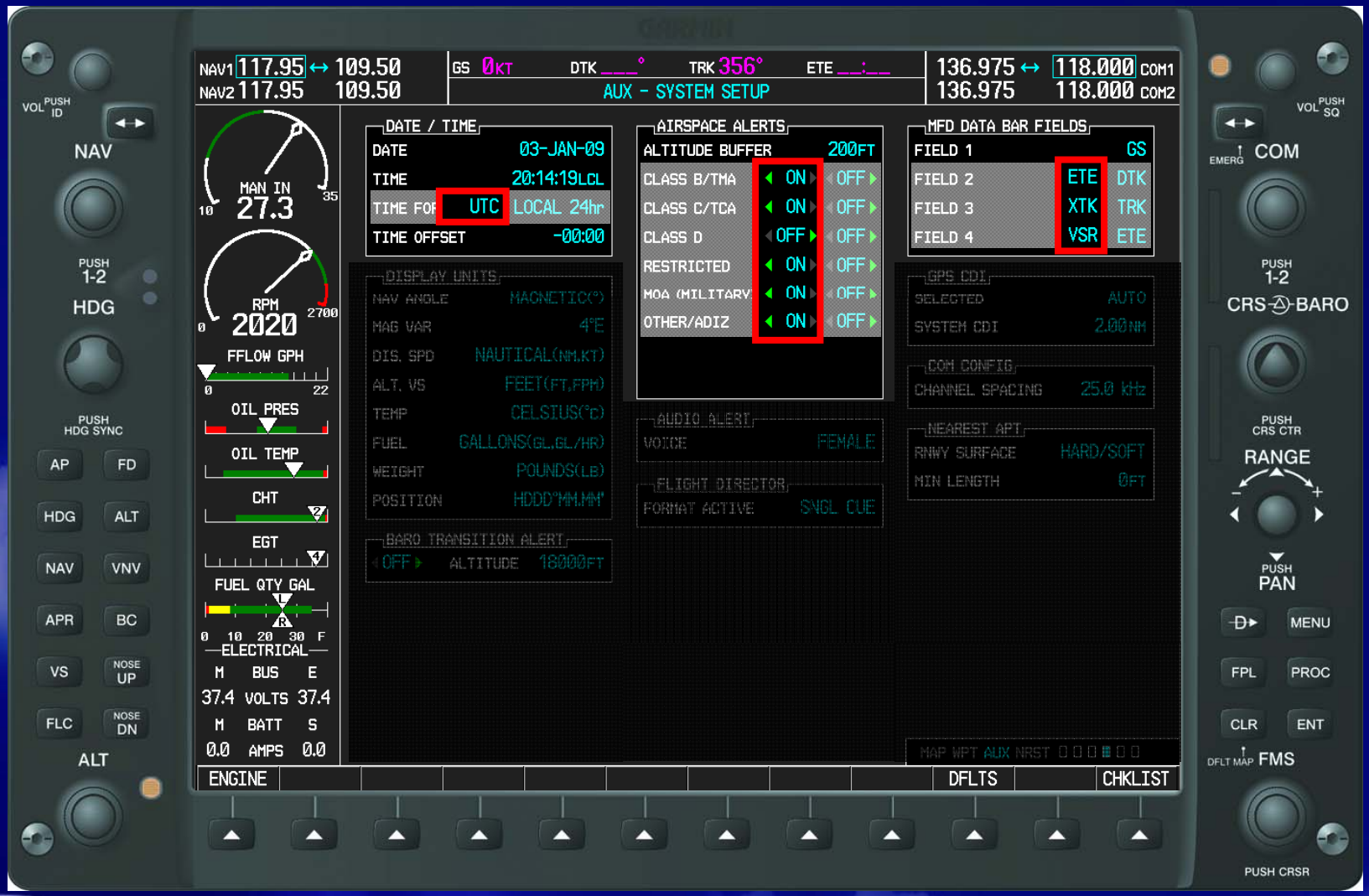
Suggested System Configuration - MFD

Suggested System Setup



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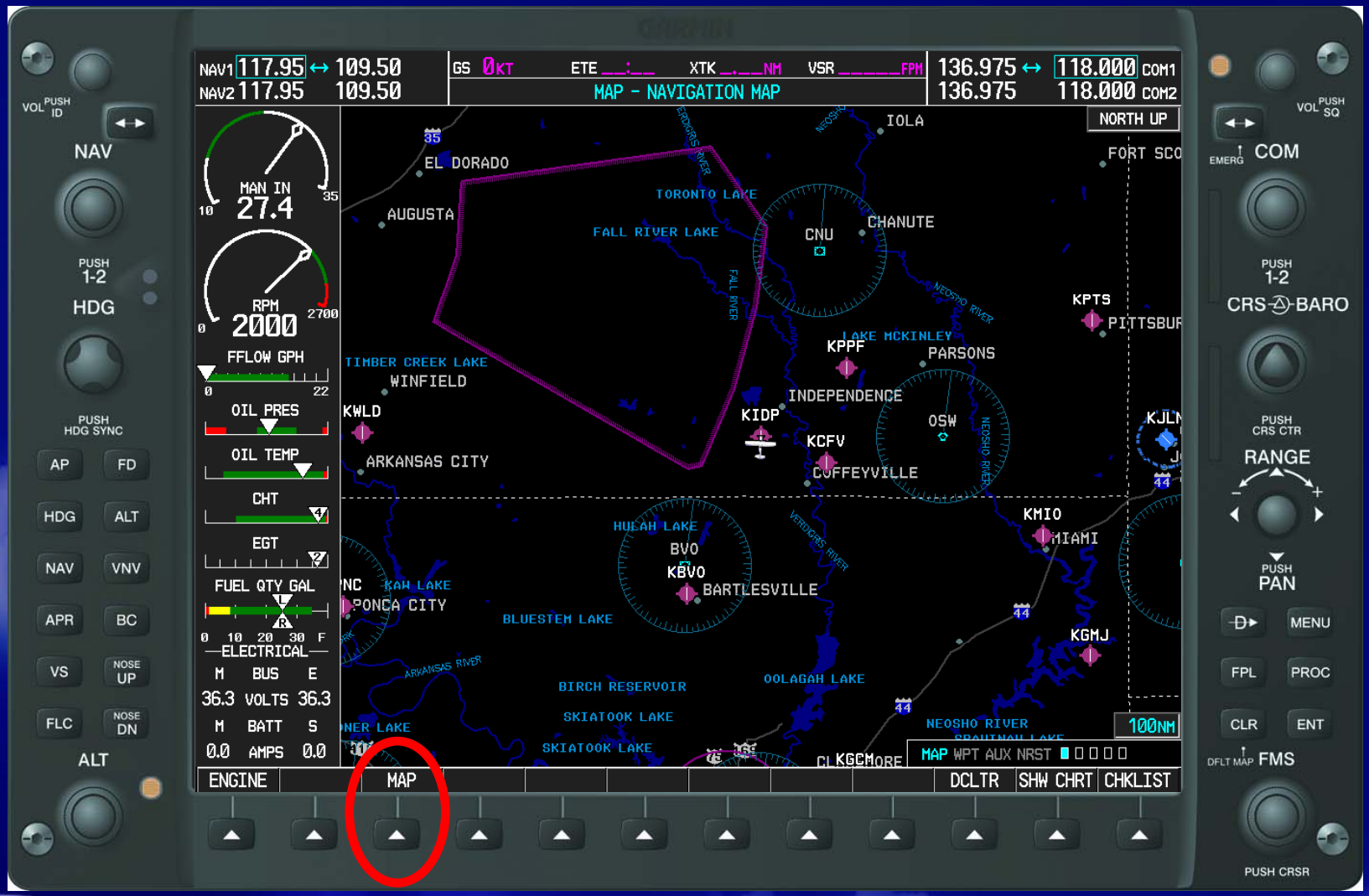
Suggested System Configuration - MFD

Default Map Configuration



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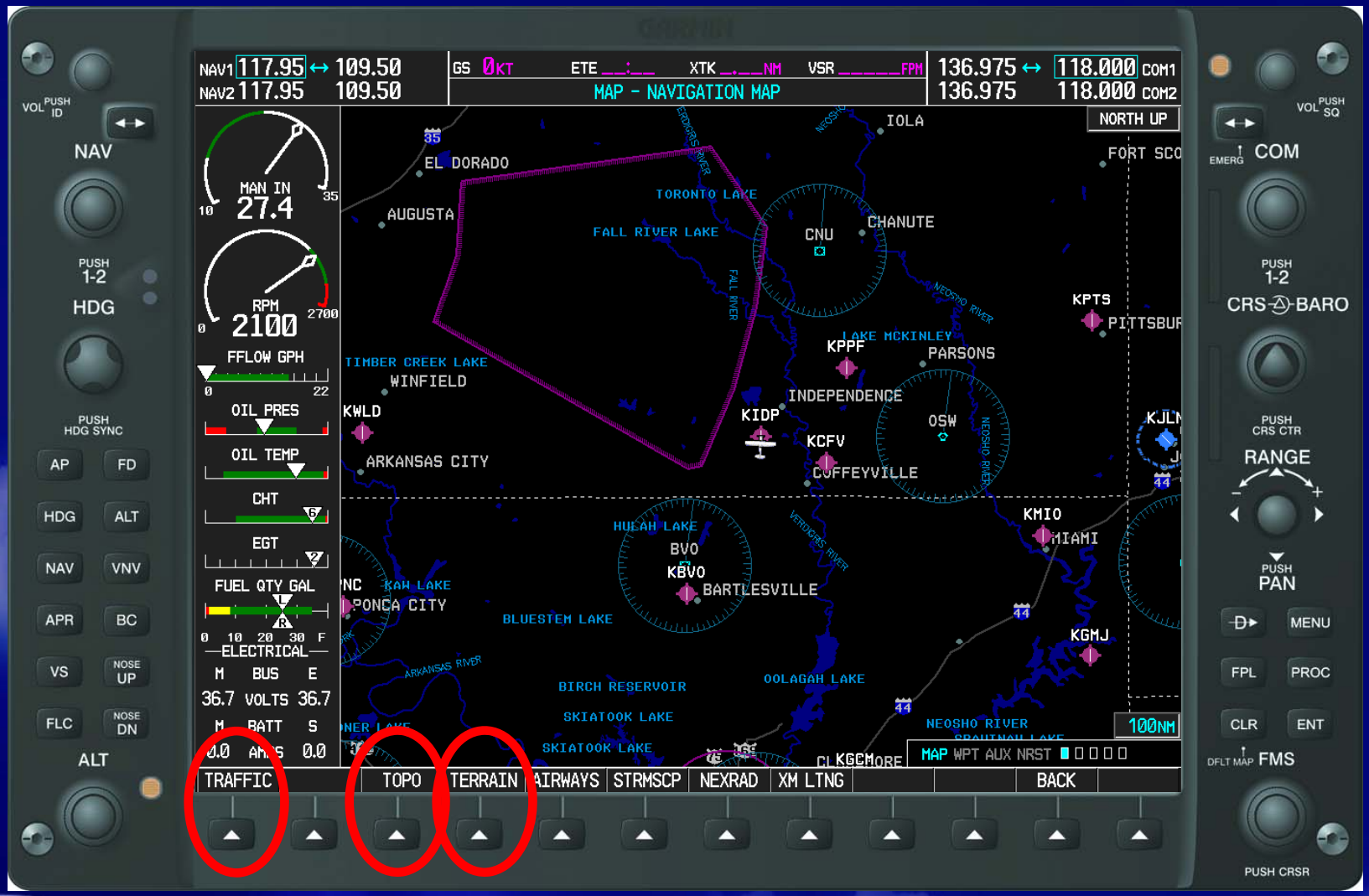
Suggested System Configuration - MFD

Press the TRAFFIC, TOPO, and TERRAIN Softkeys



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Suggested System Configuration - MFD

Suggested Map Configuration

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Agenda

- Classroom
  - Training Approach
  - Display Overview
  - Operational Basics
  - Flight Director/Autopilot Introduction
- Lab
  - System Configuration
  - **Flight Scenario 1**

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Module I Lab – Flight Scenario Content

Leg 1

- Before Taxi
  - Airport information – Waypoint Group, frequency selection – auto and manual
- Before takeoff checklist
  - Altimeter setting, Selected Altitude Set, Fuel Calculator, Flight Plan – active (Leg 1: KIDP-KJLN) and catalog (Leg 2: KJLN-KFAM),
  - GPS Status check, Transponder
- Departure
  - Autopilot on – HDG, NAV, FLC
  - Nav capture – Altitude capture
- Cruise
  - Enroute altitude change – VS mode
  - VNAV setup
  - Arrival airport information and frequency set – consider Data Link METARs
  - VNAV capture
- Descent
  - Altitude capture at BOD
  - Safe taxi features – (KJLN taxiway designators and “hot spots” information)

Leg 2 (optional leg time permitting) – review and practice Leg 1 activities as applicable (route KJLN – KFAM)

- Before departure
  - Activate stored flight plan from catalog
- Enroute
  - Enroute diversion around airspace or weather – Direct to Map Pointer then add the MAPWPT to flight plan
  - Divert to alternate airport – press D key and enter Waypoint (or place Map Pointer on Waypoint then press D key (KSGF))
- Descent
  - Direct to VNAV setup and capture

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Sample Scenario Flight Plan

Departure: Palm Beach International, West Palm Beach, Florida

Destination: Lakeland Linder Regional, Lakeland, Florida

Reference: Normal Procedures, Section 4, POH/AFM

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BEFORE TAKEOFF

1. Parking Brake . . . . . SET
2. Pilot and Passenger Seat Backs . . MOST UPRIGHT POSITION
3. Seats and Seat Belts . . . . . CHECK SECURE
4. Cabin Doors . . . . . CLOSED and LOCKED
5. Flight Controls . . . . . FREE and CORRECT
6. Flight Instruments (PFD) . . . . . CHECK (no red X's)
7. Altimeters:
   a. PFD (BARO) . . . . . SET
   b. Standby Altimeter . . . . . SET
8. ALT SEL . . . . . SET
9. Standby Flight Instruments . . . . . CHECK
10. Fuel Quantity . . . . . CHECK
    (verify level is correct)

NOTE

Flight is not recommended when both fuel quantity indicators are in the yellow band range.

11. Mixture Control . . . . . RICH
12. FUEL SELECTOR Valve . . . . . SET BOTH
13. Autopilot . . . . . ENGAGE
    (push AP button on either PFD or MFD bezel)
14. Flight Controls . . . . . CHECK
    (verify autopilot can be overpowered in both pitch and roll axes)
15. A/P TRIM DISC Button . . . . . PRESS
    (verify autopilot disengages and aural alert is heard)
16. Flight Director . . . . . OFF
    (push FD button on either PFD or MFD bezel)
17. Elevator and Rudder Trim Controls . . . . . SET FOR TAKEOFF

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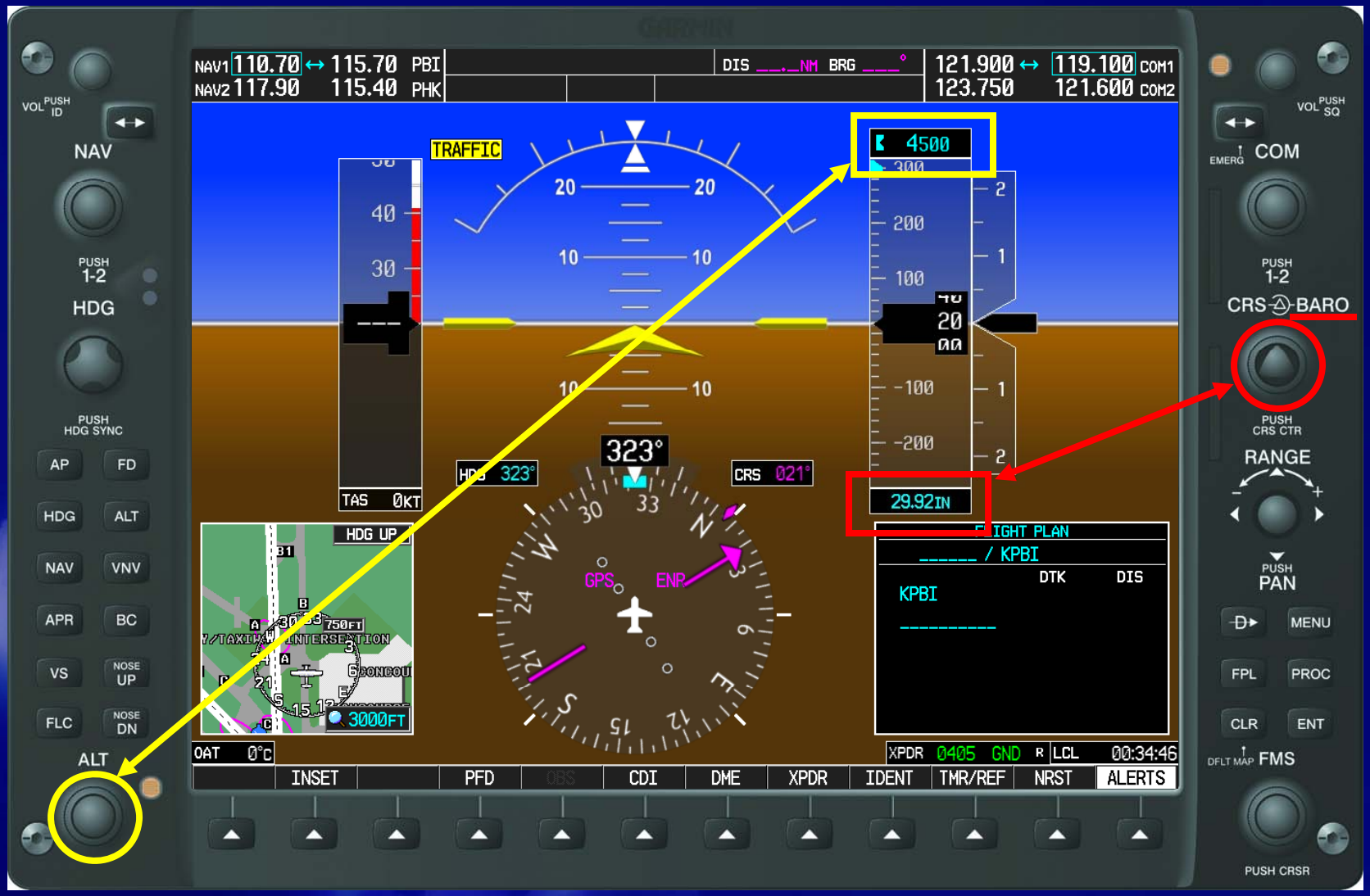

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BEFORE TAKEOFF

1. Parking Brake . . . . . SET
2. Pilot and Passenger Seat Backs . . MOST UPRIGHT POSITION
3. Seats and Seat Belts . . . . . CHECK SECURE
4. Cabin Doors . . . . . CLOSED and LOCKED
5. Flight Controls . . . . . FREE and CORRECT
6. Flight Instruments (PFD) . . . . . CHECK (no red X's)
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   a. PFD (BARO) . . . . . SET
   b. Standby Altimeter . . . . . SET
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    (verify autopilot disengages and aural alert is heard)
16. Flight Director . . . . . OFF
    (push FD button on either PFD or MFD bezel)
17. Elevator and Rudder Trim Controls . . . . . SET FOR TAKEOFF

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Press “ENGINE” Softkey

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Press “SYSTEM” Softkey

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Press “GAL REM” Softkey

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Press “64 GAL” Softkey

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Verify the GAL REM in the Fuel Calculator

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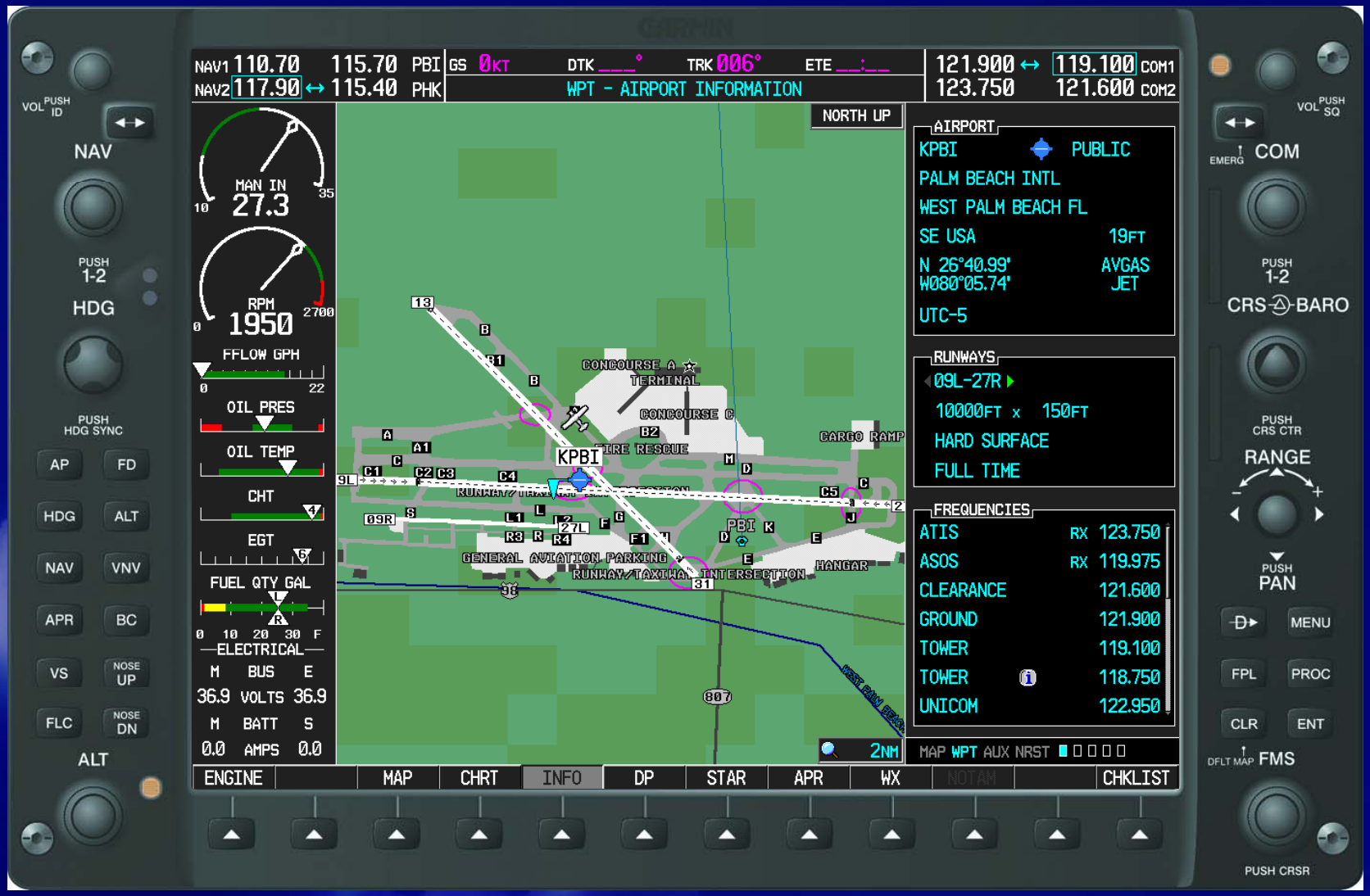

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BEFORE TAKEOFF (Continued)

18. Throttle Control . . . . . 1800 RPM
    a. MAGNETOS Switch . . . . . CHECK
       (RPM drop should not exceed 175 RPM on either magneto or 50 RPM differential between magnetos)
    b. Propeller Control . . . . . CYCLE
       (from high to low RPM; return to high RPM) (push full in)
    c. VAC Indicator . . . . . CHECK
    d. Engine Indicators . . . . . CHECK
    e. Ammeters and Voltmeters . . . . . CHECK
19. Annunciators . . . . . CHECK
    (verify no annunciators are shown)
20. Throttle Control . . . . . CHECK IDLE
21. Throttle Control . . . . . 1000 RPM or LESS
22. Throttle Control Friction Lock . . . . . ADJUST
23. COM Frequency(s) . . . . . SET
24. NAV Frequency(s) . . . . . SET
25. FMS/GPS Flight Plan . . . . . AS DESIRED

NOTE

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

26. XPDR . . . . . SET

(Continued Next Page)

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BEFORE TAKEOFF (Continued)

18. Throttle Control . . . . . 1800 RPM
    a. MAGNETOS Switch . . . . . CHECK
       (RPM drop should not exceed 175 RPM on either magneto or 50 RPM differential between magnetos)
    b. Propeller Control . . . . . CYCLE
       (from high to low RPM, return to high RPM) (push full in)
    c. VAC Indicator . . . . . CHECK
    d. Engine Indicators . . . . . CHECK
    e. Ammeters and Voltmeters . . . . . CHECK
19. Annunciators . . . . . CHECK
    (verify no annunciators are shown)
20. Throttle Control . . . . . CHECK IDLE
21. Throttle Control . . . . . 1000 RPM or LESS
22. Throttle Control Friction Lock . . . . . ADJUST
23. COM Frequency(s) . . . . . SET
24. NAV Frequency(s) . . . . . SET
25. FMS/GPS Flight Plan . . . . . AS DESIRED

NOTE

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

26. XPDR . . . . . SET

(Continued Next Page)

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Before takeoff – Transponder Set

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Engine Indication System

Skylane-182T

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Engine Indication System

Skylane-182T

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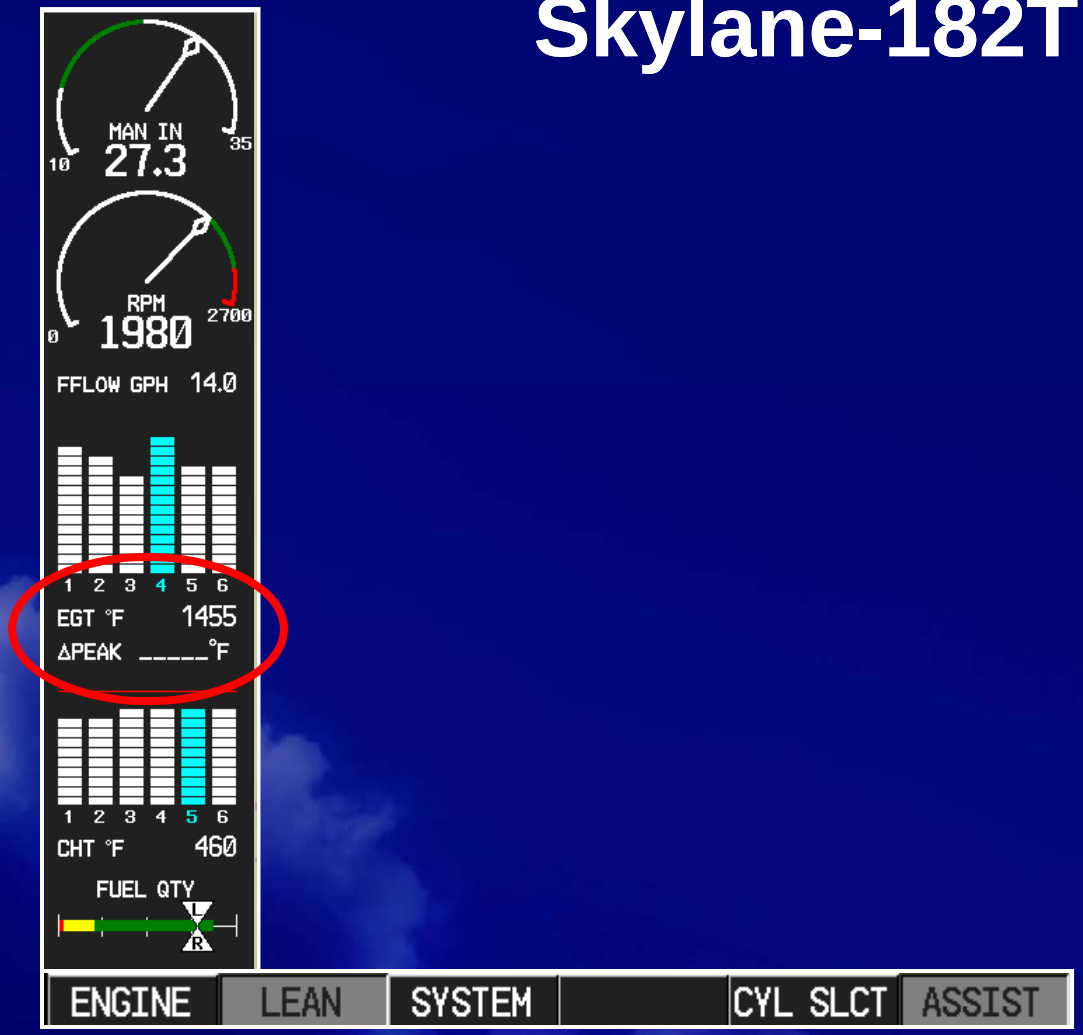
Engine Indication System

Skylane-182T



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Engine Indication System

Skylane-182T

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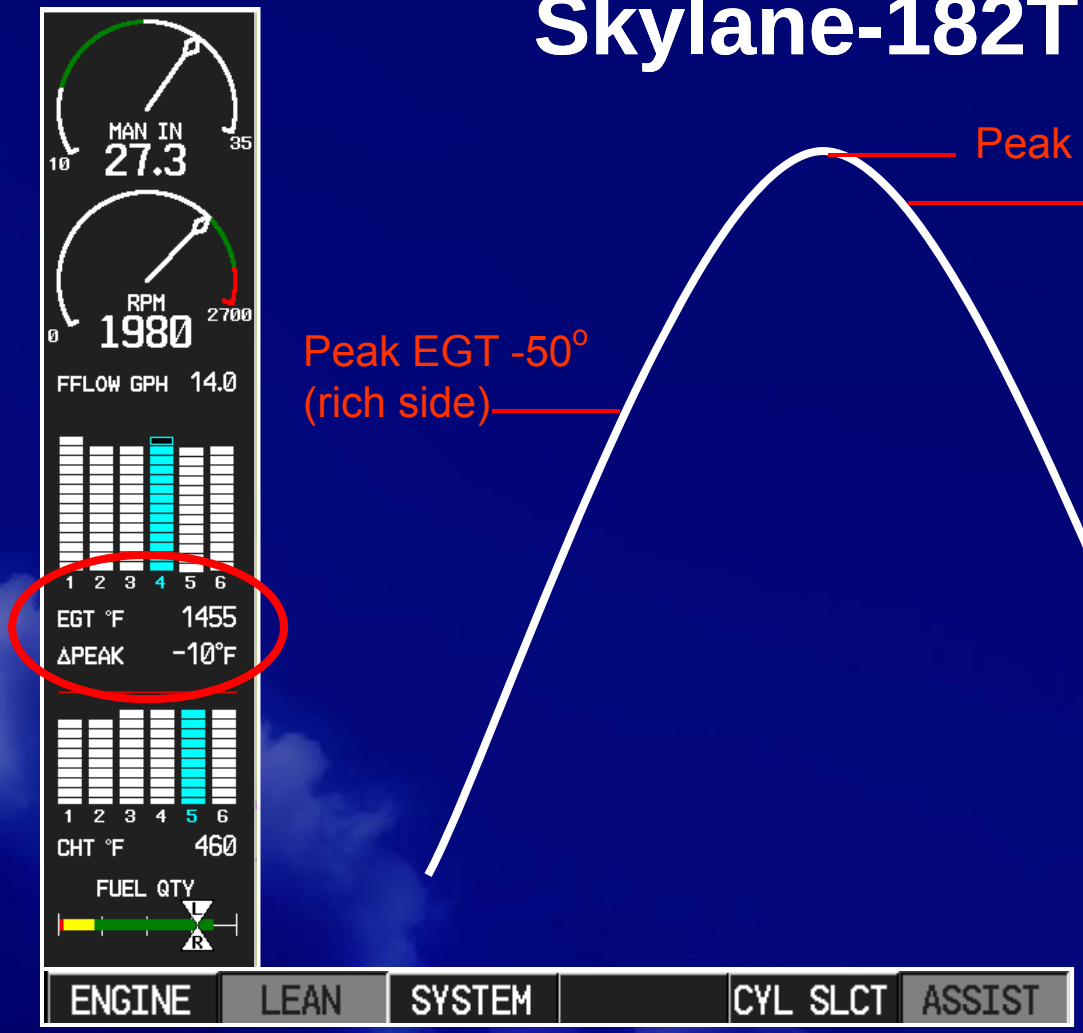
Engine Indication System

Skylane-182T



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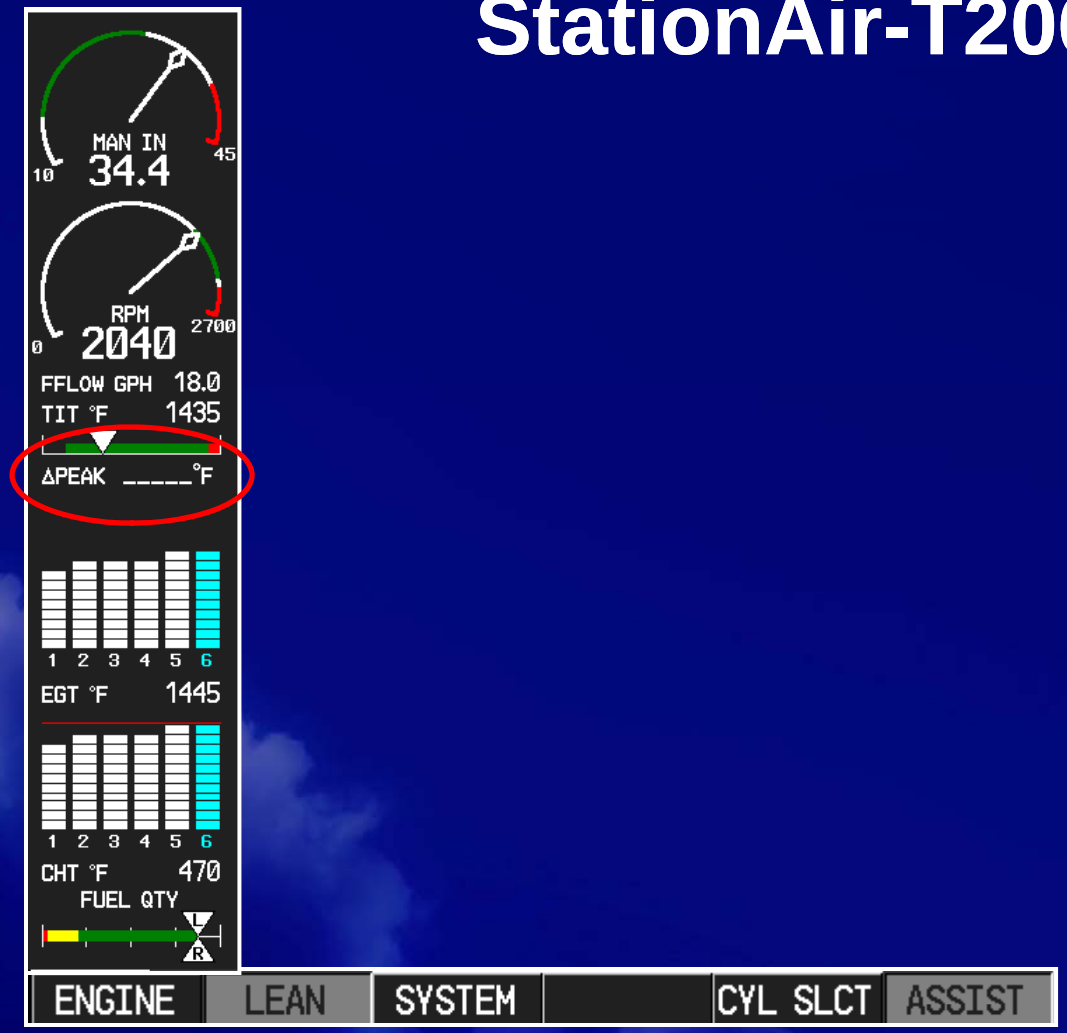
Engine Indication System

StationAir-T206



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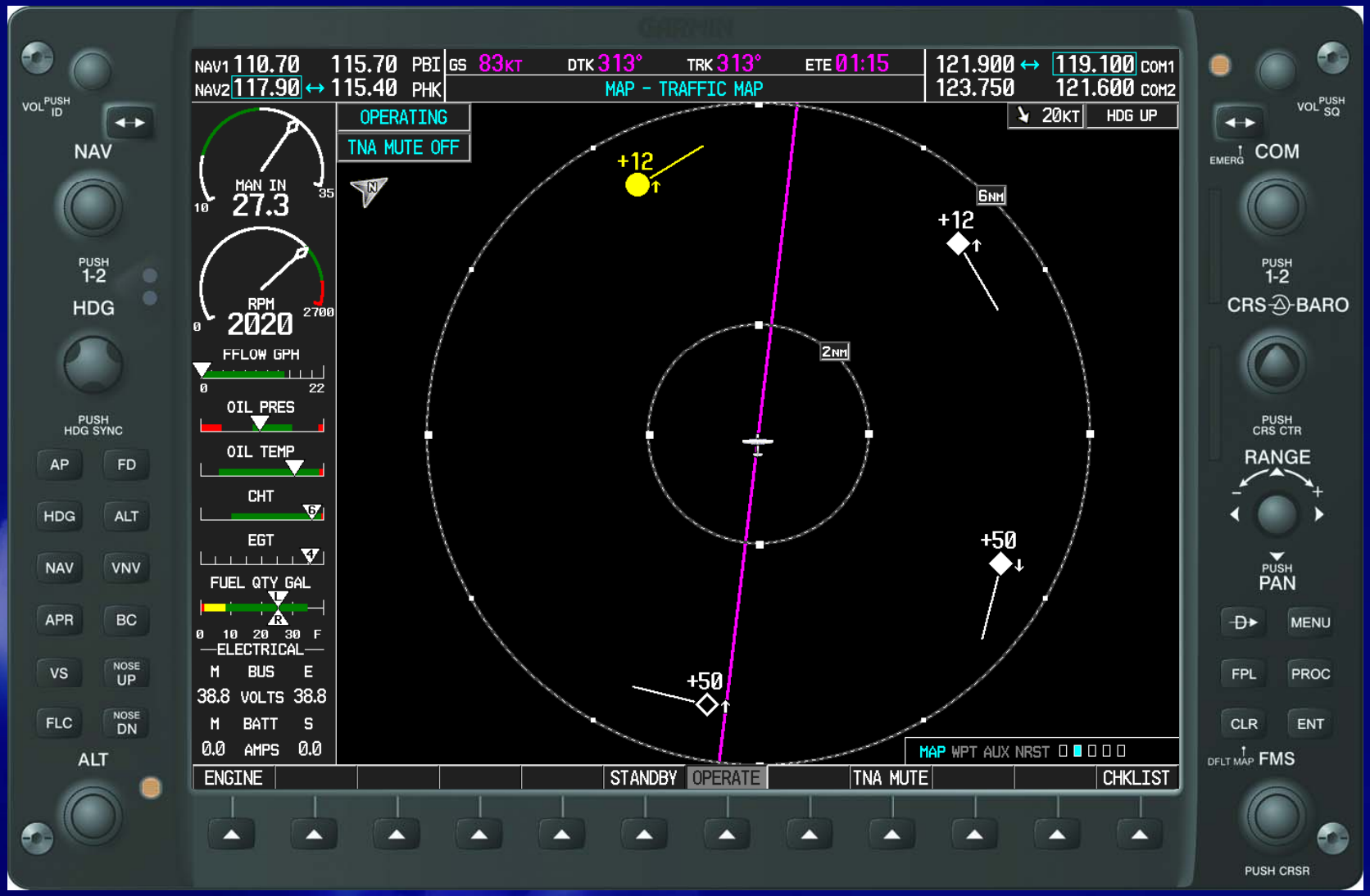

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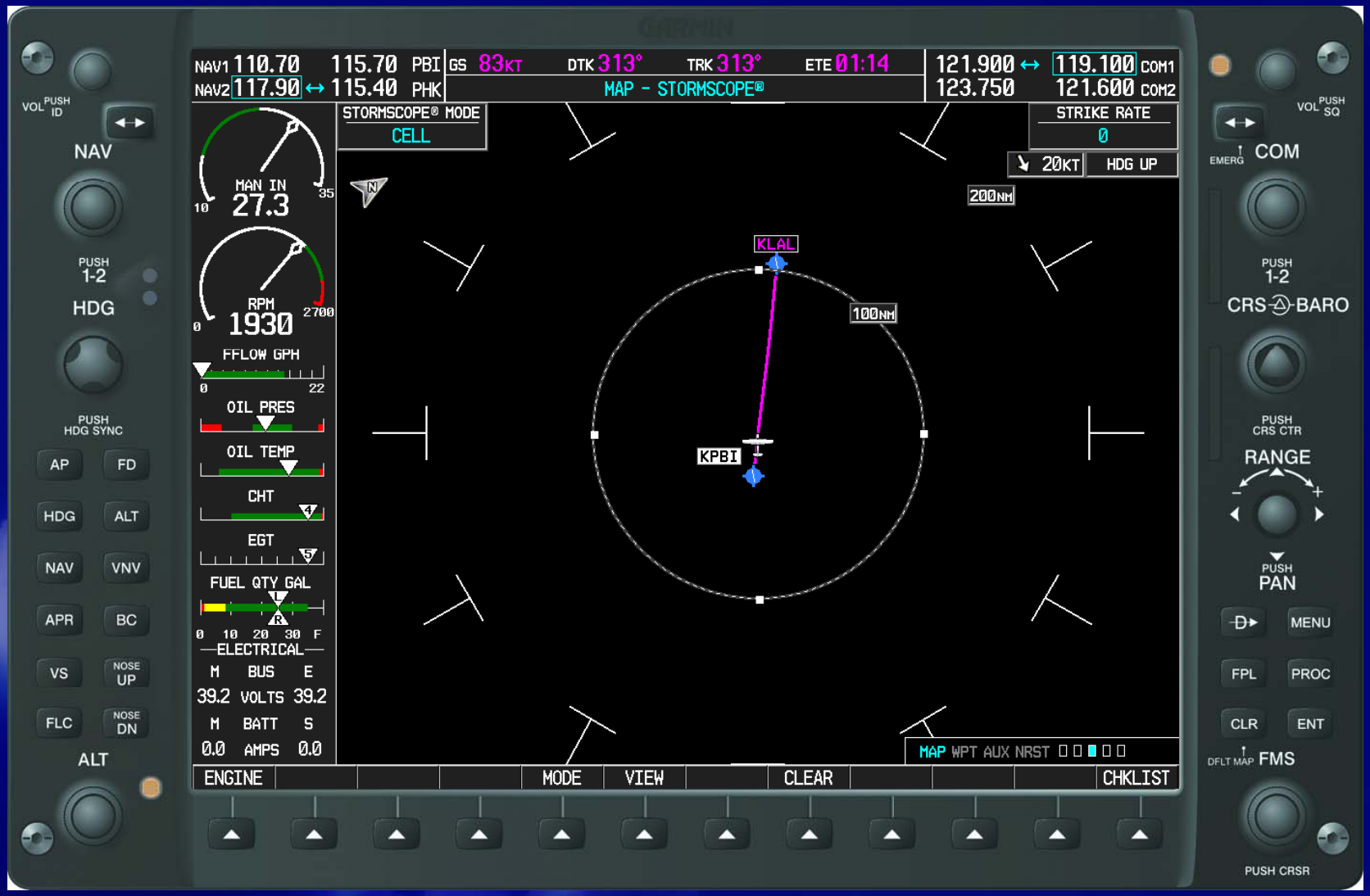

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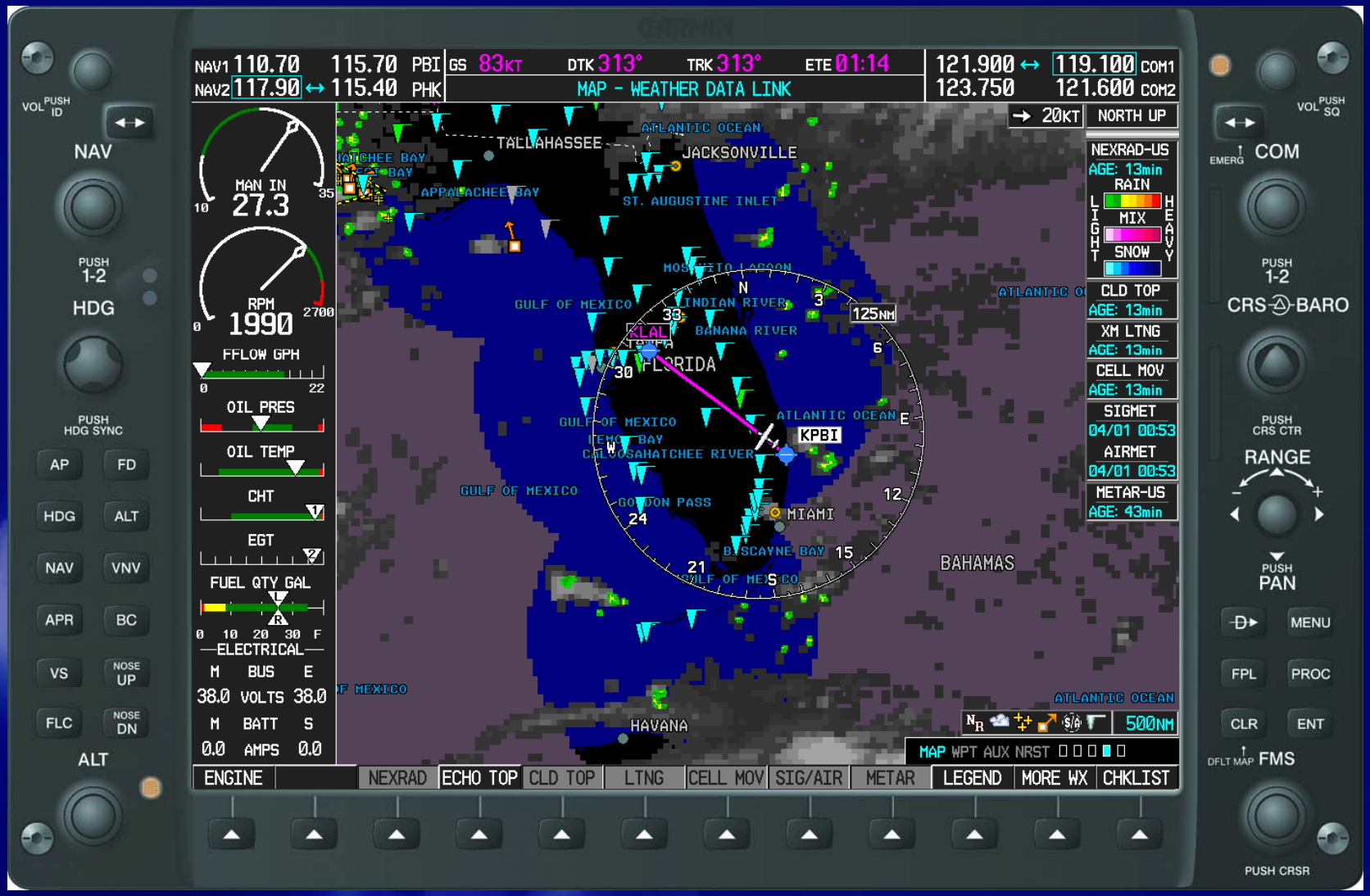

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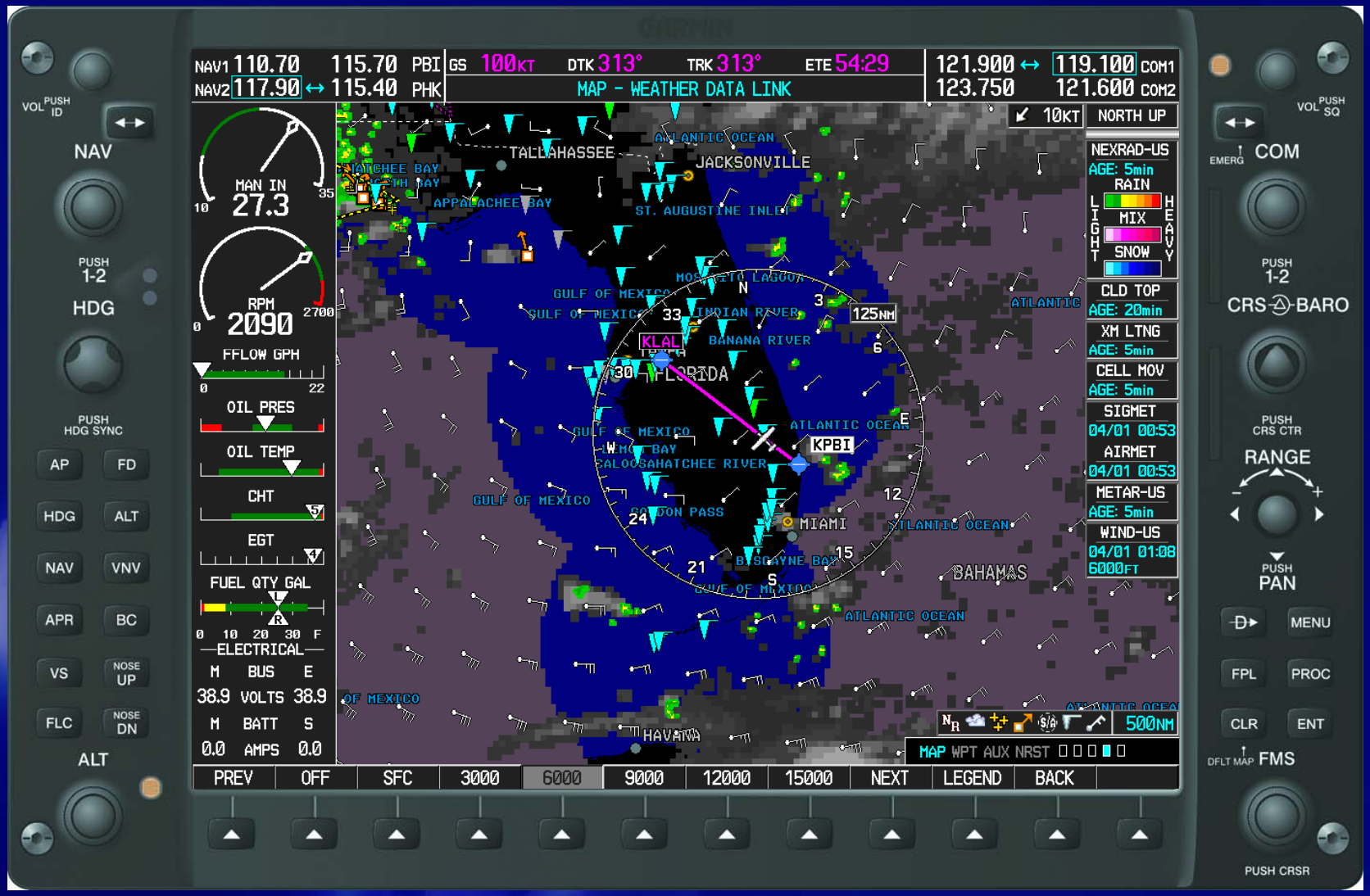

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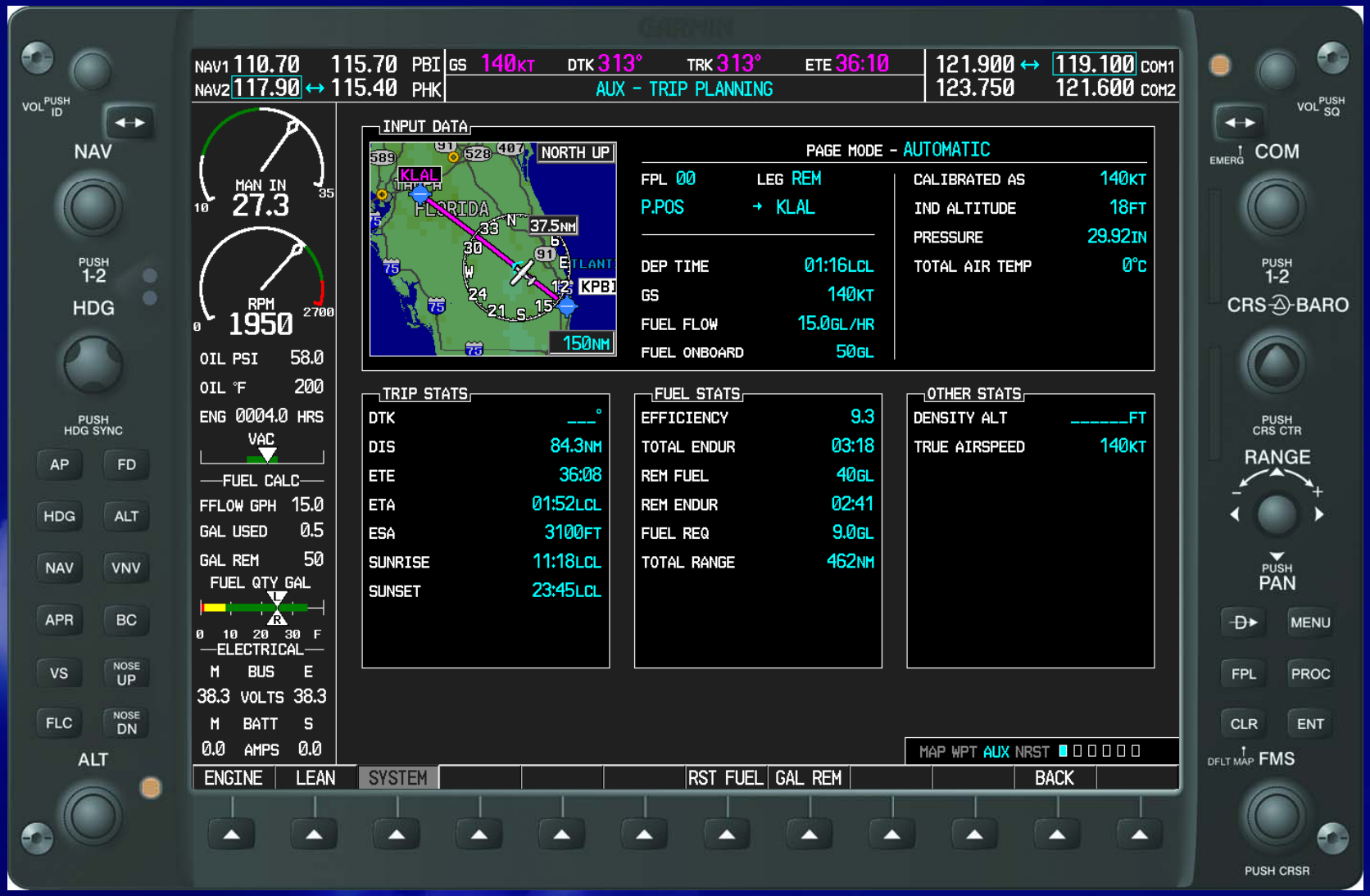

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Ground Training

Module II

Lab

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Agenda – Module II

- Lab
  - Map Setup
  - Flight Scenario 2
    - Expanded MFD
    - Instrument Approach
- Classroom
  - Expanded MFD
  - WAAS Instrument Approach Procedures
  - System Components
  - System Malfunctions
  - Questions

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Map setup – Map group, Aviation group

Leg 1

Before Taxi – review from Module I as appropriate

Airport information – Waypoint Group, frequency selection – auto and manual

Before takeoff – review from Module I as appropriate

Altimeter setting, Selected Altitude, Fuel Calculator, Flight Plan with airways (KIDP – OSW – V190 – SGF – KSGF), Transponder

Departure

Autopilot on – HDG, NAV, FLC

NAV capture – Altitude capture

Enroute

Expanded MFD Page Groups and pages - (Tailor this section to the customers needs – address more commonly used pages (the **bold underlined** ones) in more detail and limit time spent on other pages to a brief overview)

MAP – **Traffic**, Stormscope, **Weather Data Link** (suggested item to cover: NEXRAD, SIG/AIR, METAR, WIND, FRZ LVL), Terrain

WPT – **Airport**, Intersection, NDB, VOR, **User**

NRST – **Airport**, Intersection, NDB, VOR, User, **Frequencies**, Airspace Alerts (point out Softkey function)

AUX - **Trip Planning**, Utility, GPS Status, System Setup, XM Information, System Status

Arrival

Approach selection and loading (KSGF- ILS 14), Approach briefing (Show Chart, BARO MIN), VNAV setup, VNAV capture, Activate approach

Approach

Approach mode of autopilot, Automatic NAV source change, Approach tracking (LOC & GS)

Missed approach

Go Around Switch, Autopilot – ON, NAV mode

Leg 2 (optional additional leg with GPS/RNAV approach if time permits)

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Suggested System Configuration - MFD

Suggested MENU Configuration

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Suggested System Configuration - MFD

Press ENT Key

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Suggested System Configuration - MFD

Turn the Small FMS Knob to Map Group Map Setup Groups

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Suggested System Configuration - MFD

Additional Map Setup Groups

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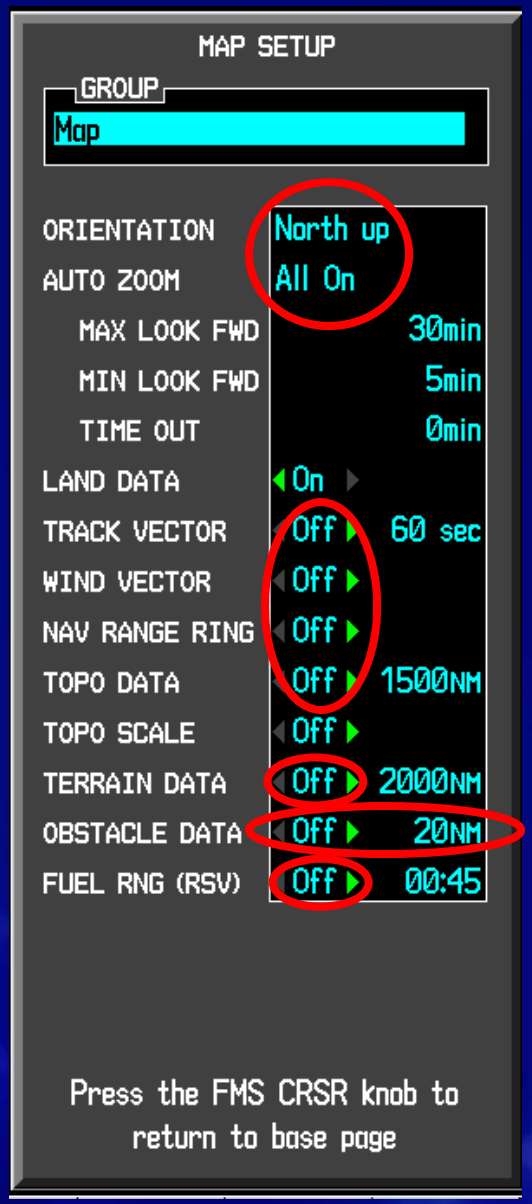
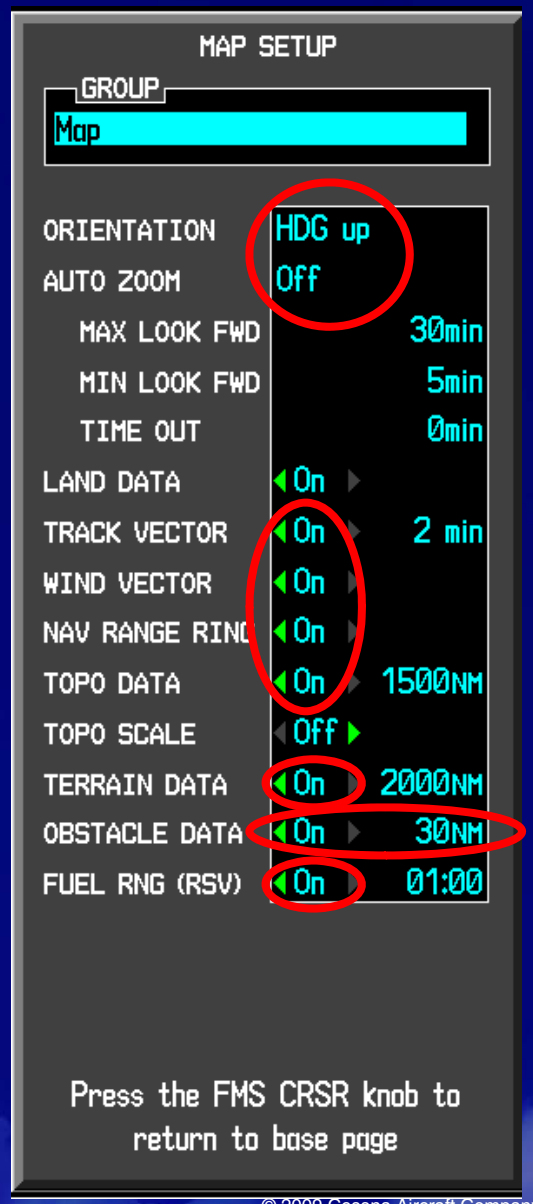
Map Group

Map Setup Groups

Defaults



Suggestions



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Aviation Group

Defaults

MAP SETUP

GROUP: Aviation

	TEXT	RNG
ACTIVE FPL		2000NM
ACTIVE FPL WPT	Med	2000NM
LARGE APT	Lrg	200NM
MEDIUM APT	Med	150NM
SMALL APT	Med	50NM
SAFETAXI		3NM
RWY EXTENSION		Off
INT WAYPOINT	Med	15NM
NDB WAYPOINT	Med	15NM
VOR WAYPOINT	Med	150NM
CLASS B/TMA		200NM
CLASS C/TCA		200NM
CLASS D		150NM
RESTRICTED		200NM
MOA (MILITARY)		200NM
OTHER/ADIZ		200NM
TFR		500NM

Press the FMS CRSR knob to return to base page

Suggestions

MAP SETUP

GROUP: Aviation

	TEXT	RNG
ACTIVE FPL		2000NM
ACTIVE FPL WPT	Med	2000NM
LARGE APT	Lrg	500NM
MEDIUM APT	Med	300NM
SMALL APT	Small	100NM
SAFETAXI		3NM
RWY EXTENSION		30NM
INT WAYPOINT	Med	15NM
NDB WAYPOINT	Med	15NM
VOR WAYPOINT	Med	150NM
CLASS B/TMA		200NM
CLASS C/TCA		200NM
CLASS D		150NM
RESTRICTED		200NM
MOA (MILITARY)		200NM
OTHER/ADIZ		200NM
TFR		500NM

Press the FMS CRSR knob to return to base page

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KAP 140 Autopilot

Instrument Approach Procedures

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Autopilot Operations

1. Departed KWLD for KIDP.
2. Altitude >800' AGL, AP engaged.
3. 5,000' selected, armed and captured.
4. HDG established to intercept DTK, NAV captured.

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1. Enroute…

   Clearance received: “Skylane N21454, cleared for the ILS Runway 35 at Independence, pilot’s discretion to 3,000 until established.”

2.

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- Select Procedures:
- Option #1: SELECT APPROACH.
- Press ENT.

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- Select Approach:
- Option #1: ILS 35.
- Press ENT.

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- Select Transition:
- Option #1: VECTORS.
- Use FMS knob to scroll through list.

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- Select desired transition.
- Press ENT.

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- LOAD? Press ENT.
- ACTIVATE? Use FMS knob to change selection.

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- ACTIVATE?
  Press ENT.

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- "GPS guidance is for monitoring only. Activate Approach?"
- YES? Press ENT.

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- DTK 105° to VOVRY.
- Autopilot turns to intercept new DTK.

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- DTK established.
- Brief Approach
- Press SHW CHRT Softkey.

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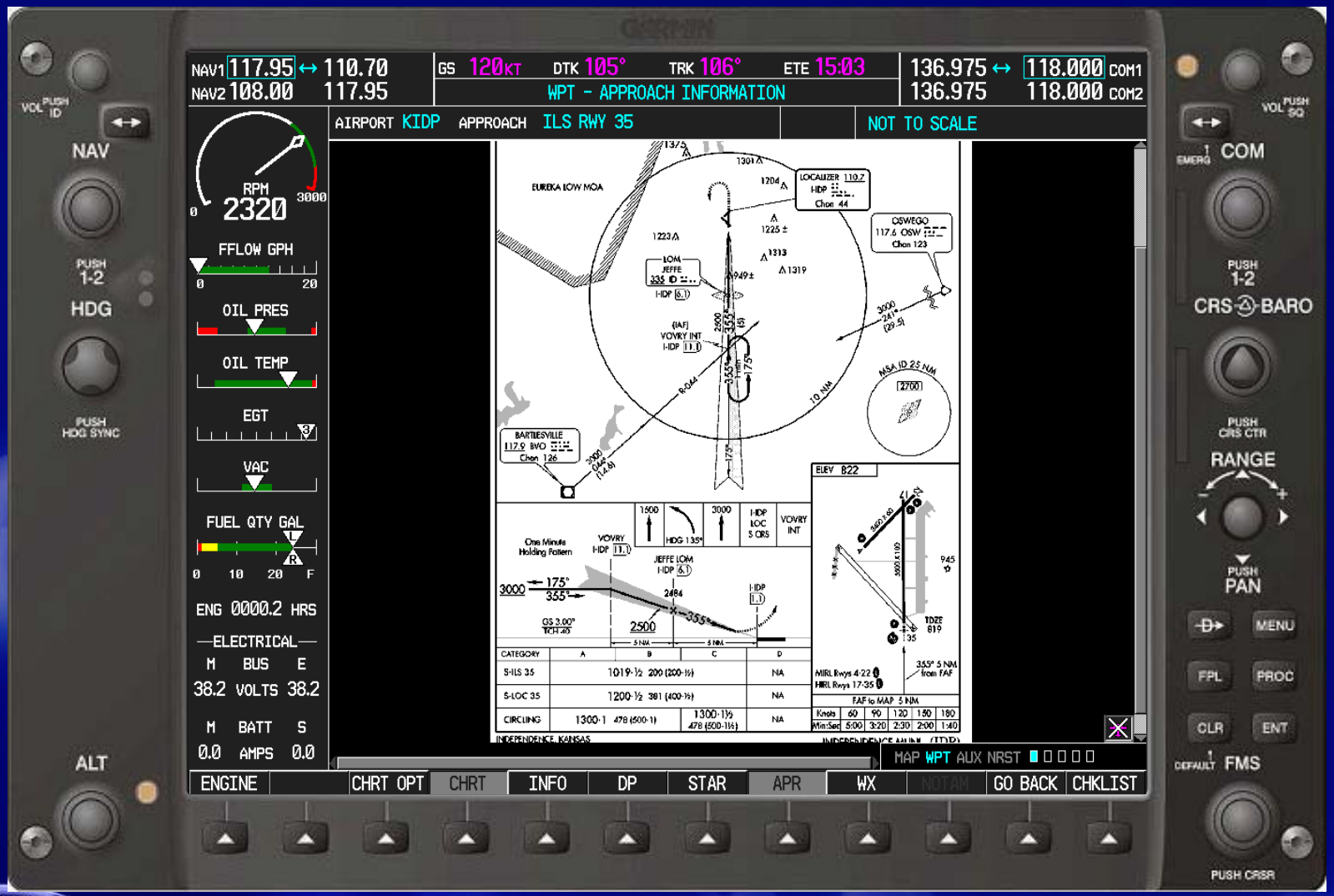
- Garmin FliteCharts



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- Active Flight Plan-VNAV

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- “TOD within 1 minute”
- 3000’ armed.

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- VS set to ≈ 600’

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- Prior to reaching IAF, recommended entry provided on PFD.

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- Turn anticipation provided in Waypoint Status Bar.

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- Turn anticipation provided in Waypoint Status Bar.
- *NOTE*: Automatic course slewing, next DTK 355º.

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- *NOTE*: Holding pattern timer in FLIGHT PLAN window.
- Fly outbound predetermined length of time.

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- Turn Inbound.

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- Inbound course established.

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- Next DTK 355º.

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WARNING!!

When the KAP 140 is engaged in NAV, APR, or REV and the NAV source is changed manually or automatically, the AP will revert to ROL. <u>This is indicated by NAV, APR or REV *FLASHING*</u>

1. Press APR.

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- Display reverts to ROL, APR armed, momentarily.
- Precomputed capture point is reached.

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- APR captured.
- GS armed.

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- GS captured.

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- BARO MIN set.

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- At DH, disengage AP.
- AP will appear flashing.

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- Initiate climb.
- Crossing MAP, note SUSP on HSI.
- Press CDI twice to switch to GPS.

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- Press SUSP Softkey.

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- Maintain 355º until 1500'.

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- Next HDG Leg 135°.

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- HDG 135º to intercept.

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- HDG established.
- AP Engage.

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- Turn right to 175º now.

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- ARM selected altitude.

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- Turn right to 175º now.

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- Turn to intercept crs 175º.

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- Course established.
- Altitude captured.

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- Brief Holding Pattern.

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Emergency Procedures

RECOVERY PROCEDURE

1. In case of Autopilot, Autopilot Trim, or Manual Electric Trim malfunction (accomplish Items a and b simultaneously):

   a. Airplane Control Wheel - **GRASP FIRMLY** and regain control of aircraft.
   b. **A/P DISC/TRIM INT** Switch - **PUSH** and **HOLD** throughout recovery.
   c. AIRCRAFT - **TRIM** manually as needed.
   d. AUTO PILOT Circuit Breaker - **OPEN** (pull out).

WARNING

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

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Ground Training

Module II

Classroom

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Agenda

- Lab
  - Map Setup
  - Flight Scenario 2
- Classroom
  - Expanded MFD
    - TIS
    - Stormscope
    - Terrain Awareness
  - WAAS Instrument Approach Procedures
  - System Components
  - System Malfunctions
  - Questions

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Traffic Information Service - TIS

Traffic Display

- Aircraft Location
- Aircraft altitude relative to you
- Anticipated Track

Traffic Alert

- Within 30 sec.

Projected to be

- Within ½ nm AND
- Within 500 feet

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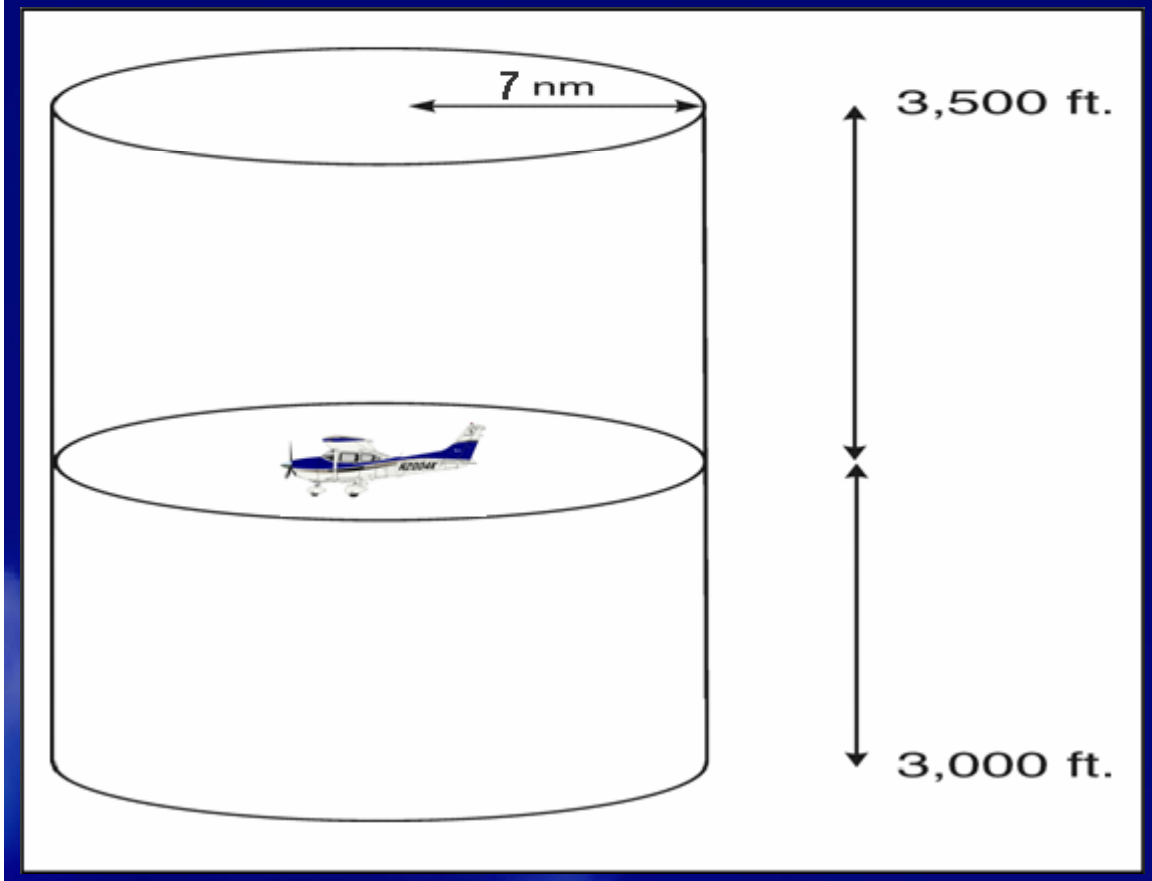

Service Area

Limitations

- Only available within ±55 n.m. of designated locations (Center airspace not available)
- Up to 8 intruder aircraft, within service area
- Secondary radar targets only (Mode A, C and S transponder equipped)
- Traffic Alerts (TA), but no Resolution Advisories (RA)

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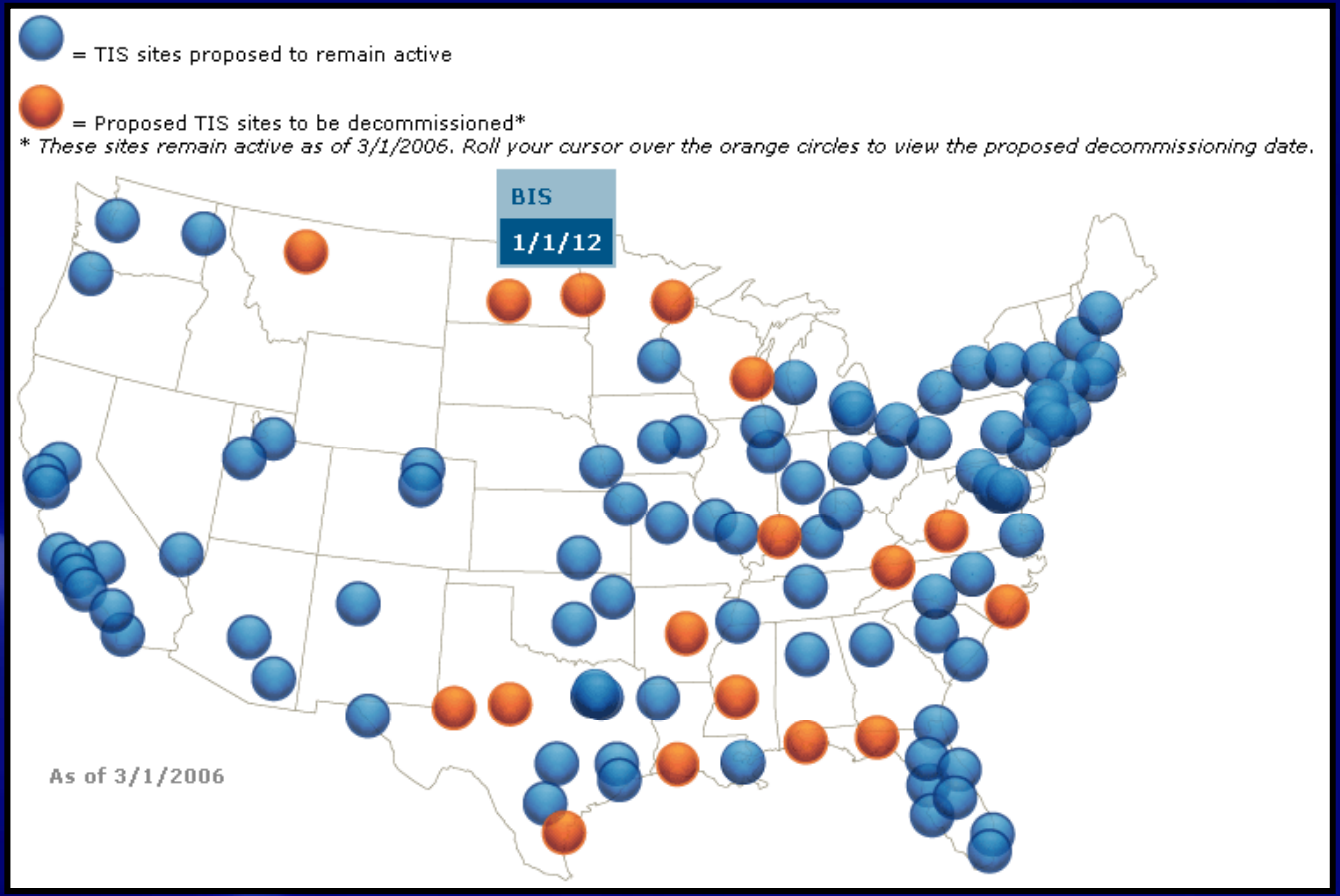
View of Mode S Coverage Area



www.garmin.com/aviation/tis.jsp

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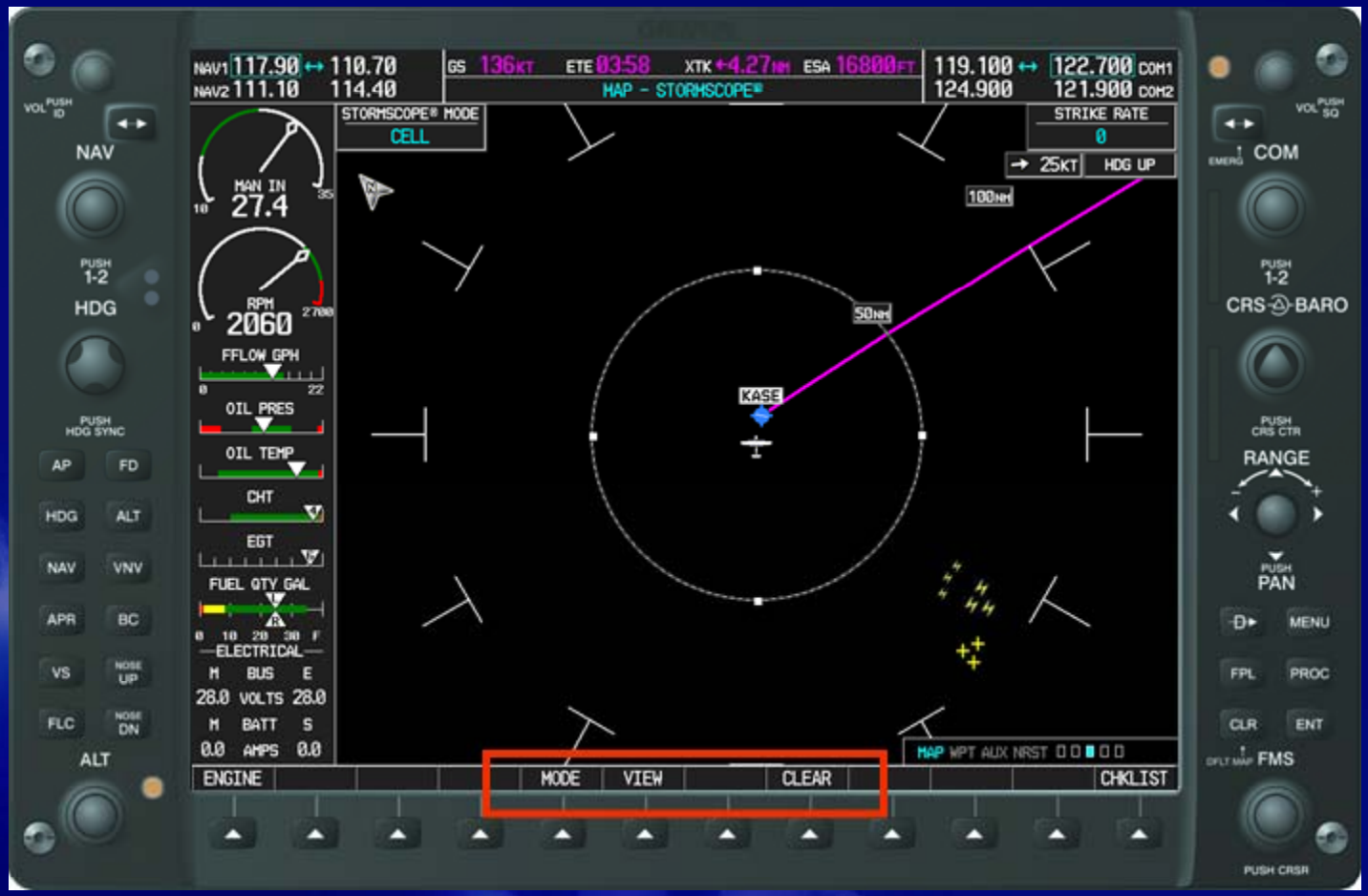
WX 500 Stormscope



- WX-500 Stormscope Interface
- Cell and Strike Modes

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Stormscope Display

"Strike Aging"

- Bold lightning bolt for 6 Seconds after detection
- Normal lightning bolt from 6 seconds to 1 minute
- Bold "Plus Sign" after 1 minute
- Normal "Plus Sign" after 2 minutes

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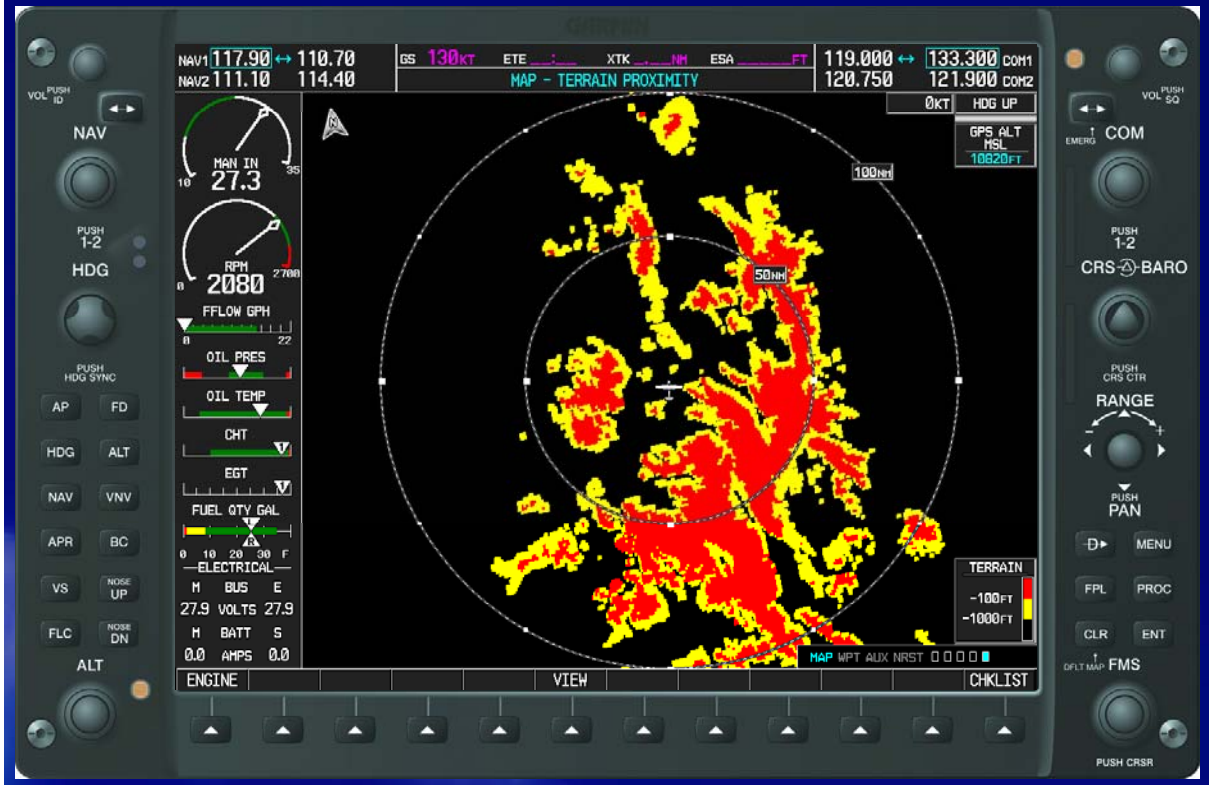
Terrain Proximity



- For situational awareness only
- No voice callout
- Yellow = aircraft within 100’-1000’ AGL of terrain
- Red = Aircraft within 100’ above or below ground zero
- Remember, This is the “hard-deck” and does not account for trees or towers.

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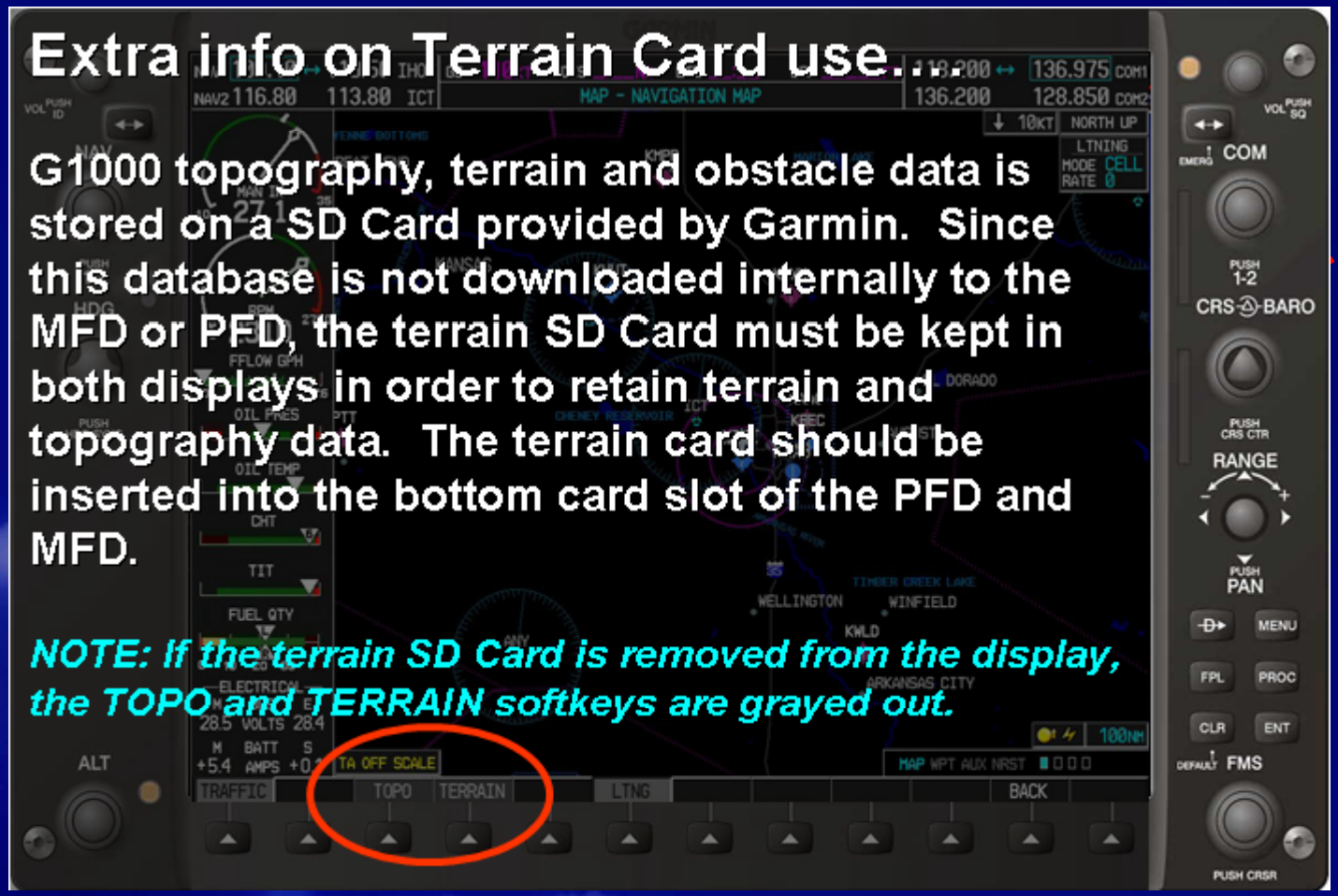
Secure Digital Cards



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Agenda

- Lab
  - Map Setup
  - Flight Scenario 2
- Classroom
  - Expanded MFD
  - **WAAS Instrument Approach Procedures**
  - System Components
  - System Malfunctions
  - Questions

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What Is WAAS?

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What Is WAAS?

Wide Area Augmentation System

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WAAS is a GPS-based navigation and landing system that provides enhanced **accuracy** and **integrity** to the basic GPS signal.

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WAAS Accuracy

The WAAS broadcast message improves the GPS signal accuracy from 20 meters to approximately 2 meters in both the horizontal and vertical dimensions.

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WAAS Integrity

WAAS improves the integrity of the basic GPS signal by quickly detecting smaller accuracy errors. Within six seconds of detecting accuracy errors the WAAS receiver will either correct the errors or shut-off connections and notify the pilot.

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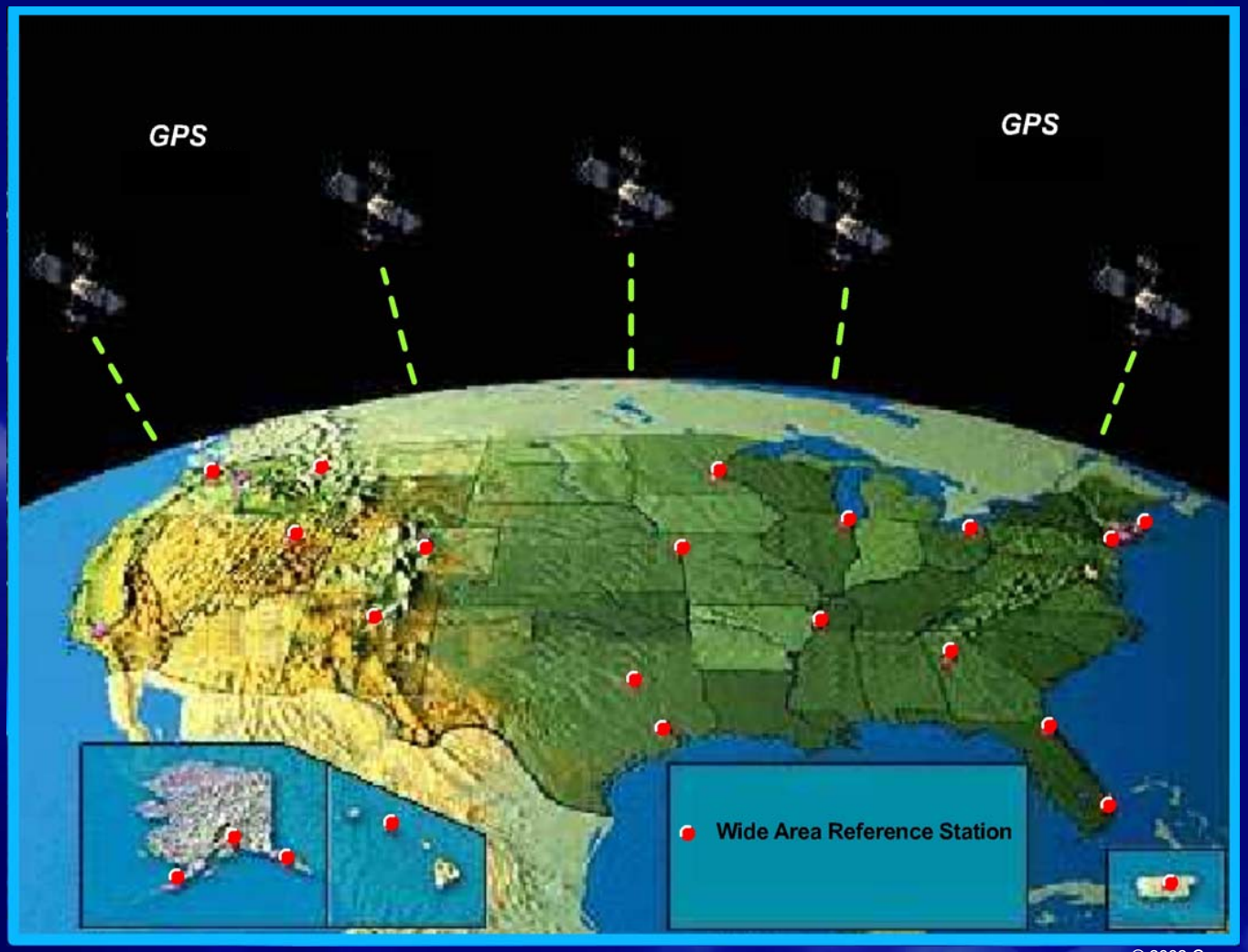
Several Wide Area Reference Stations monitor the GPS satellites.



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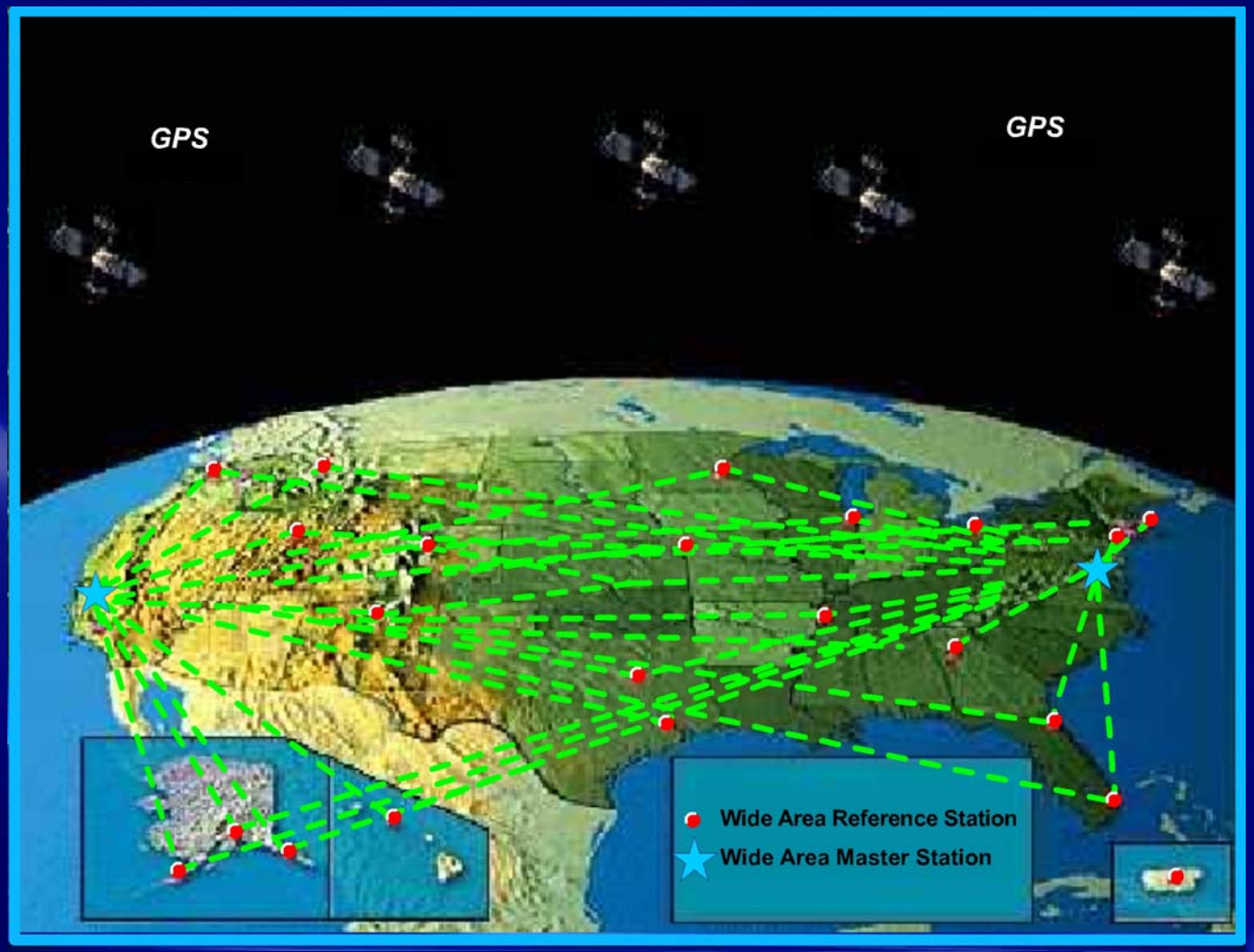
The information collected by the Wide Area Reference Stations is sent to two Wide Area Master Stations where the correction message is calculated.



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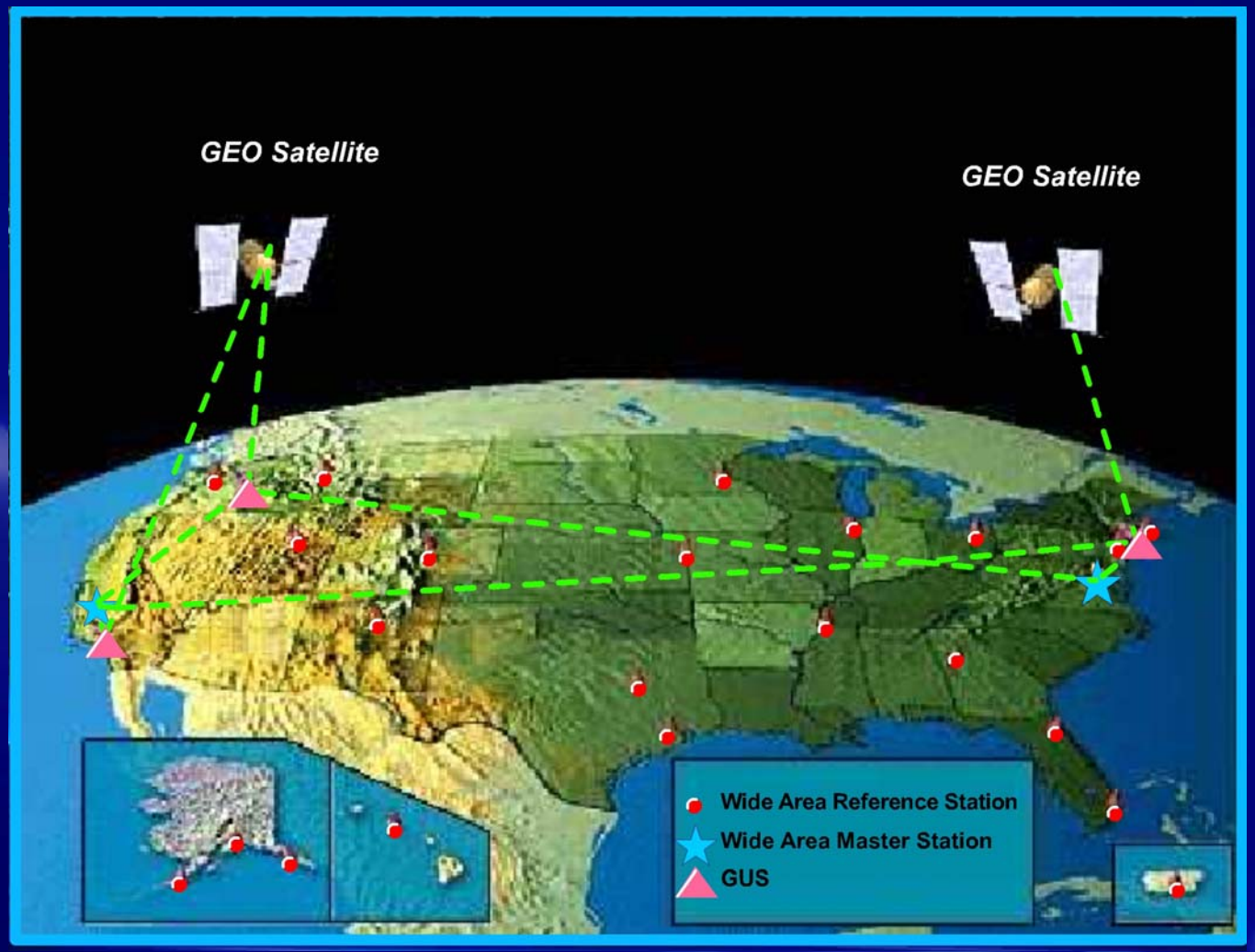
The Wide Area Master Station sends the correction message to the WAAS GEO satellites via three ground uplink stations.



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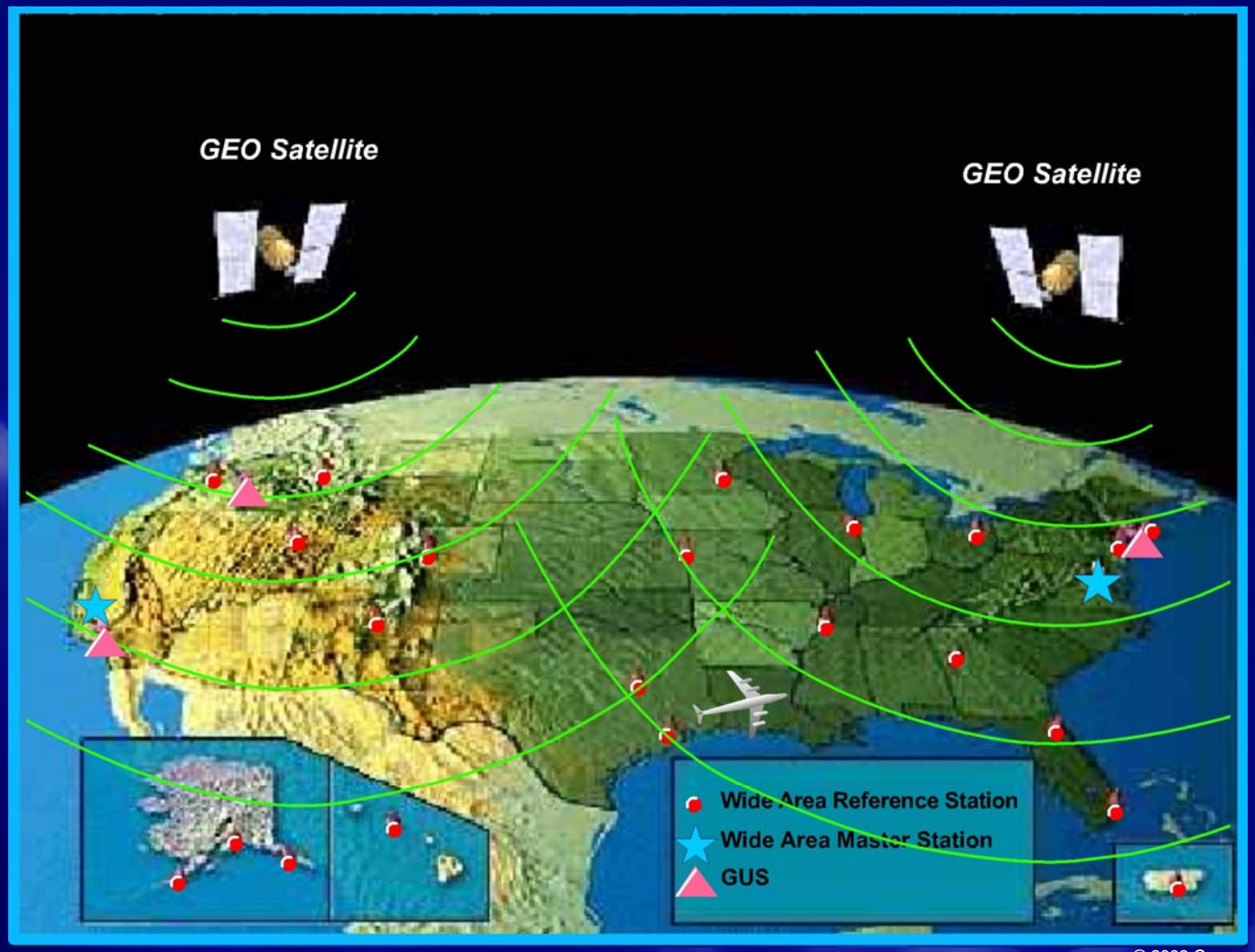
The two WAAS GEO satellites broadcast the WAAS-corrected signal to aircraft.



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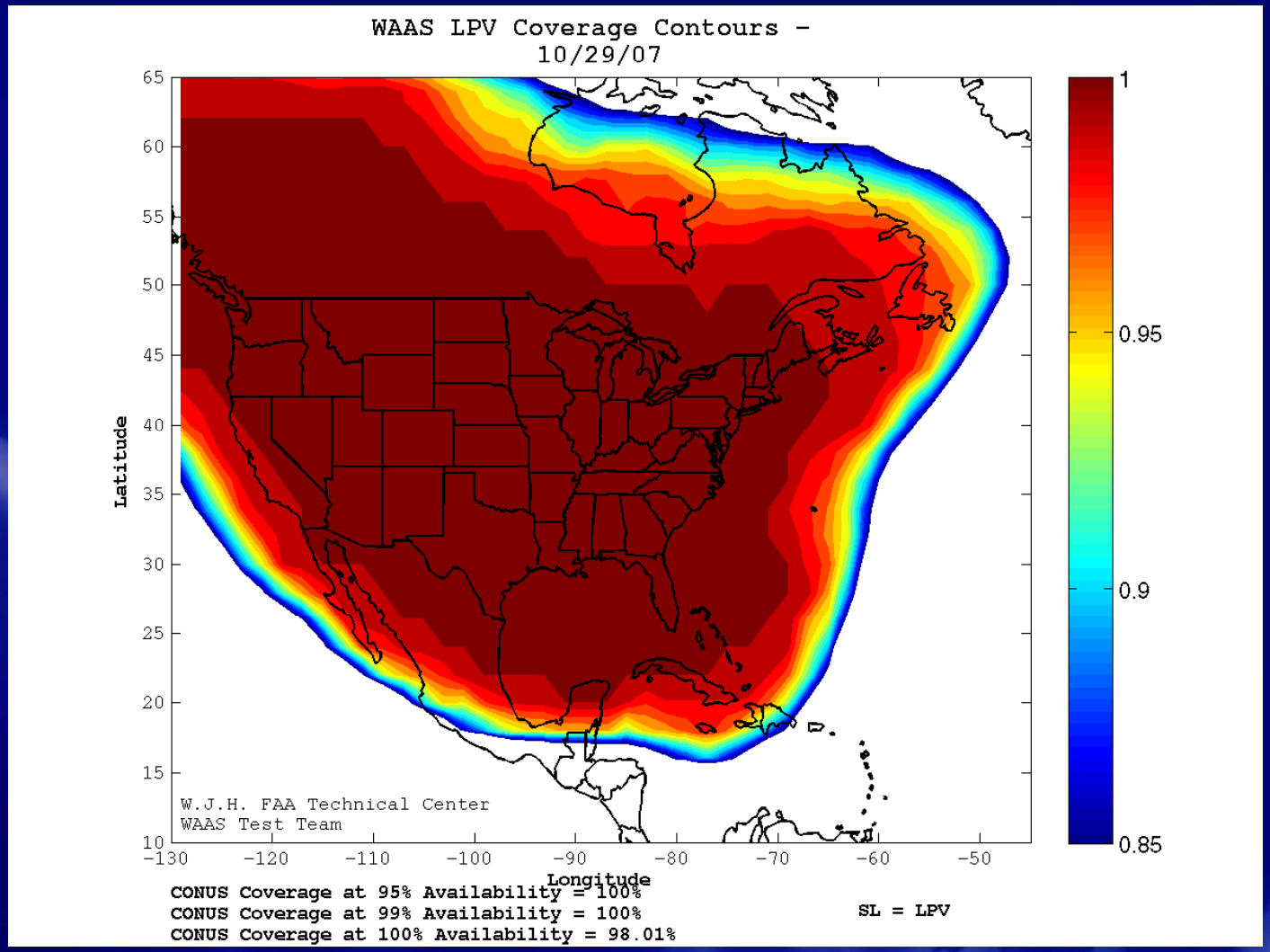
WAAS is now available for IFR approach operations throughout most of North America.



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RNAV Approach Minima

LNAV

LNAV + V

LNAV / VNAV

LPV

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RNAV Approach Minima

CATEGORY	A	B	C	D
LPV DA	1346-1 250 (300-1)			NA
LNAV/ VNAV DA	1462-1¼ 366 (400-1¼)			NA
LNAV MDA	1500-1 404 (500-1)		1500-1¼ 404 (500-1¼)	NA
CIRCLING	1540-1¼ 444 (500-1¼)	1560-1¼ 464 (500-1¼)	1560-1½ 464 (500-1½)	NA

OLATHE/JOHNSON COUNTY EXECUTIVE (OJC)

38° 51′ N-94° 44′ W

RNAV (GPS) RWY 18

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LNAV (Lateral Navigation)

- Non-Precision Approach
- Descend at desired rate to an MDA
- Fly level at MDA
  - Until runway environment in sight – Land
    - or
  - To MAP – Begin missed approach

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LNAV

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LNAV + V (Lateral Navigation Plus Advisory Vertical Guidance)

- Non-Precision Approach
- Descend along WAAS Advisory GP to an MDA
- Fly level at MDA
  - Until runway environment in sight – Land
    - or
  - To MAP – Begin Missed Approach

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LNAV + V

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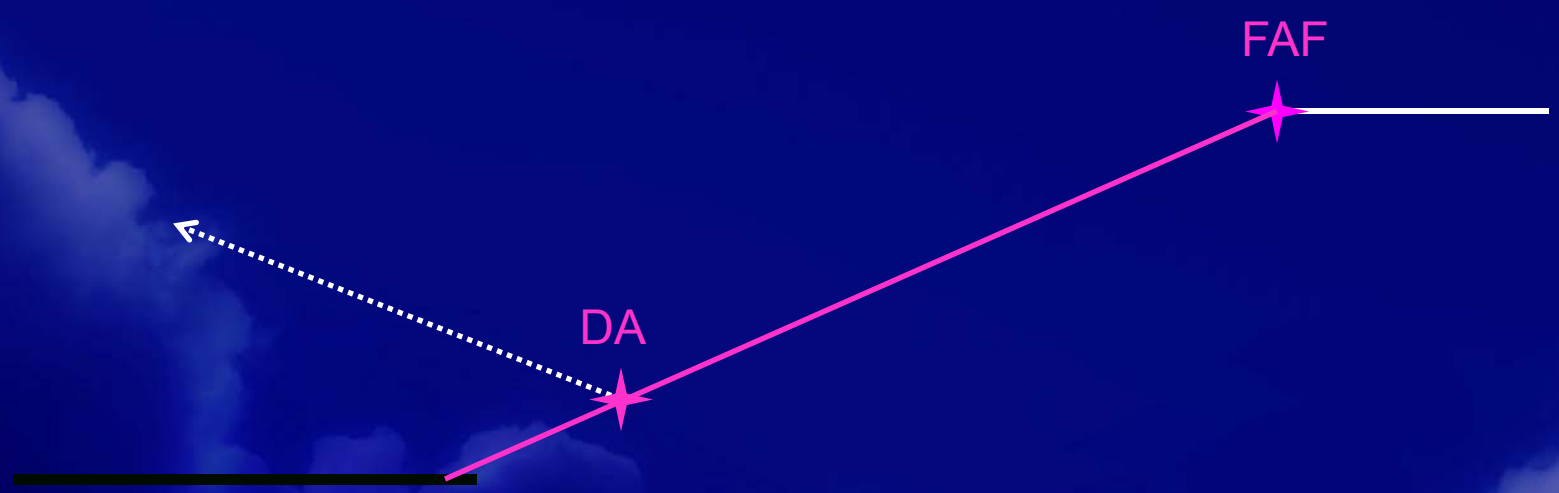
LNAV / VNAV (Lateral Navigation with Vertical Navigation)

- Approach with Vertical Guidance (APV)
- Descend along WAAS GP to a DA
- At DA – Make a decision
  - If runway environment in sight – Land
    - or
  - If runway environment not in sight – Missed Approach



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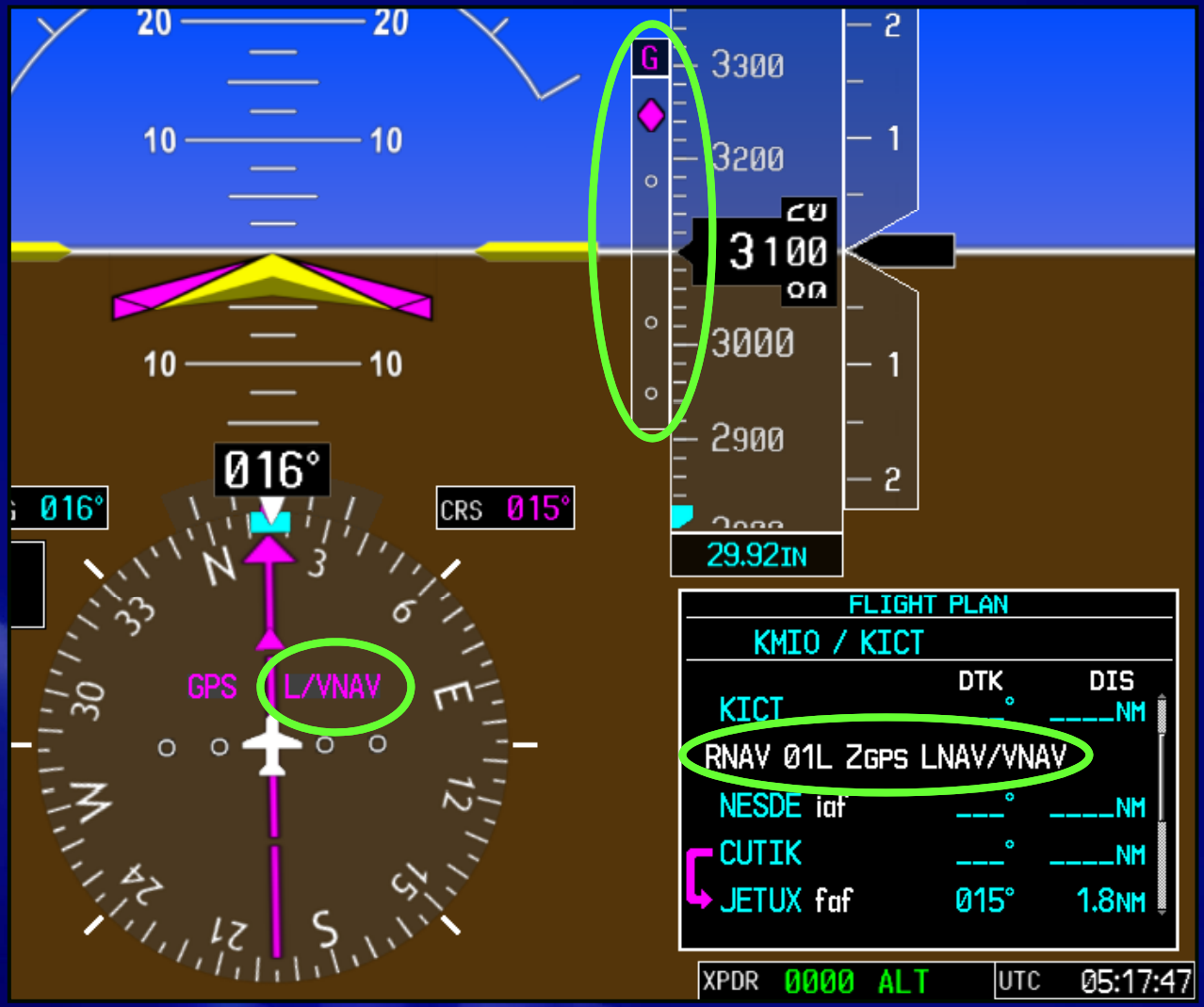

LNAV / VNAV

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LPV (Localizer Performance with Vertical Guidance)

- Approach with Vertical Guidance (APV)
- Descend along WAAS GP to a DA
- At DA – Make a decision
  - If runway environment in sight – Land
    - or
  - If runway not in sight – Missed Approach

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LPV

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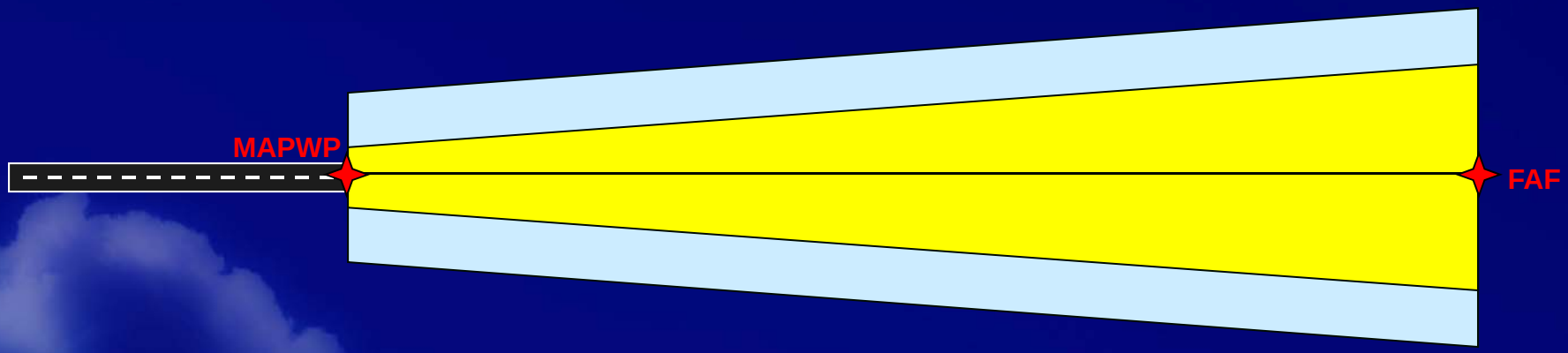
Comparison of Obstacle Evaluation Area

LNAV, LNAV+V and LNAV/VNAV obstacle evaluation area



LPV obstacle evaluation area

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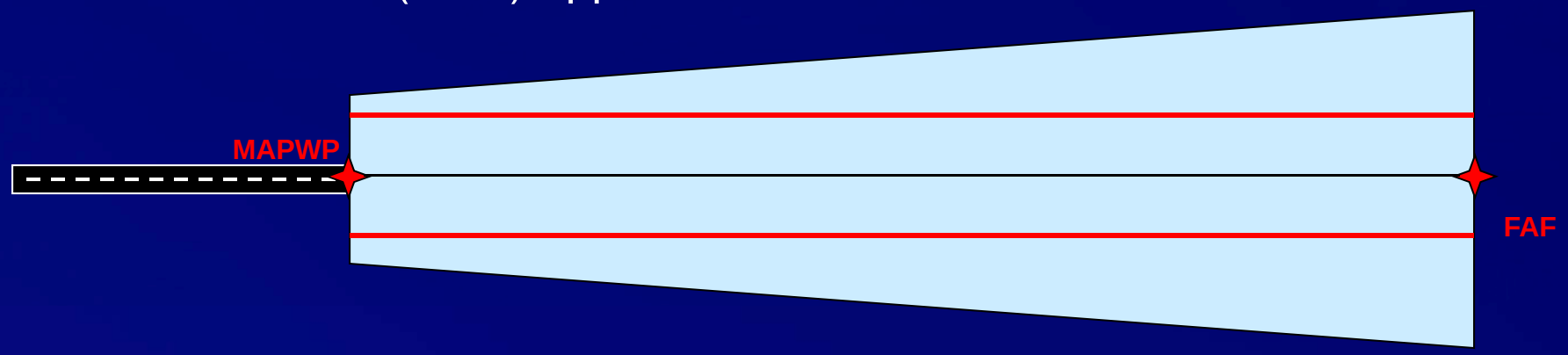
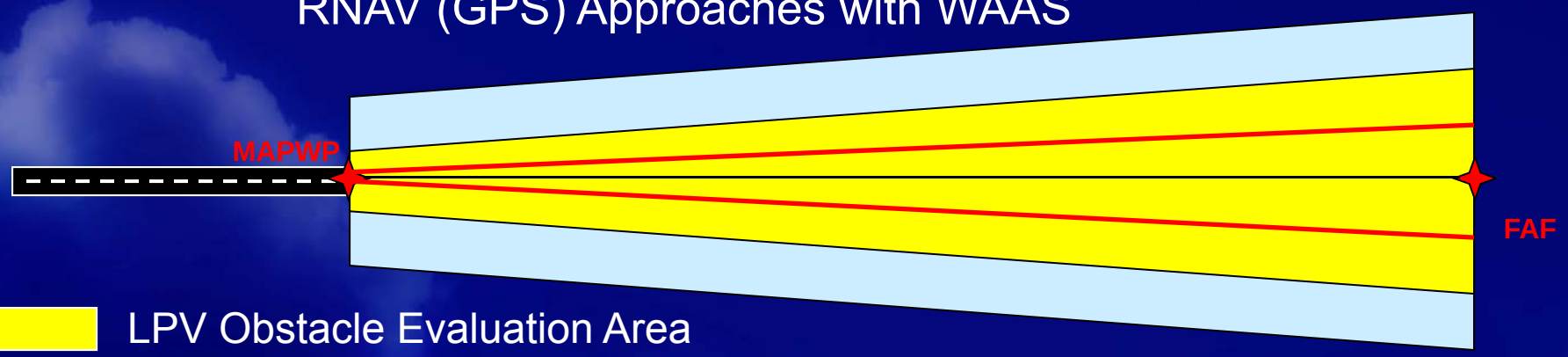
Comparison of Full Scale CDI Deflection

RNAV (GPS) Approaches without WAAS



RNAV (GPS) Approaches with WAAS



LPV Obstacle Evaluation Area

LNAV, LNAV+V, and LNAV/VNAV Obstacle Evaluation Area

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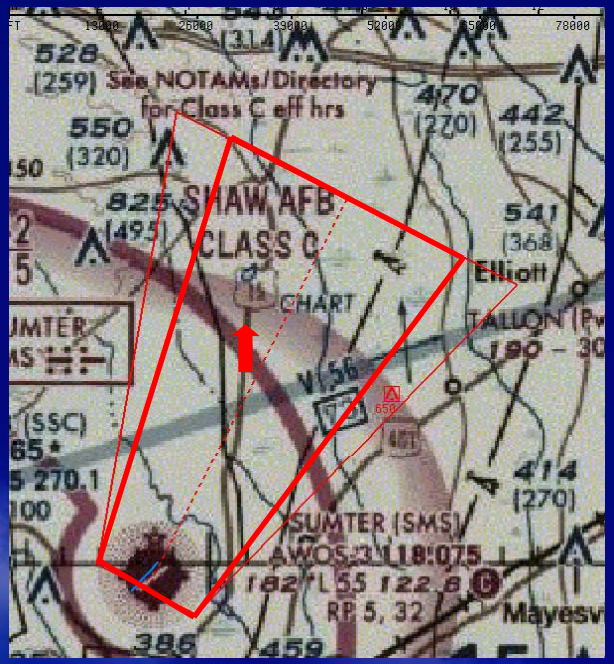
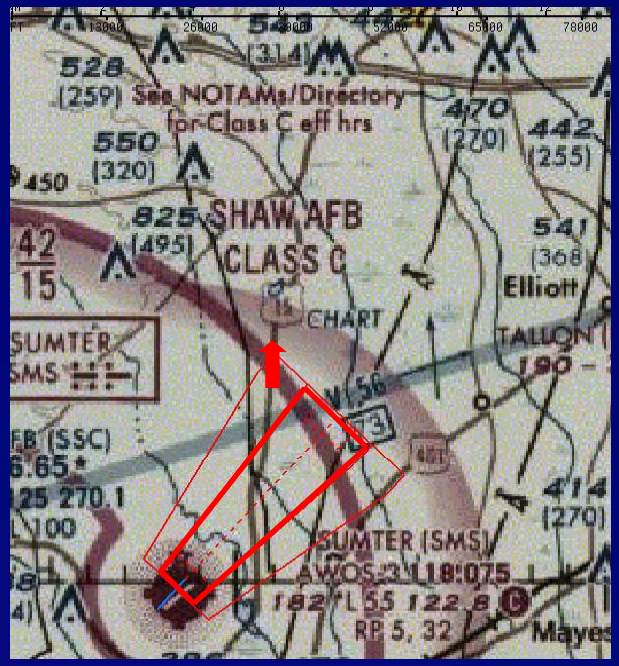
Obstacle Evaluation Area

NDB



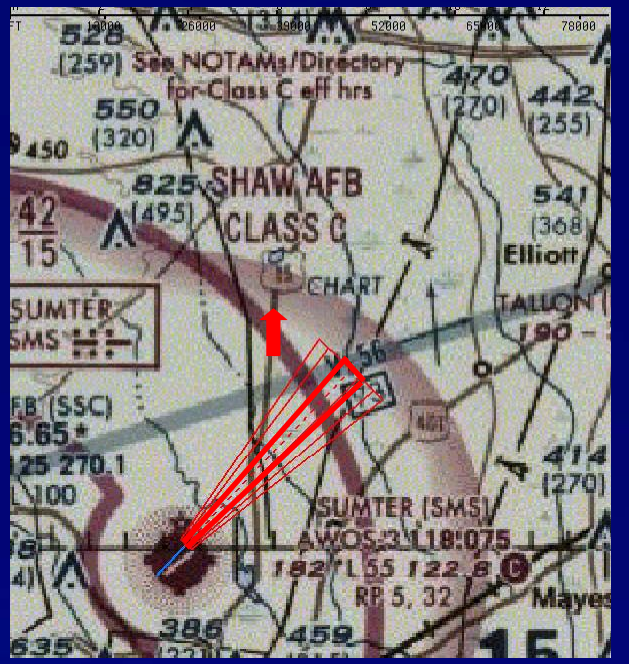
ROC = 350’

LNAV



ROC = 250’

LPV



ROC = 250’ or 200’

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Loss of WAAS Signal

- LNAV + V
- LNAV / VNAV
- LPV

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RNAV Approach Minima

- LNAV
- LNAV + V
- LNAV / VNAV
- LPV

No Glidepath (GP)

WAAS-derived Glidepath

Downgraded to LNAV with loss of WAAS signal

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RNAV Approach Minima

- LNAV
- LNAV + V
- LNAV / VNAV

Wider Obstacle Evaluation Area

Angular Course Guidance

- LPV

Narrower Obstacle Evaluation Area

Angular Course Guidance

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Agenda

- Lab
  - Map Setup
  - Flight Scenario 2
- Classroom
  - Expanded MFD
  - WAAS Instrument Approach Procedures
  - System Components
  - System Malfunctions
  - Questions

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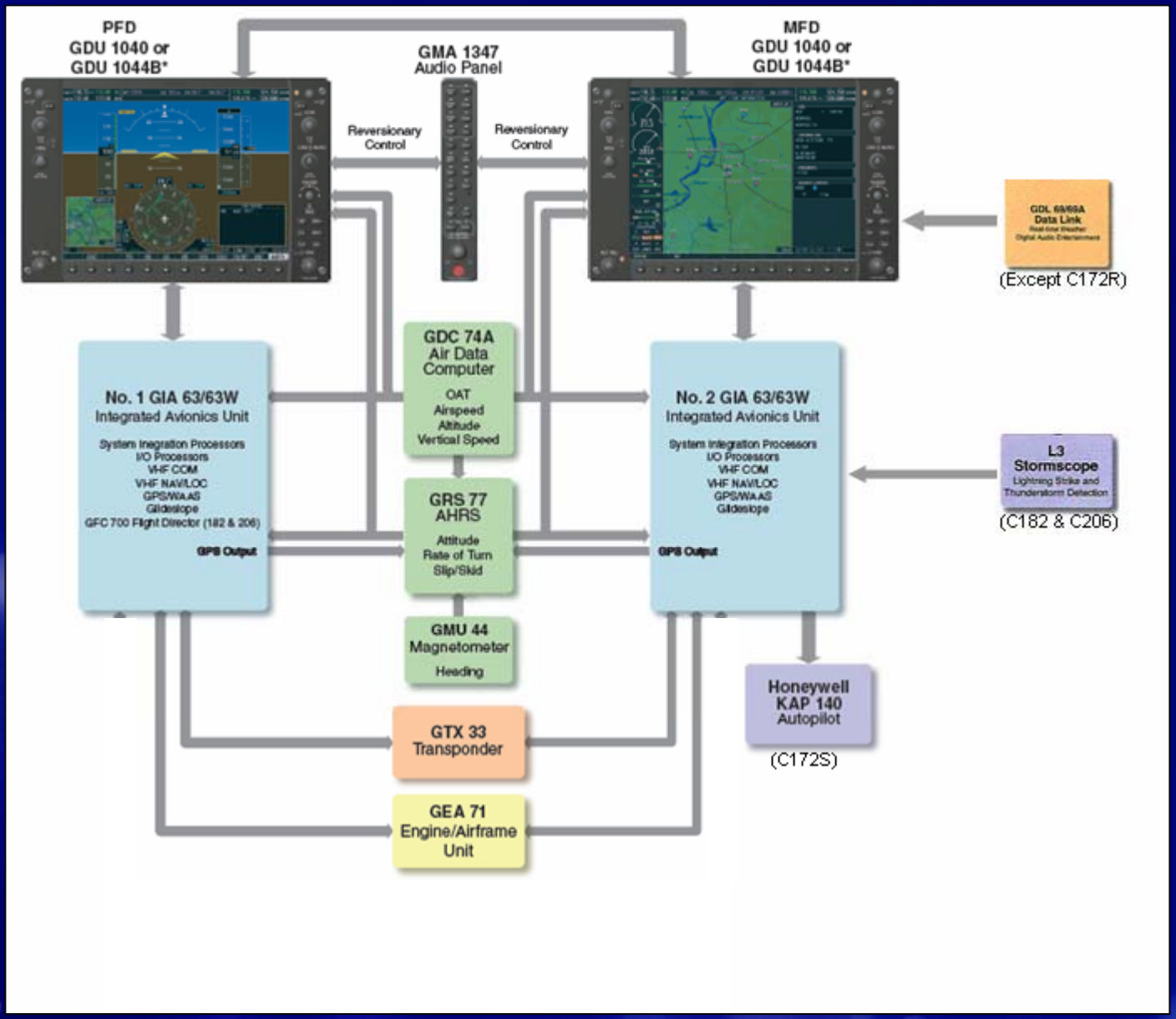
G1000 Block Diagram



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System Components

- Two Control Display Units
- Audio Panel
- Attitude and Heading Reference System
- Air Data Computer
- Engine/Airframe Unit
- Two Integrated Avionics Units
- Data Link
- Mode S Transponder
- Magnetometer

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G1000 System Message Advisories

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Auxiliary – System Status

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G1000 Components

- Two Control Display Units
- Marker/Audio Panel
- Attitude and Heading Reference System
- Air Data Computer
- Engine/Airframe Unit
- Two Integrated Avionics Units
- Data Link
- Mode S Transponder
- Magnetometer

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G1000 Components

- Two Control Display Units = GDU
- Marker/Audio Panel
- Attitude and Heading Reference System
- Air Data Computer
- Engine/Airframe Unit
- Two Integrated Avionics Units
- Data Link
- Mode S Transponder
- Magnetometer

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G1000 Components

- Two Control Display Units = GDU
- Marker/Audio Panel = GMA
- Attitude and Heading Reference System
- Air Data Computer
- Engine/Airframe Unit
- Two Integrated Avionics Units
- Data Link
- Mode S Transponder
- Magnetometer

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G1000 Components

- Two Control Display Units = GDU
- Marker/Audio Panel = GMA
- Attitude and Heading Reference System = GRS
- Air Data Computer
- Engine/Airframe Unit
- Two Integrated Avionics Units
- Data Link
- Mode S Transponder
- Magnetometer

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G1000 Components

- Two Control Display Units = GDU
- Marker/Audio Panel = GMA
- Attitude and Heading Reference System = GRS
- Air Data Computer = GDC
- Engine/Airframe Unit
- Two Integrated Avionics Units
- Data Link
- Mode S Transponder
- Magnetometer

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G1000 Components

- Two Control Display Units = GDU
- Marker/Audio Panel = GMA
- Attitude and Heading Reference System = GRS
- Air Data Computer = GDC
- Engine/Airframe Unit = GEA
- Two Integrated Avionics Units
- Data Link
- Mode S Transponder
- Magnetometer

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G1000 Components

- Two Control Display Units = GDU
- Marker/Audio Panel = GMA
- Attitude and Heading Reference System = GRS
- Air Data Computer = GDC
- Engine/Airframe Unit = GEA
- Two Integrated Avionics Units = GIA
- Data Link
- Mode S Transponder
- Magnetometer

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G1000 Components

- Two Control Display Units = GDU
- Marker/Audio Panel = GMA
- Attitude and Heading Reference System = GRS
- Air Data Computer = GDC
- Engine/Airframe Unit = GEA
- Two Integrated Avionics Units = GIA
- Data Link = GDL
- Mode S Transponder
- Magnetometer

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G1000 Components

- Two Control Display Units = GDU
- Marker/Audio Panel = GMA
- Attitude and Heading Reference System = GRS
- Air Data Computer = GDC
- Engine/Airframe Unit = GEA
- Two Integrated Avionics Units = GIA
- Data Link = GDL
- Mode S Transponder X = GTX
- Magnetometer

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G1000 Components

- Two Control Display Units = GDU
- Marker/Audio Panel = GMA
- Attitude and Heading Reference System = GRS
- Air Data Computer = GDC
- Engine/Airframe Unit = GEA
- Two Integrated Avionics Units = GIA
- Data Link = GDL
- Mode S Transponder X = GTX
- Magnetometer Unit = GMU

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G1000 Components

- Two Control Display Units = GDU
- Marker/Audio Panel = GMA
- Attitude and Heading Reference System = GRS
- Air Data Computer = GDC
- Engine/Airframe Unit = GEA
- Two Integrated Avionics Units = GIA
- Data Link = GDL
- Mode S Transponder X = GTX
- Magnetometer Unit = GMU

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Control Display Units

- **Garmin Control Display Unit**
  - Best resolution on the market
  - 1044B contains AFCS mode select buttons
  - Reversionary capabilities

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Automatic Reversion

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Automatic Reversion

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Attitude and Heading Reference System-AHRS

GRS 77

- Source for:
  - Attitude
  - Heading
  - Rate of Turn
  - Slip/Skid
- Solid State
  - More reliable than conventional vacuum gyros
- “On-the-Run” Initialization
- Tail Cone Avionics Bay

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Air Data Computer - ADC

GDC 74A

- Source for:
  - Altitude
  - Indicated Airspeed
  - Vertical Speed
  - Outside Air Temperature
  - True Airspeed
  - Wind Vector
- Located:
  - Behind Instrument Panel (182/206)
  - Tailcone Avionics Bay(172)

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Engine/Airframe Unit

GEA 71

- Receives data from airframe and engine systems
  - Presents the information on the Engine Indication System (EIS)
- Provides System Integrity Monitoring
- Behind Instrument Panel

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Integrated Avionics Unit

GIA 63W

- WAAS-Enabled
- Similar to a Garmin 530A without the display interface
- Dual GPS, NAV, and COM Radios
  - Redundancy
  - Reliability
  - 16 watts
  - 8.33 kHz spacing
- Tail Cone Avionics Bay

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Garmin Data Link

GDL 69A

- XM Satellite Radio Receiver
  - Near, Real-time Weather
  - Digital Audio Entertainment
- Subscription Service

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Transponder

GTX 33

- Mode S Transponder
- Automatic activation feature at approximately 30 knots
- Traffic Information Service -TIS
- Tail Cone Avionics Bay

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Magnetometer

GMU 44

- 3 Axis Magnetic Sensor
  - Replaces traditional Flux Valve
- Located in Left Wing

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Audio Panel – GMA 1347

- Powered ON and OFF by Avionics Master Switch
- All annunciators illuminate for approximately two seconds after avionics power-up. This time allows for an operational check of the lights within the audio panel.
- Selected items on the audio panel will be annunciated by an illuminated light directly above the respective key.
- Selecting COM1 or COM2 selects the audio source. The audio source can be selected independently of the active microphone source.

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Audio Panel

NOTE: The Cessna NAV III is not equipped with COM3 MIC, COM3 and TEL. In the Cessna Nav III G1000 configuration, pressing the **COM3 MIC, COM3 or TEL** key does not illuminate the respective annunciator light.

THE COM 1/2 (SPLIT COM) FUNCTION OF AUDIO PANEL IS NOT APPROVED FOR USE.

LIMITATION - Section 2

During COM 1/2 operation, transmission by one crew member inhibits reception by the other crew member.

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Audio Panel

- PA – Passenger Address, allows pilot to transmit to passengers over cabin speaker. Not Supported on Cessna 172 SkyHawk.

- SPKR – Allows selected aircraft radios to be heard over the cabin speaker

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Audio Panel

- When MKR/MUTE is selected, the audio signal can be heard over the headsets

- While receiving a tone on approach, pressing the MKR/MUTE key mutes the audio but keeps the marker annunciator light illuminated (PFD)

- The HI SENS key can be pressed to augment marker beacon reception sensitivity. It is generally used either over airway markers or to receive an early indication of nearing outer marker during an approach

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Audio Panel

- Pressing NAV1 or NAV2 selects the corresponding audio source and activates the annunciator

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Audio Panel

- **NOTE**: The Cessna NAV III is NOT equipped standard with **DME**, **ADF**, or **AUX** radios.

- In the Cessna Nav III G1000 configuration, pressing the **DME**, **ADF** or **AUX** key does not illuminate the respective annunciator light.

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Audio Panel

- PLAY- Clearance Recorder
  - Records COM signal blocks of up to 2 ½ minutes
  - Press MKR/Mute key to end playback

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Audio Panel

Annunciation

- When the MAN SQ key is selected, **"PRESSING"** the **VOL/SQ knob** toggles between volume and squelch adjustment modes.

- Intercom squelch can be controlled via the VOL/SQ knob. The "Inner Knob" controls the pilot ICS squelch, while the "Outer Knob" controls the copilot/passenger ICS squelch.

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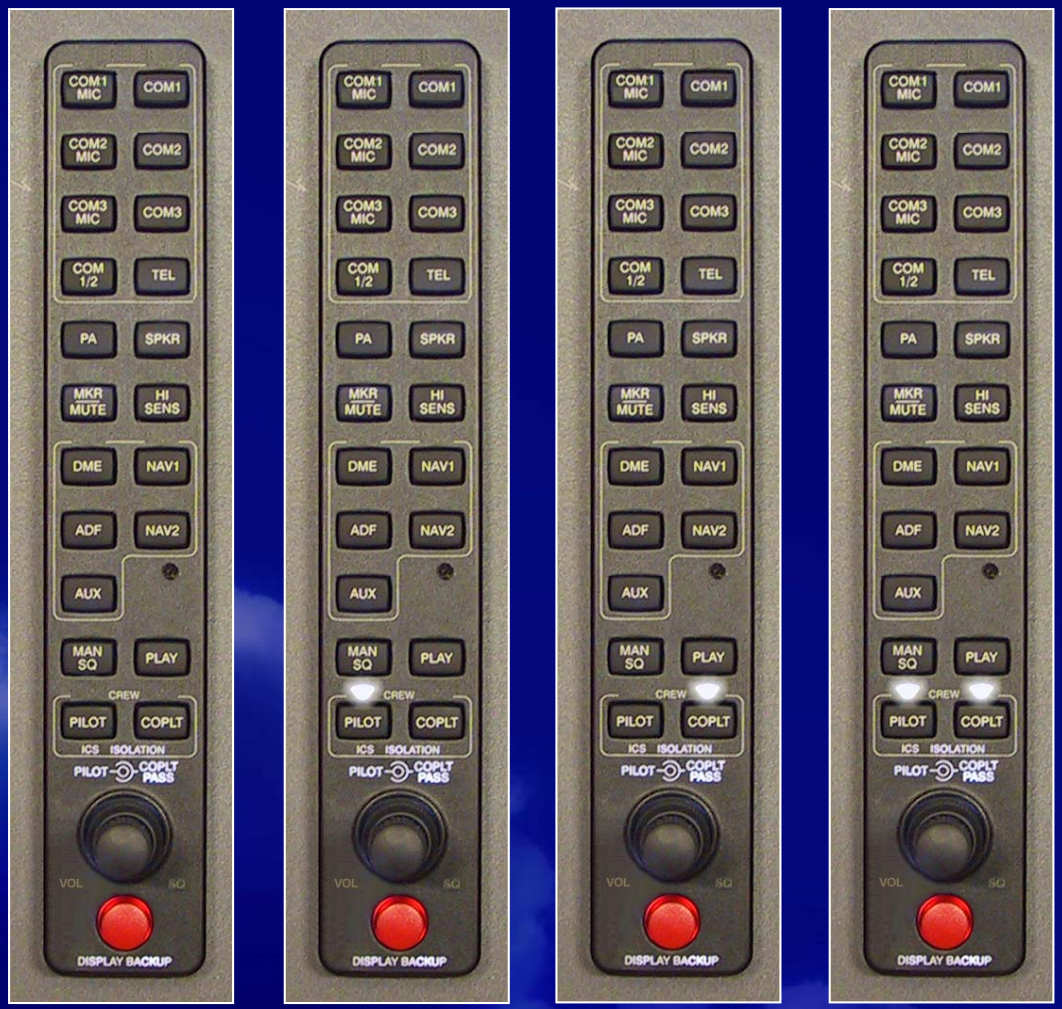
Audio Panel



ICS Isolation

- PILOT Mode – the pilot can hear the selected radios, co-pilot and passengers only communicate with each other
- COPLT Mode – the co-pilot is isolated from everyone
- CREW mode – Both Pilot and Co-pilot can hear selected radios

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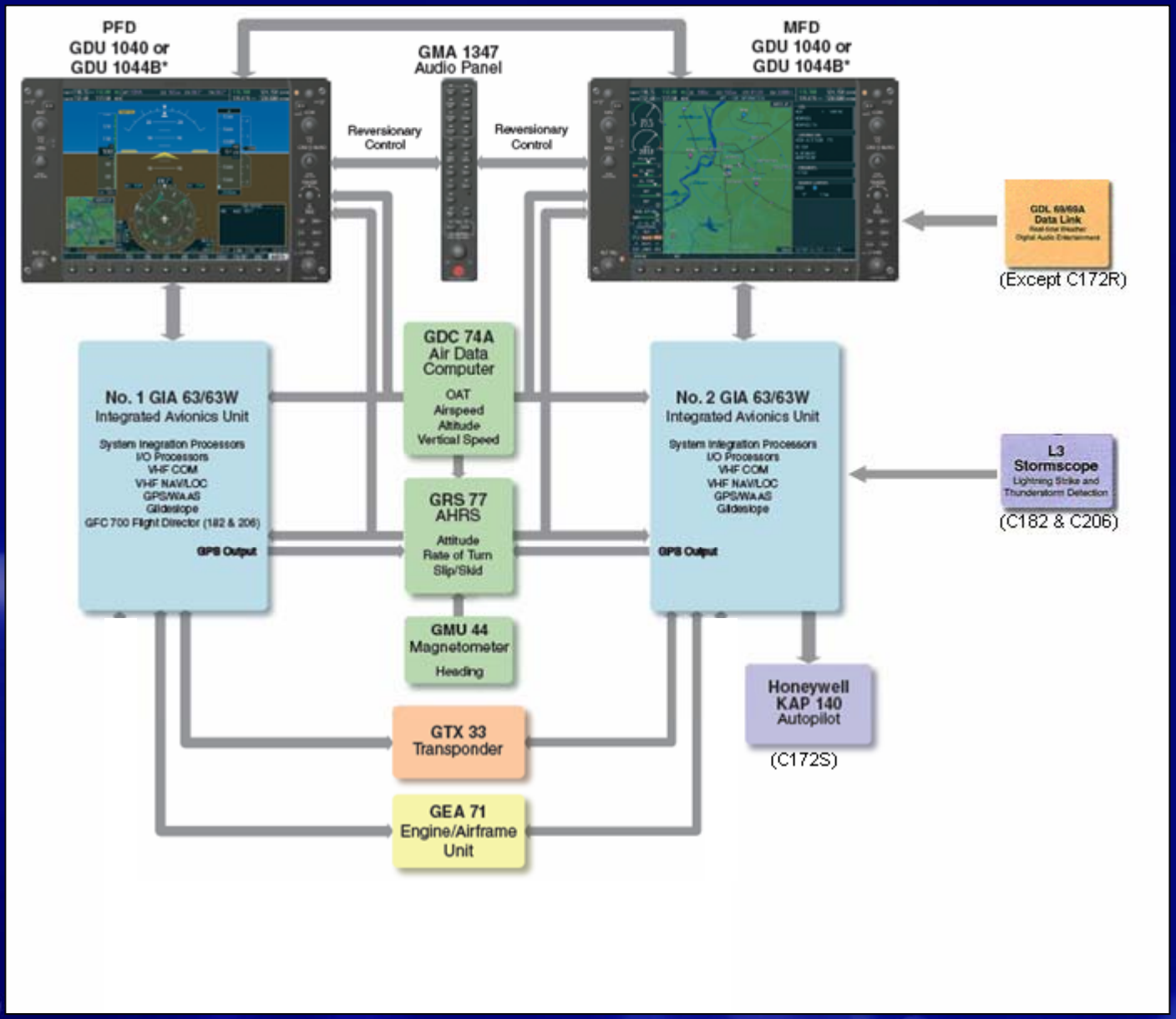
G1000 Block Diagram



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Agenda

- Lab
  - Map Setup
  - Flight Scenario 2
- Classroom
  - Expanded MFD
  - WAAS Instrument Approach Procedures
  - System Components
  - **System Malfunctions**
  - Questions

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Systems Malfunctions

Items to be covered:

- ALERT Messages: 3 Categories
  - **ADVISORY**
  - **CAUTION**
  - **WARNING**
- System Annunciators
- Electrical Failure
- Component Failures

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Message Advisory

Flashing Advisory Annunciation

No Chime

Must PRESS Softkey to acknowledge and to display Alerts Window

This level of alert provides general information to the pilot

Acknowledge by pressing ALERTS Softkey

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Message Advisory

Alerts Window

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Annunciation Window

Flashing Caution Annunciation

One Chime

Must PRESS Softkey to acknowledge

This level of alert indicates the existence of abnormal conditions on the aircraft that may require pilot intervention.

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Annunciation Window

Flashing Warning Annunciation

Continual Chime (every 2 sec.)

Must PRESS Softkey to acknowledge and to silence tone

This level of alert requires immediate pilot attention

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System Annunciators

OIL PRESSURE
LOW VOLTS
HIGH VOLTS
CO LVL HIGH
LOW VACUUM
LOW FUEL L
LOW FUEL R
STBY BATT
PROP HEAT
PROP HEAT

Oil Pressure - < 20 psi
Low Volts - < 24 Volts
High Volts - > 32 Volts
CO Level High - > 50 ppm
Low Vacuum - < 3.5 in. Hg
Low Fuel Left/Right –
- 172 - < 5 gals. After 60 seconds
- 182/206 - < 8 gals. After 60 seconds

Standby Battery - Drawing > 0.5 amps
Prop Heat Yellow - Detect Failure
Prop Heat Green - System ON

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Electrical Failure

LOW VOLTS

- **LOW VOLTS**
  - Reference the appropriate checklist.
  - Ensure the standby battery is in the ARM position.
  - If the annunciation does not extinguish, begin load shedding on the Main Battery.

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Electrical Distribution

Essential Bus: The Standby Battery powers the equipment on the essential bus for at least 30 minutes of continued operation if the alternator or aircraft battery fail to keep main bus above 20 VDC.

- Primary Flight Display (PFD)
- Air Data Computer (ADC)
- Attitude / Heading Reference System (AHRS)
- Navigation 1
- Engine / Airframe Unit (GEA)
- Communication 1
- Standby Instruments Internal Lighting (Compass, O2 Light)
- Standby Battery (Charged when Essential Bus above 26 VDC)

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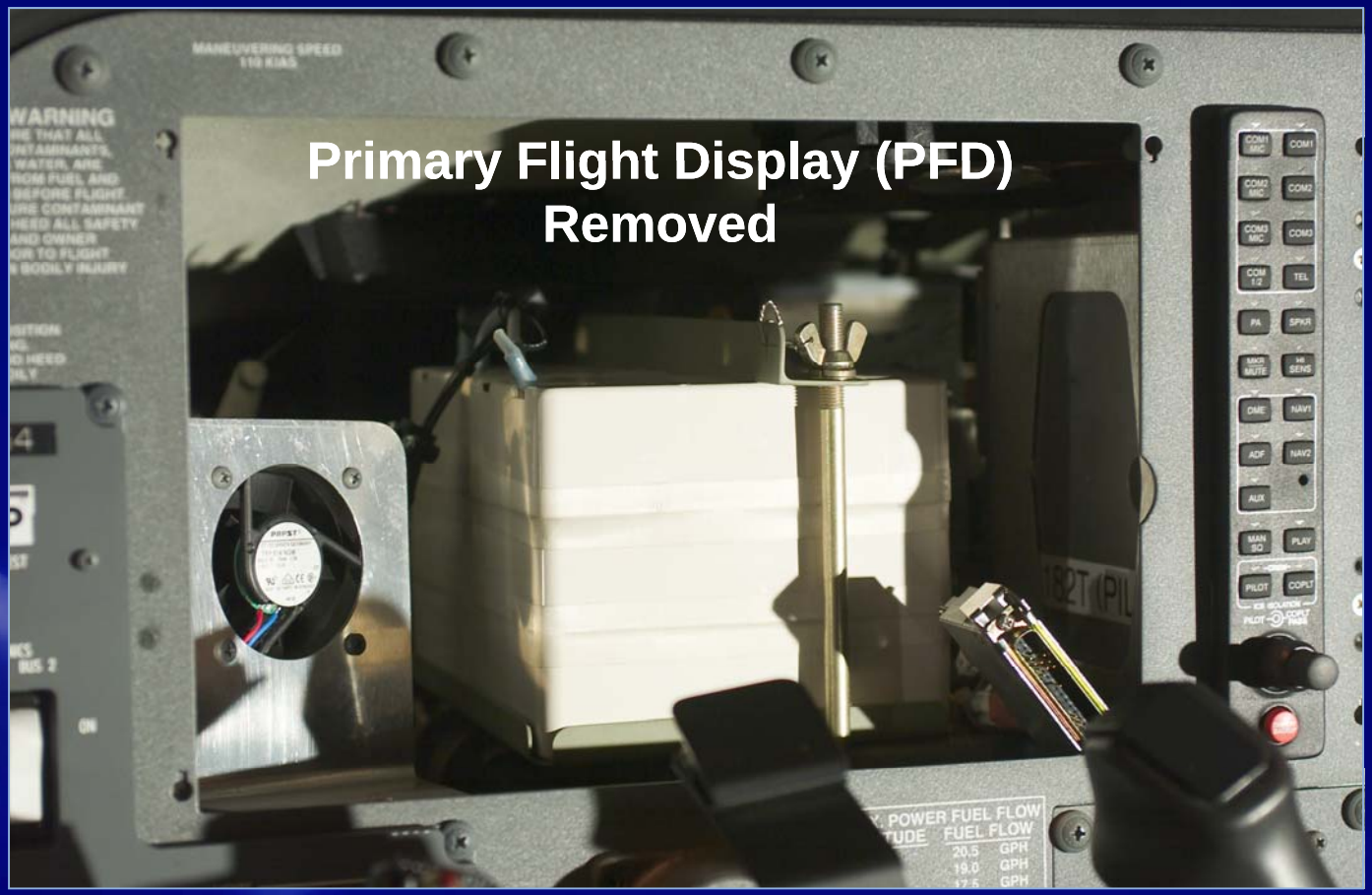
Electrical Distribution



Standby Battery Installation

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Component Failures

- Display Unit
- AHRS
- ADC
- Magnetometer
- Audio Panel

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Display Failure

- In the event of a display failure, the system automatically switches to reversionary mode.
- All critical flight information is displayed, including flight indications and engine instruments.
- One NAV/COM is lost.

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Display Failure

Pressing the Display Backup button manually selects the reversionary mode for all operational displays in the event the display problem is not detected by the system.

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PFD Failure

- Check Circuit Breakers
- Do Not Enter IMC
- **KAP 140: Not Affected**

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MFD Failure

- Check Circuit Breakers
- Do Not Enter IMC
- **KAP 140: ROL, VS and ALT hold modes only**

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AHRS Failure

- Check Circuit Breakers.
- Refer to standby Attitude Indicator and Magnetic Compass.
- Do Not Enter IMC.

KAP 140: Reverts to ROL mode

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ADC Failure

- Check Circuit Breakers.
- Refer to standby Airspeed and Altitude Indicators.
- Do Not Enter IMC.

KAP 140: Loss of Altitude Pre-Select and Alert functions

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AHRS/ADC Failure

- Check Circuit Breakers.
- Refer to Standby Instruments.
- Do Not Enter IMC.

KAP 140: ROL, VS and ALT hold modes only

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AHRS/ADC Failure

- Check Circuit Breakers.
- Refer to Standby Instruments.
- Do Not Enter IMC.

(ILS with AHRS/ADC Failure)

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Magnetometer Failure

- Use Magnetic Compass for heading information.
- Do Not Enter IMC.

KAP 140: Reverts to ROL mode

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Standby Instruments

Non-electrical systems in the event of an electrical failure:

- Airspeed Indicator and Altimeter
  - Conventional Pitot Static System
  - Alternate Static Air
- Attitude Indicator
- Magnetic Compass

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Audio Panel Failure

- **Backup analog mode connects directly to Com 1 radio, without intercom functions**
- **Use of the autopilot is prohibited when the audio panel is inoperative**

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  - Questions
  - Optional Systems
    - G1000 Systems
      - TAS
      - TAWS
    - Other Aircraft Systems
      - Amsafe Aviation Inflatable Restraints
      - Turbo charging
      - Oxygen
      - McCauley Constant Speed Propeller

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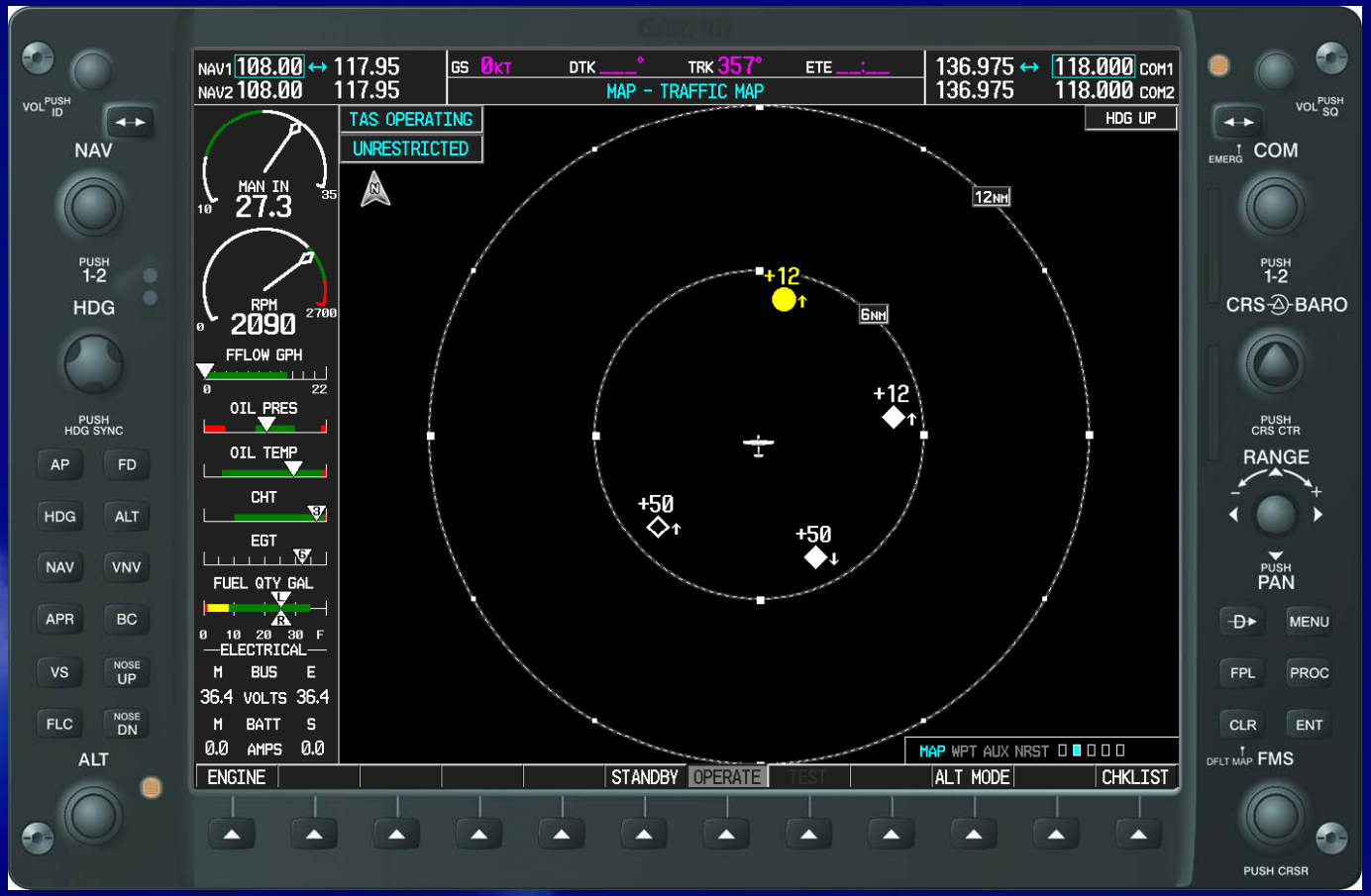
Traffic Advisory System - TAS



Traffic Display

- Aircraft Location
- Aircraft altitude relative to you

Traffic Alert

- Within 30 sec.

Projected to be

- Within ½ nm AND
- Within 800 feet

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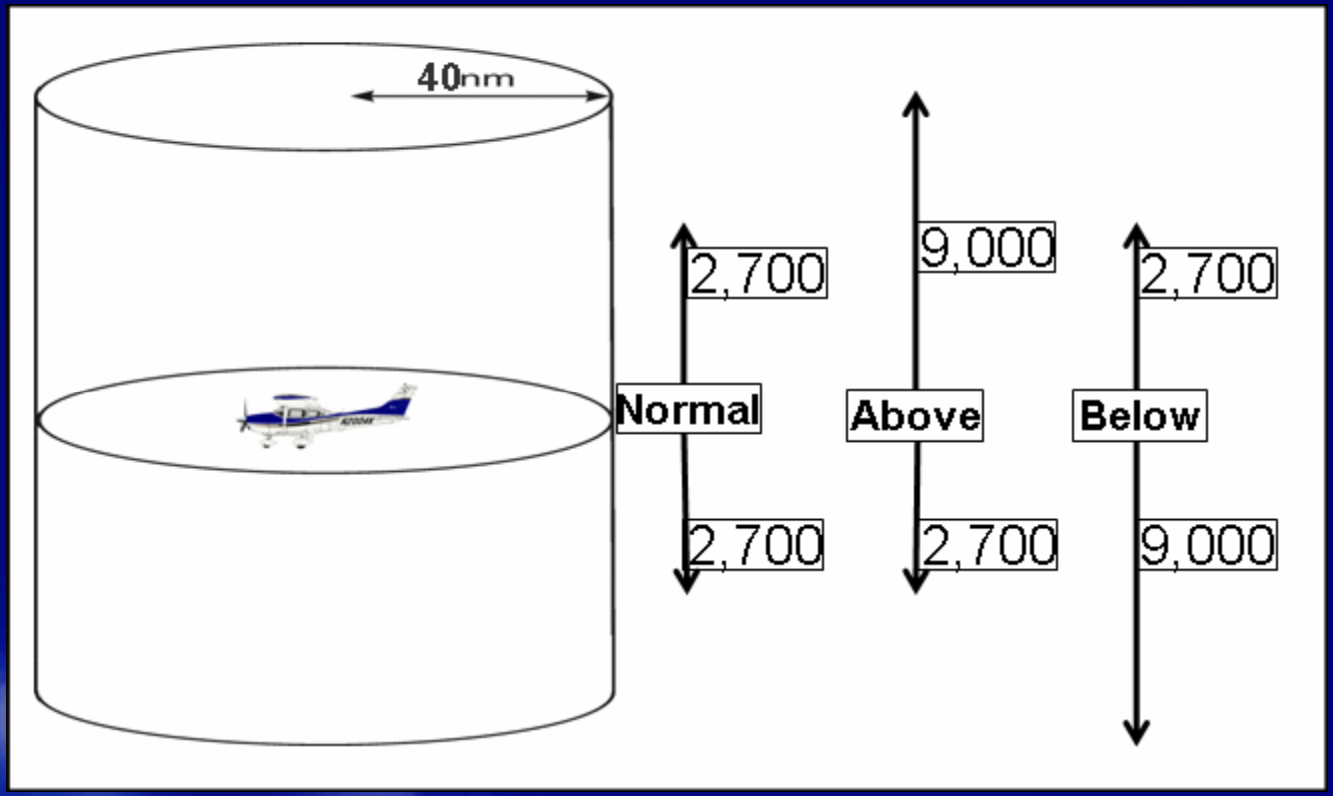

Limitations

- Displays up to 30 aircraft
- Secondary radar targets only (Mode A, C and S transponder equipped)
- Traffic Alerts (TA), but no Resolution Advisories (RA)

Service Area

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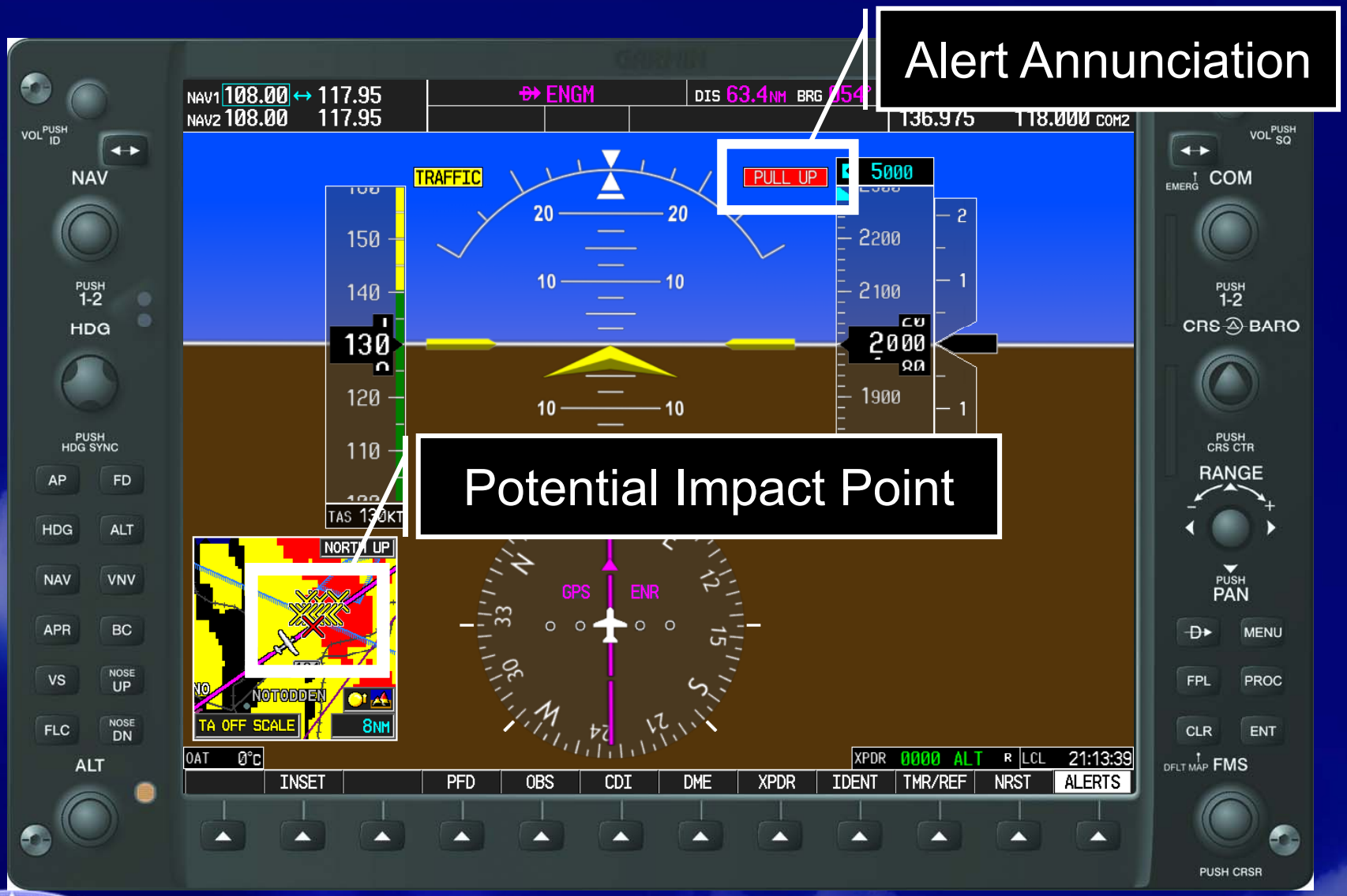
Terrain Awareness Warning System



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Amsafe Aviation Inflatable Restraints

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Inflatable Restraint

- AAIR
  - Amsafe Aviation Inflatable Restraint
  - Self-contained, modular design
  - Designed to improve occupant protection from serious head injury during a survivable crash.

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Inflatable Restraint

- Limitations: Supplement, Section 9
  - The standard inflatable restraint buckle can not be used to secure a child safety seat
  - The restraint in an empty co-pilot or passenger seat must not be buckled so as to prevent inflation of the lapbelt airbag in the unoccupied seat.
  - Service Life:
    - Return for refurbishment at seven (7) years

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Inflatable Restraint

3-pt pilot restraint, airbag Top View.avi

Click to animate

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Turbocharging

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Turbocharging

Turbocharged Engines:

- **Maintain a higher manifold pressure at a given throttle setting, regardless of air temperature and pressure.**
- **Maintain sea level atmospheric manifold pressure with altitude gain.**
- **Will not lose horsepower with altitude gain.**
- **Provides pressurized air which permits more air, and therefore more fuel, to be introduced into the cylinder.**
  - **The result is more power and higher combustion efficiency.**

Normally aspirated engine will lose horsepower with altitude gain

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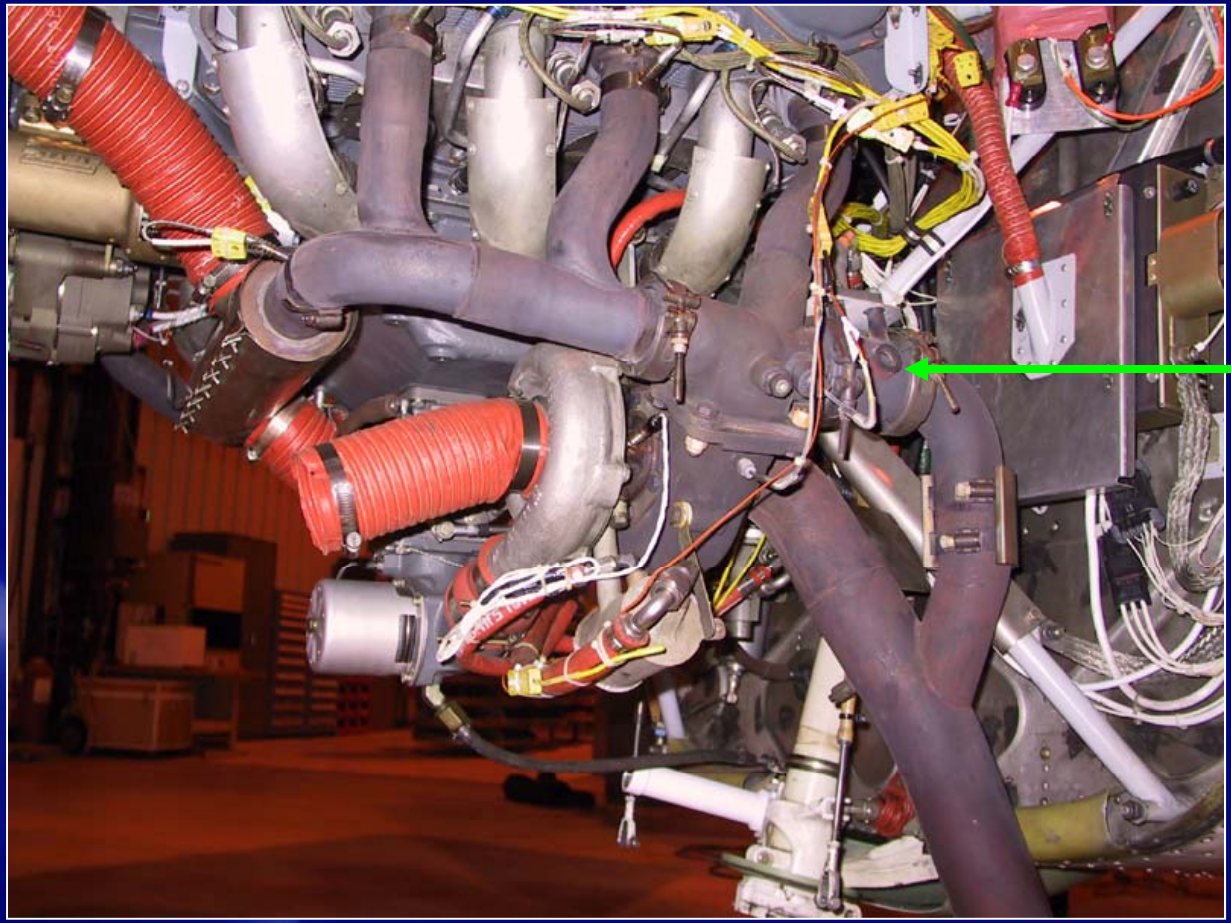
Turbocharging



Waste Gate

View of turbocharger installed on T182 engine

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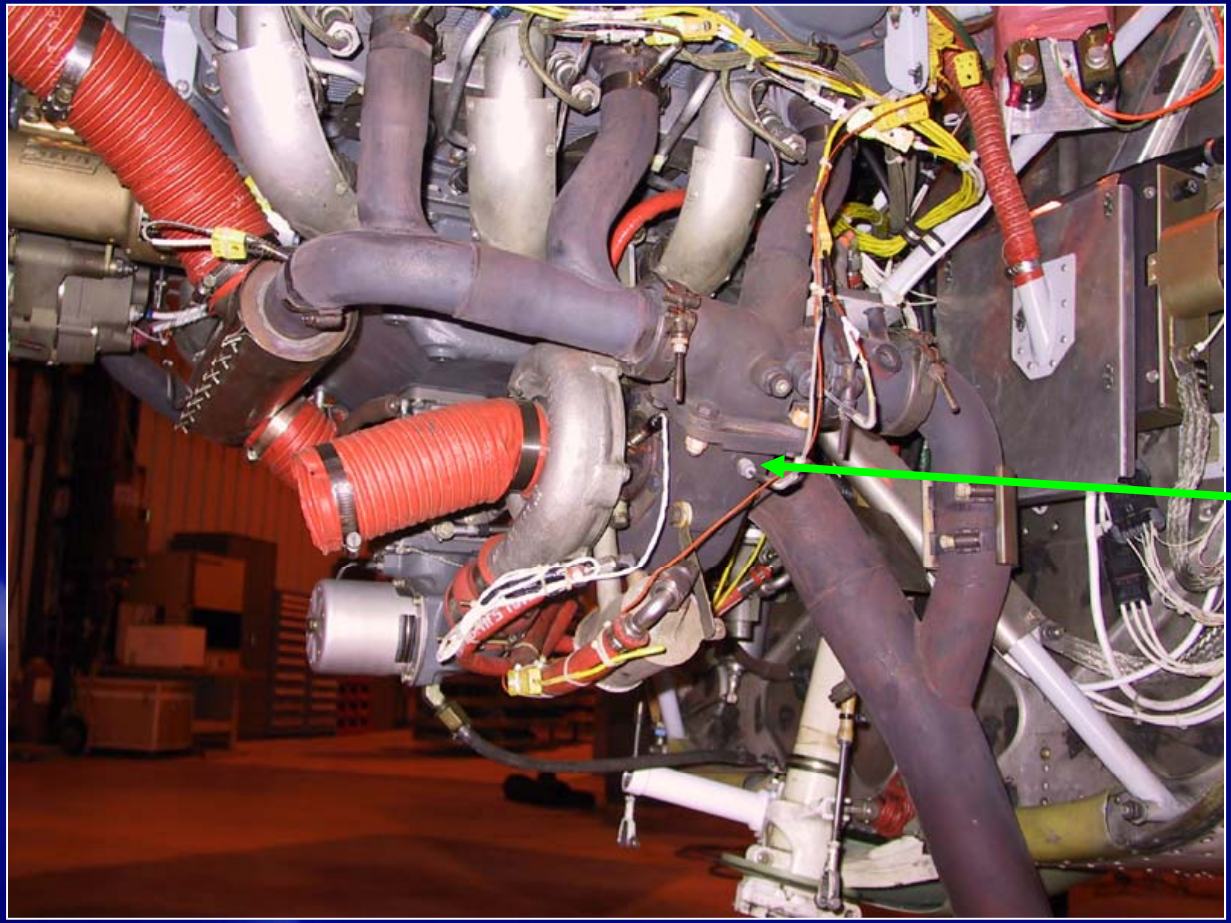
Turbocharging



T.I.T. Probe

View of turbocharger installed on T182 engine

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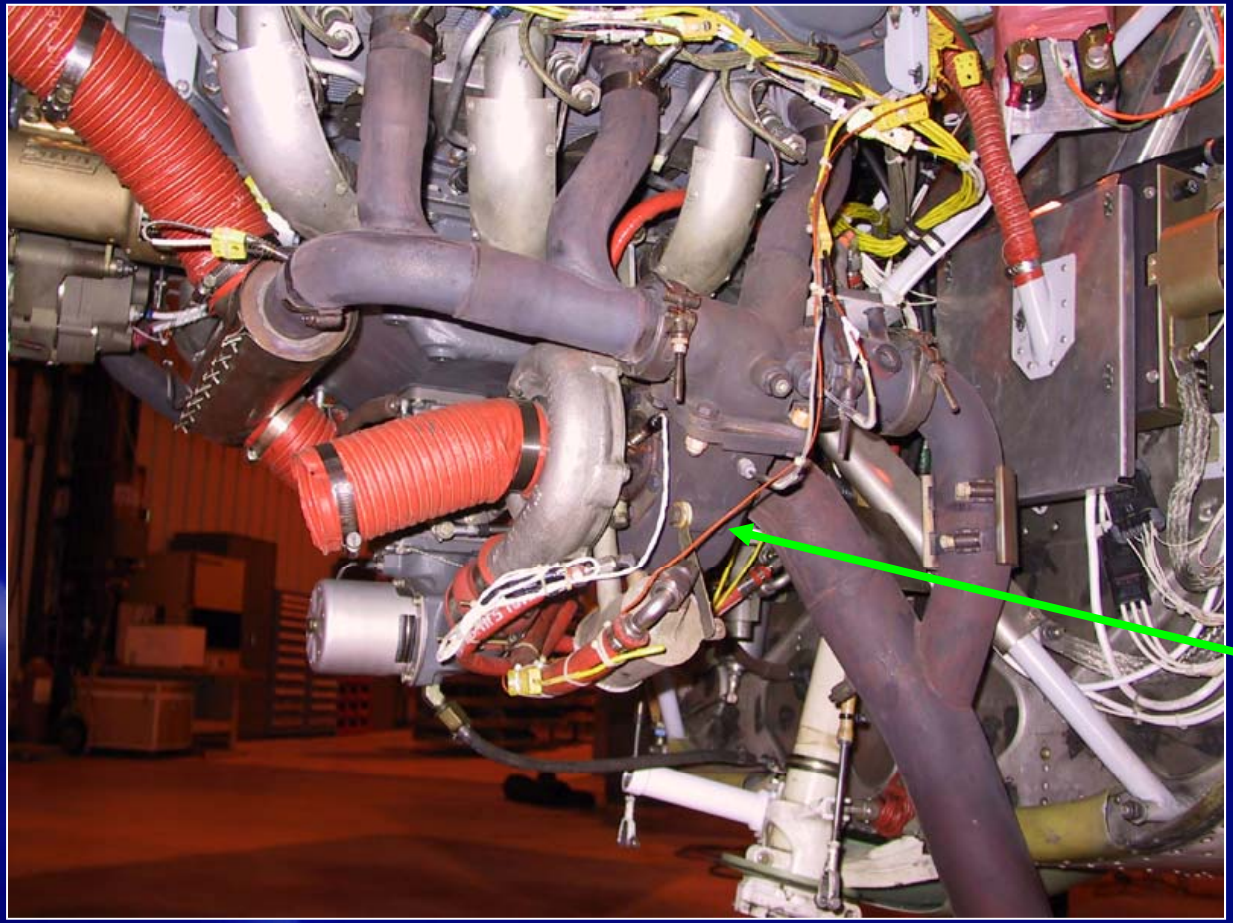
Turbocharging



View of turbocharger installed on T182 engine

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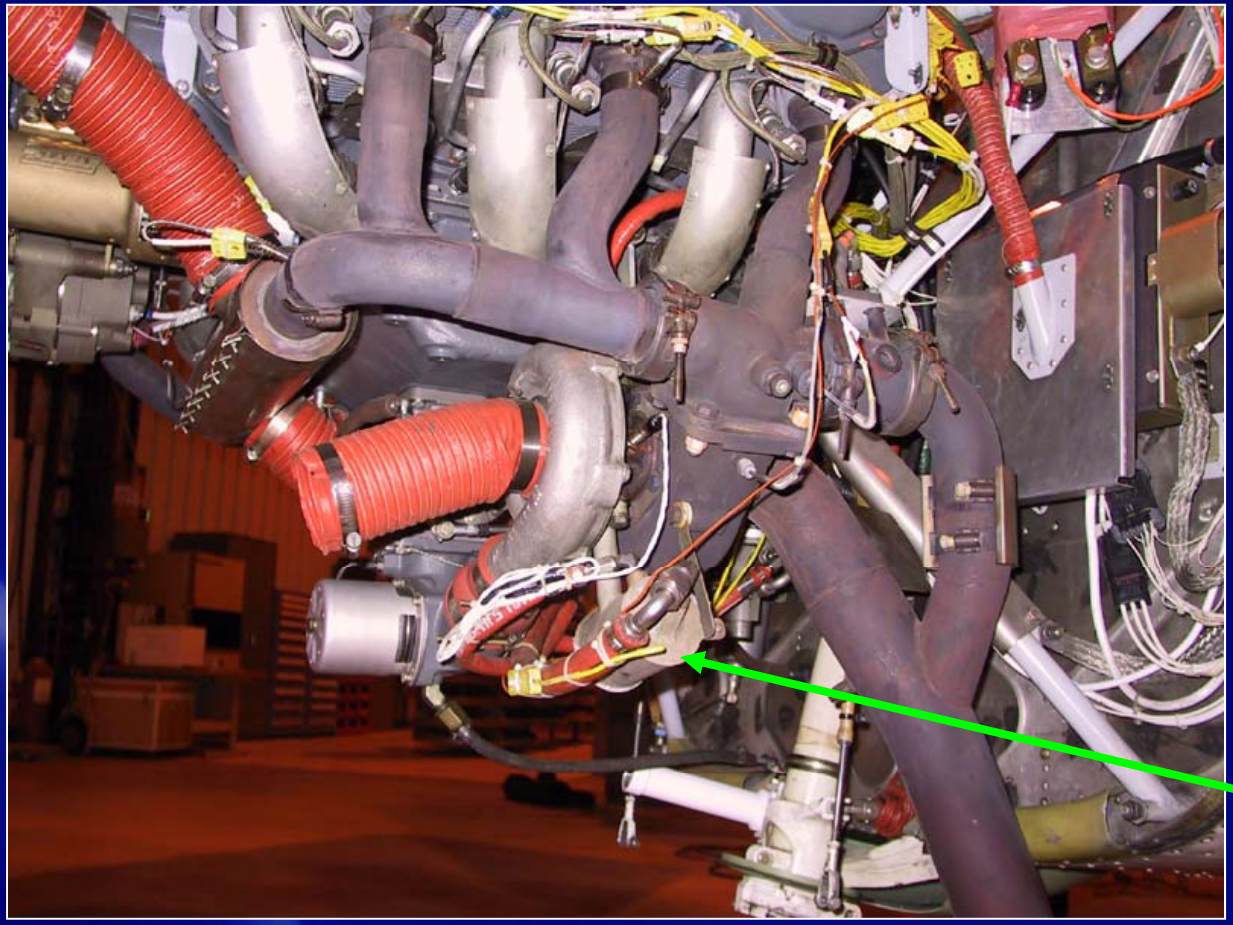
Turbocharging



Oil Accumulator

View of turbocharger installed on T182 engine

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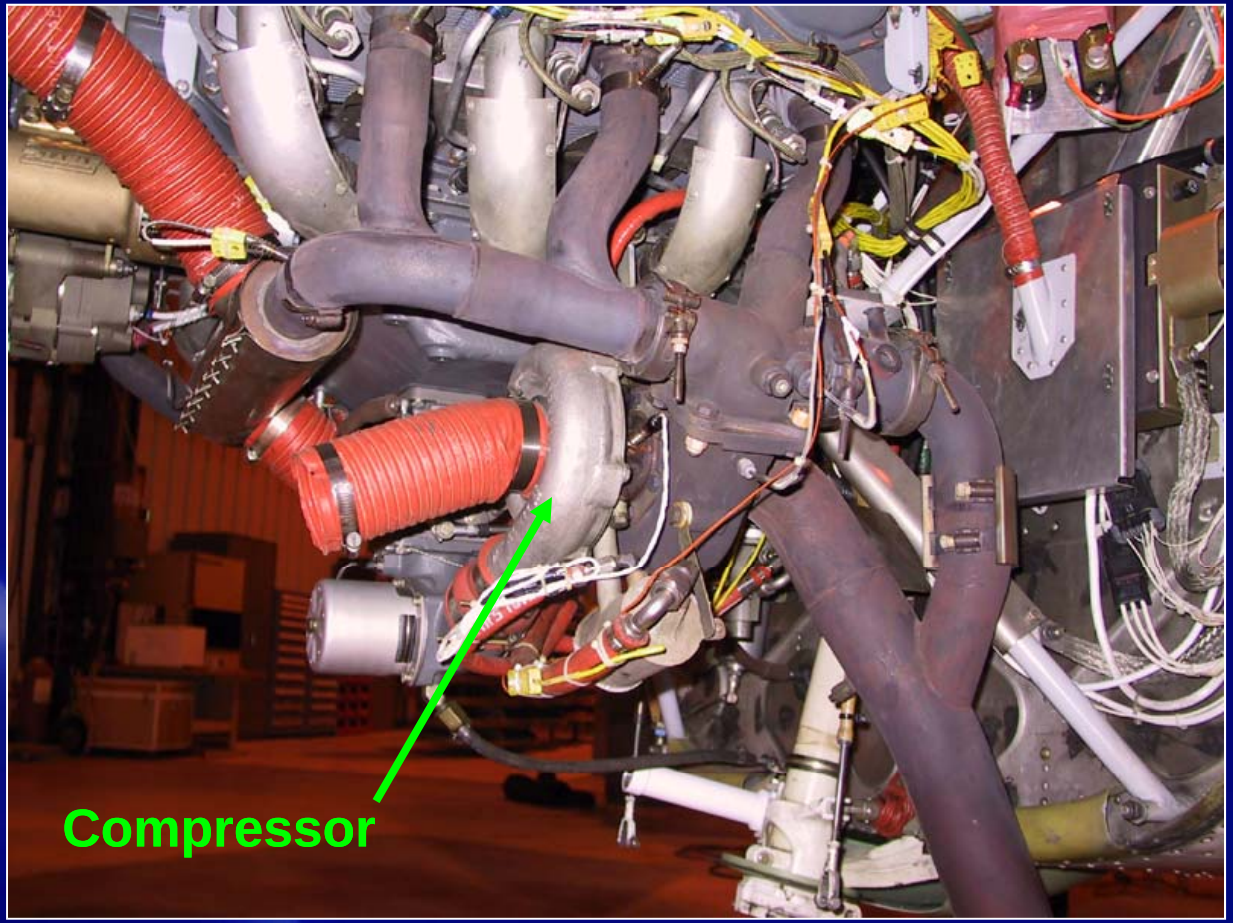
Turbocharging



View of turbocharger installed on T182 engine

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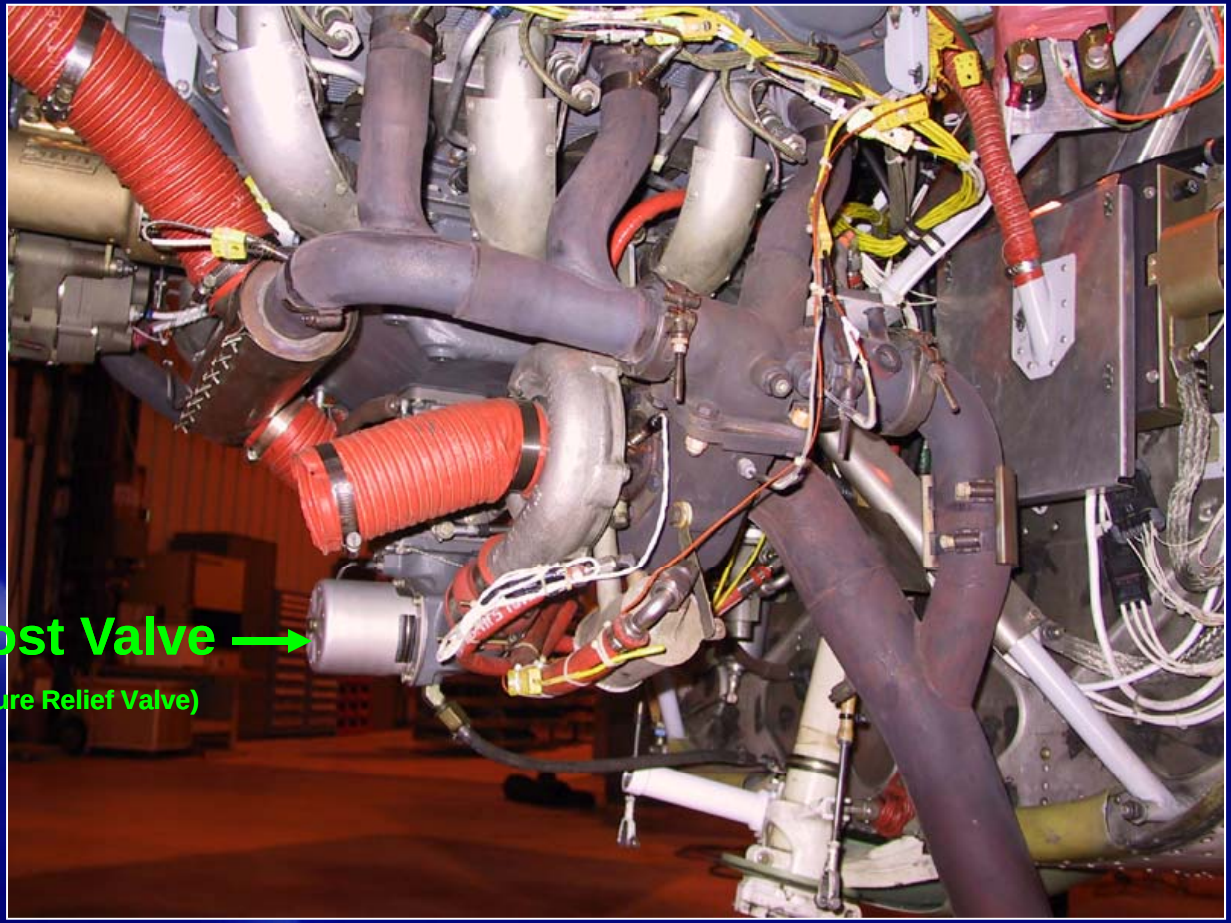
Turbocharging



Over Boost Valve →

(Manifold Pressure Relief Valve)

View of turbocharger installed on T182 engine

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Turbo Skylane

Normal Operating Range

Powerplant Instrument Markings

Instrument	Normal	Max Limit
Tachometer (RPM)	2000 - 2400	2400
Manifold Pressure (in. Hg.)	15 - 28	32
Cylinder Head Temperature (°F)	200 - 500	500
Oil Temperature (°F)	100 - 245	245
Oil Pressure (PSI)	50 - 90	115
Turbine Inlet Temperature (T.I.T.) (°F)	1350 - 1685	1685

Maximum Operating Range

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Turbo StationAir

Normal Operating Range

Maximum Operating Range

Powerplant Instrument Markings

Instrument	Normal	Max Limit
Tachometer (RPM)	2000 - 2400	2500
Manifold Pressure (in. Hg.)	15 - 30	39
Cylinder Head Temperature (°F)	200 - 480	480
Oil Temperature (°F)	100 - 245	245
Oil Pressure (PSI)	50 - 90	115
Turbine Inlet Temperature (T.I.T.) (°F)	1350 - 1675	1675

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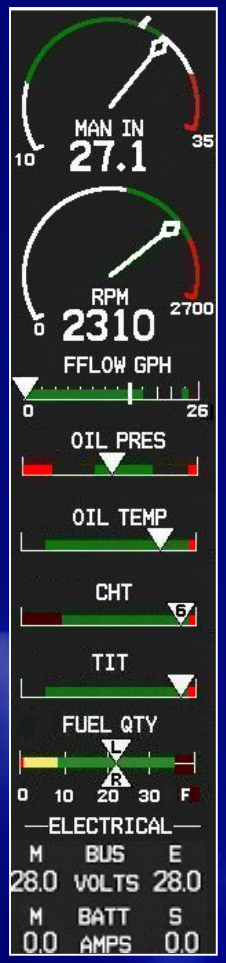
MFD Details

Engine Indication System



Turbo Skylane

- **Manifold Pressure**
  - **White Tick Mark (25 in. Hg)**
    - Normal Enroute Climb
- **Fuel Flow**
  - **White Tick Mark (16 GPH)**
    - Normal Enroute Climb
  - **Green Tick Mark (24 GPH)**
    - Maximum Performance Climb

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MFD Details

Engine Indication System

Turbo StationAir

- **Manifold Pressure**
  - **Top of the Green Arc (30 in. Hg)**
    - Normal Enroute Climb
- **Fuel Flow**
  - **Top of the Green Range (20 GPH)**
    - Normal Enroute Climb
  - **Green Tick Mark (34 GPH)**
    - Maximum Performance Climb

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Turbocharging

MOMENTARY OVERSHOOT OF MANIFOLD PRESSURE

- Rapid throttle movement, especially with cold oil makes it possible that the engine can be overboosted slightly above the maximum manifold pressure.

- Most likely be experienced during the takeoff roll or during a change to full throttle operation in flight.

- A slight overboost of 2 to 3 inches of manifold pressure is not considered detrimental to the engine as long as it is momentary.

- IF overboosting persists when oil temperature is normal or if the amount of overboost tends to exceed 3 inches or more, the throttle should be retarded to eliminate the overboost and the controller system, including the waste gate and relief valve, should be checked for adjustment or replacement of components.

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Turbocharging

Maximum Continuous Power – (MCP)

Manifold Pressure Limitations

Minimum Fuel Flows
Maximum Continuous Power
2500 RPM

ALT (FT)	M.P. (IN. Hg)	FUEL FLOW (GPH)
SL - 17,000	39	34.0
18,000	37	30.5
20,000	35	28.5
22,000	33	26.5
24,000	31	24.5
26,000	29	23.0
28,000	27	21.0
30,000	25	19.0

T206

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Turbocharging

Section 2, Limitations:

Maximum Operating Altitude

(T182 ONLY)

20,000 Feet MSL

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Oxygen System

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Oxygen

OXYGEN SYSTEM- provides the supplementary oxygen necessary for continuous flight at high altitude

T182
- Four-Place Oxygen System
- 50 cubic foot oxygen cylinder, located in aircraft tailcone

T206
- Six-Place Oxygen System
- 76 cubic foot oxygen cylinder

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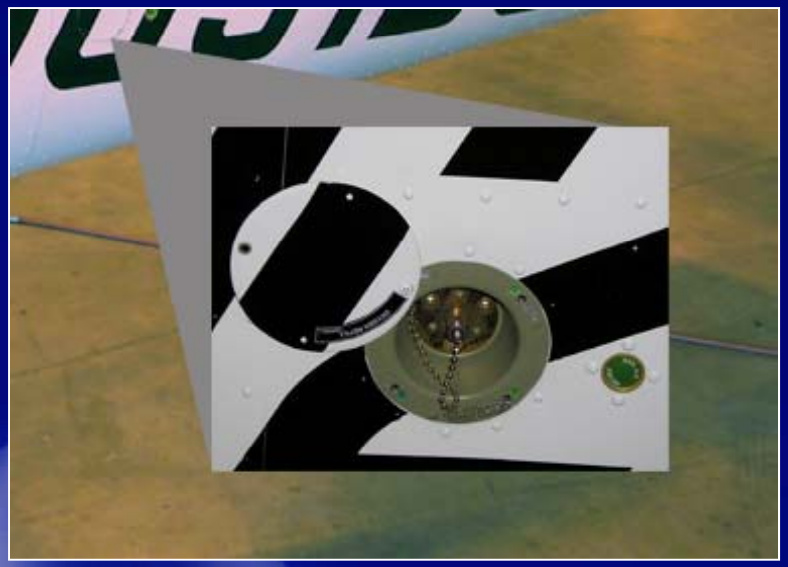
Oxygen



The oxygen cylinder filler valve is located on the left side fuselage tailcone under a cover plate

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Oxygen

Four oxygen outlets (T182) or six outlets (T206) are provided; two in the overhead oxygen console and two (T182) or four (T206) in the cabin ceiling just above the side windows.

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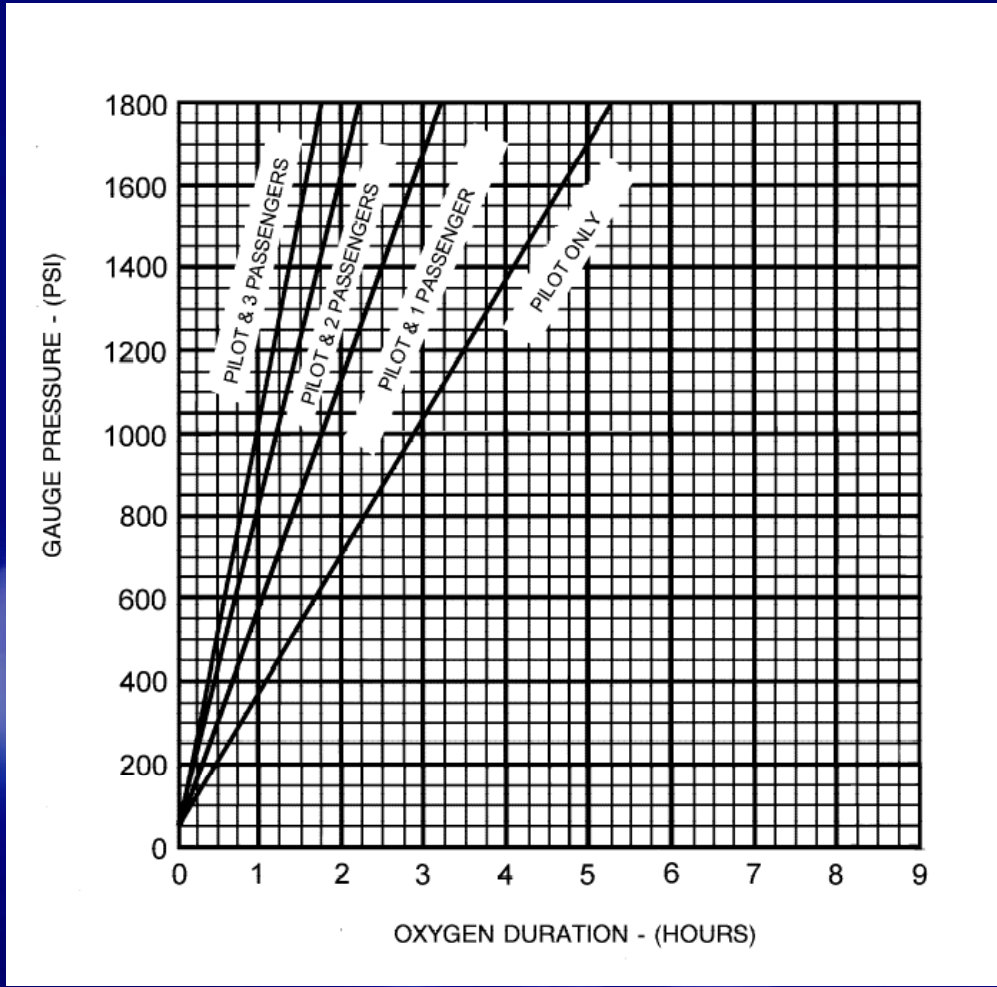
Oxygen



T182-Example

The Oxygen Duration Chart for **your appropriate airplane** should be used in determining the usable duration (in hours) of the oxygen supply in your specific airplane. The procedure outlined in the POH can be used to find the duration from the chart.

This chart is based on the following mask configuration.

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Oxygen

ONE microphone-equipped mask is provided for the pilot, and THREE or FIVE masks are provided for the passengers. All masks are the partial-breathing type, equipped with vinyl plastic hoses and flow indicators.

The hose provided for the pilot is of a higher flow rate than those for the passengers; it is color-coded with a RED band adjacent to the plug-in fitting.

The passenger hoses are color-coded with an ORANGE band. If the airplane owner prefers, he may provide higher flow hoses for all passengers, however, this WILL lower oxygen duration.

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Oxygen

When ready to use the oxygen system, proceed as follows:

1. Mask and Hose -- SELECT. Adjust mask to face and adjust metallic nose strap for snug mask fit.

PERMIT NO SMOKING WHEN USING OXYGEN. OIL, GREASE, SOAP, LIPSTICK, LIB BALM, AND OTHER FATTY MATERIALS CONSTITUTE A SERIOUS FIRE HAZARD WHEN IN CONTACT WITH OXYGEN. BE SURE HANDS AND CLOTHING ARE OIL FREE BEFORE HANDLING OXYGEN EQUIPMENT.

2. Delivery Hose -- PLUG INTO OUTLET nearest to the seat you are occupying.

NOTE
When the oxygen system is turned on, oxygen will flow continuously at the proper rate of flow for any altitude without any manual adjustments.

3. Oxygen Supply Control Knob -- ON.
4. Face Mask Hose Flow Indicator -- CHECK. Oxygen is flowing if the indicator is being forced toward the mask.
5. Delivery Hose -- UNPLUG from outlet when discontinuing use of oxygen. This automatically stops the flow of oxygen.
6. Oxygen Supply Control Knob -- OFF when oxygen is no longer required.

For FAA requirements concerning supplemental oxygen, refer to FAR 91.211. Supplemental oxygen should be used by the pilot when cruising above 12,500 feet for greater than 30 minutes. Above 14,000 feet, oxygen use is required by the crew. Above 15,000 feet, oxygen must be provided to all occupants. It is often advisable to use oxygen under conditions of night flying, fatigue, or periods of physiological or emotional disturbances at lower altitudes.

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McCauley Constant-Speed Propeller

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Propeller

The airplane has an all-metal, three-bladed, constant speed, governor regulated propeller.

A blue control knob on the center area of the switch and control panel is used to set the propeller and control engine RPM as desired for various flight conditions.

The knob is labeled **PROPELLER, PUSH INCR RPM**. When the control knob is pushed in, blade pitch will decrease, giving a higher RPM. When the control knob is pulled out, the blade pitch increases, thereby decreasing RPM.

The propeller control knob is equipped with a vernier feature which allows slow or fine RPM adjustments by rotating the knob.

To make rapid or large adjustments, depress the button on the end of the control knob and reposition the control as desired.

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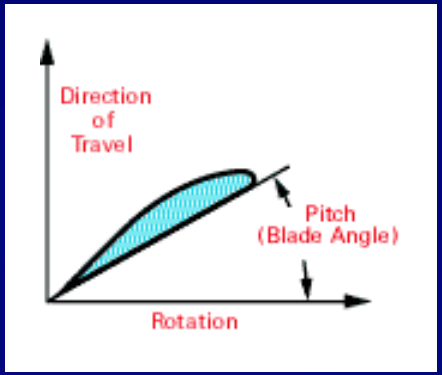
Propeller

- A constant-speed (RPM) system permits the pilot to select the propeller and engine speed and maintain that RPM under varying conditions of aircraft attitude and engine power.

- With a fixed RPM and power setting, the blade angle automatically changes as airspeed increases or decreases.



- In a single-acting propeller system, oil pressure supplied by the **governor**, acting on the piston produces a force that is opposed by the natural centrifugal twisting moment of the blades in constant speed models.

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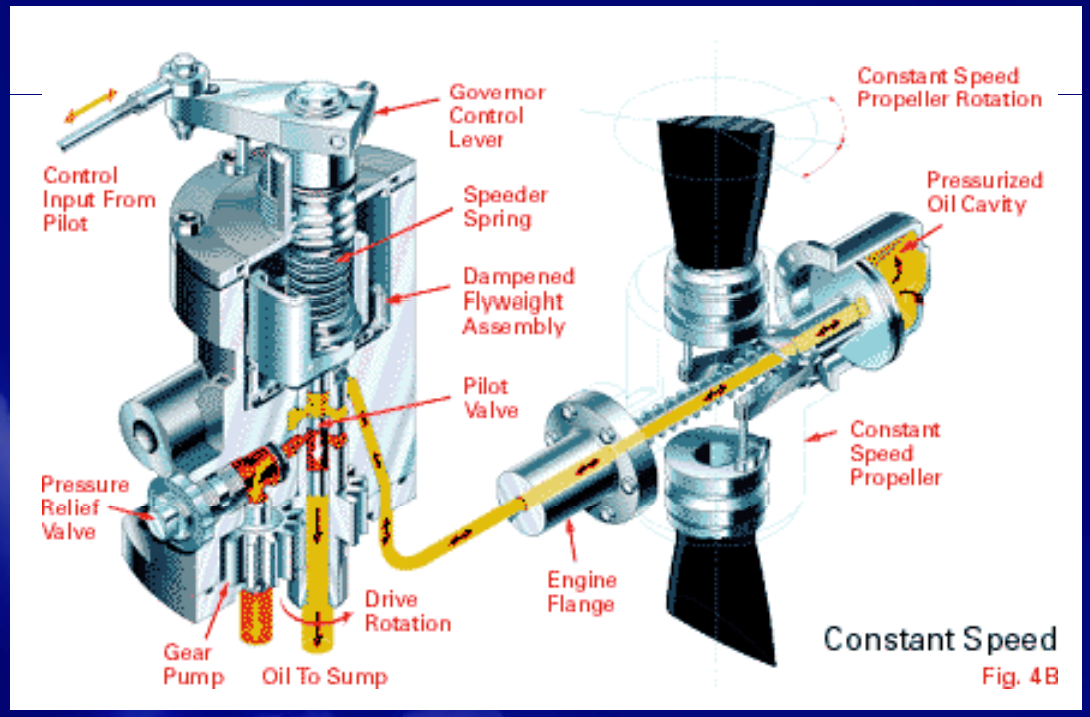
Propeller Governor

The Cockpit Propeller Control Lever is connected to the Propeller Governor Control Lever in the engine compartment. Depending on the selected RPM by the pilot, the governor will regulate oil into or out of the Propeller Oil Dome to change blade pitch or blade angle to maintain a selected RPM.



Governor Regulates Oil to or from the Propeller

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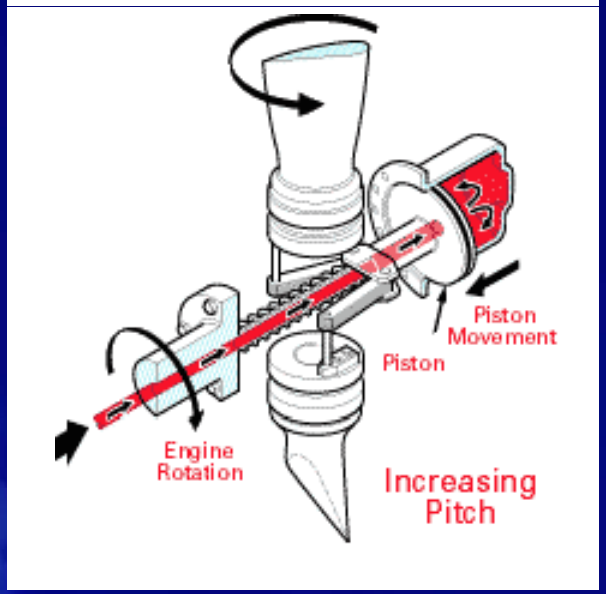
Propeller

To increase the blade pitch, high pressure engine oil is directed to the propeller, which moves the piston back. The motion of the piston is transmitted to the blades through actuating pins and links, moving the blades toward high pitch for constant-speed systems.



Oil IN – Increases Pitch

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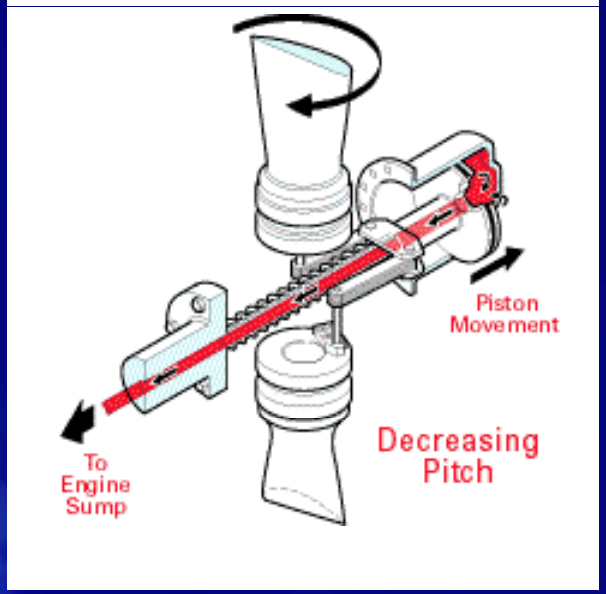
Propeller

From this position, pitch is decreased for constant-speed systems by allowing oil to flow out of the propeller and return to the engine sump.



Oil OUT – Decreases Pitch

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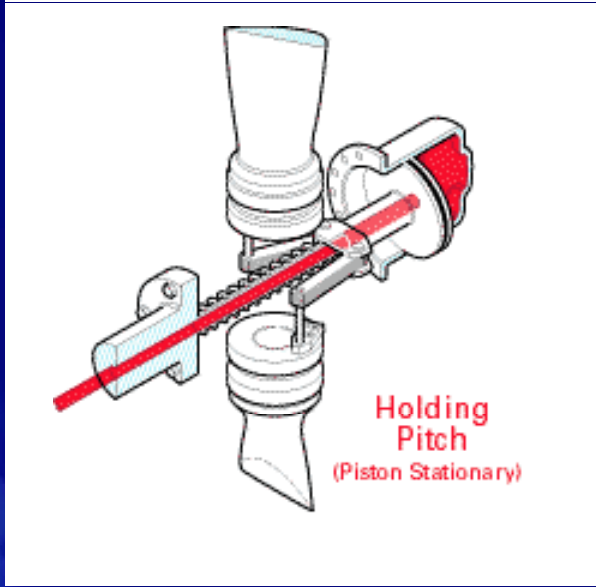
Propeller

When the opposing forces are equal, oil flow to the propeller stops and the piston also stops. The piston will remain in this position, maintaining the pitch of the blades until oil flow to or from the propeller is again established by the governor.



Oil Stationary – Holding Pitch

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Propeller Operations

Before Takeoff Check

Propeller Control Lever in Cockpit

PROP Control – CYCLE

Cycle the prop control through its full range of travel to make sure the prop control works properly and it functions to reduce RPM.

A drop of 200 - 400 RPM should be adequate, it is recommended not to let the RPM drop more than 500 R.P.M.

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Please refer to the Pilot's Operating Handbook/Airplane Flight Manual for all of the operating limitations for your aircraft.

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