Flying the Garmin G1000

Ed Williams CFII/ATP   *SMX-XX April 2008*

Primary Flight Display (PFD)   Multi-Function Display (MFD)
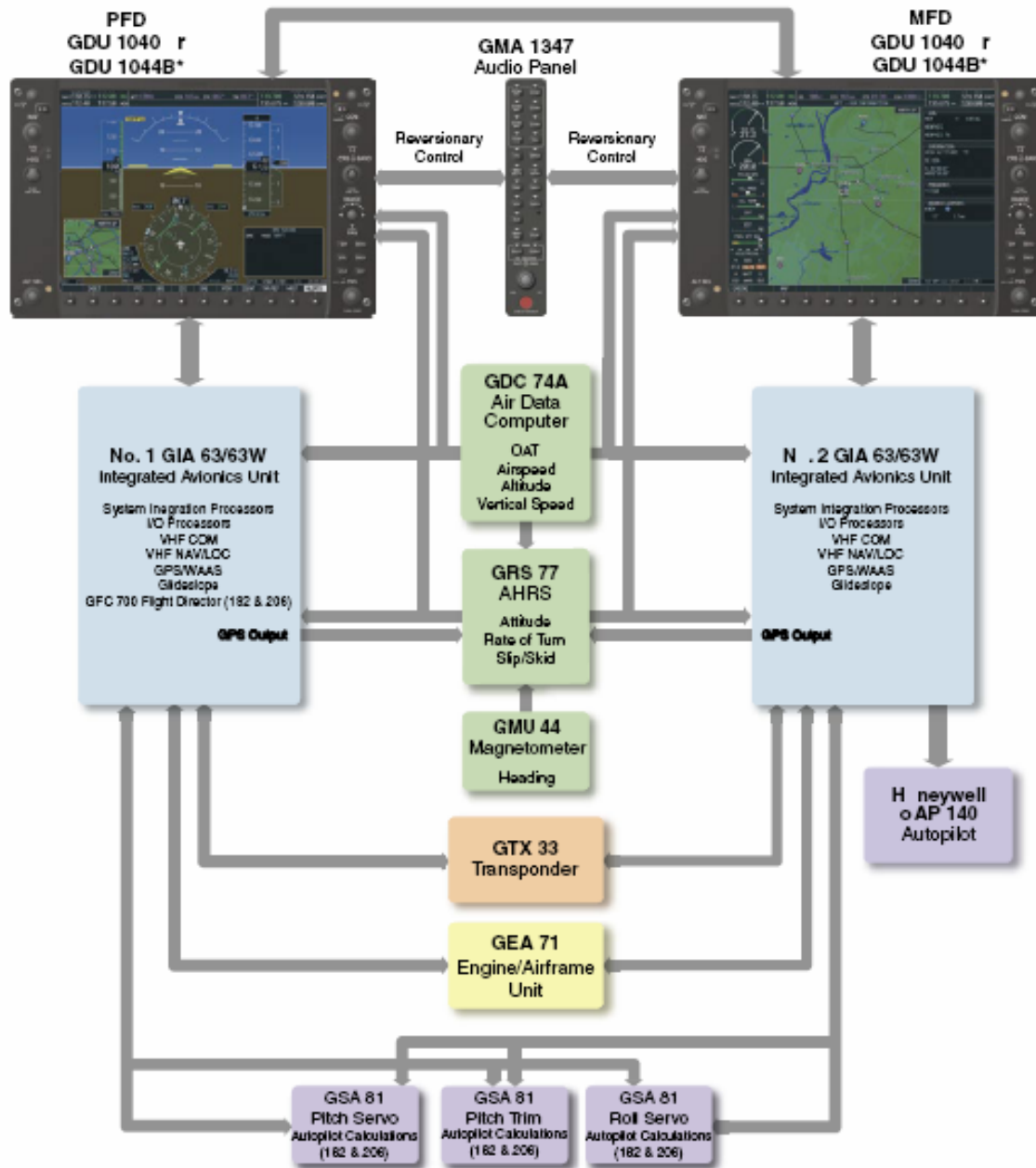
An intro to glass panels…

Garmin's G1000 panel dominates the *new* airplane market

Cessna 172, 182, T206
Beech G36
Columbia 400
Diamond DA40, DA42
Mooney Ovation 20R
Tiger AG-5B
VLJ's etc…

Diamond DA42 twinstar

- The promise is greater functionality at lower cost.
- Better maintainability and reliability than analog instrumentation?
- Not just data, but information.

It's modular…

PFD
GDU 1040 r
GDU 1044B*

GMA 1347
Audio Panel

MFD
GDU 1040 r
GDU 1044B*

Reversionary Control

Reversionary Control

GDC 74A
Air Data Computer
OAT
Airspeed
Altitude
Vertical Speed

No. 1 GIA 63/63W
Integrated Avionics Unit

System Integration Processors
I/O Processors
VHF COM
VHF NAV/LOC
GPS/WAAS
Glideslope
GFC 700 Flight Director (182 & 206)

GPS Output

N. 2 GIA 63/63W
Integrated Avionics Unit

System Integration Processors
I/O Processors
VHF COM
VHF NAV/LOC
GPS/WAAS
Glideslope

GPS Output

GRS 77
AHRS
Attitude
Rate of Turn
Slip/Skid

GMU 44
Magnetometer
Heading

Honeywell o AP 140 Autopilot

GTX 33
Transponder

GEA 71
Engine/Airframe Unit

GSA 81
Pitch Servo
Autopilot Calculations
(182 & 206)

GSA 81
Pitch Trim
Autopilot Calculations
(182 & 206)

GSA 81
Roll Servo
Autopilot Calculations
(182 & 206)

The G1000 is a integrated system of communicating modules.

Service is primarily swapping LRUs and repairing them in-house or back at Garmin.

The various LRUs are common to many different airframes from the C172 to VLJs.

I'm familiar with the C172S configuration, so I'll concentrate on that.

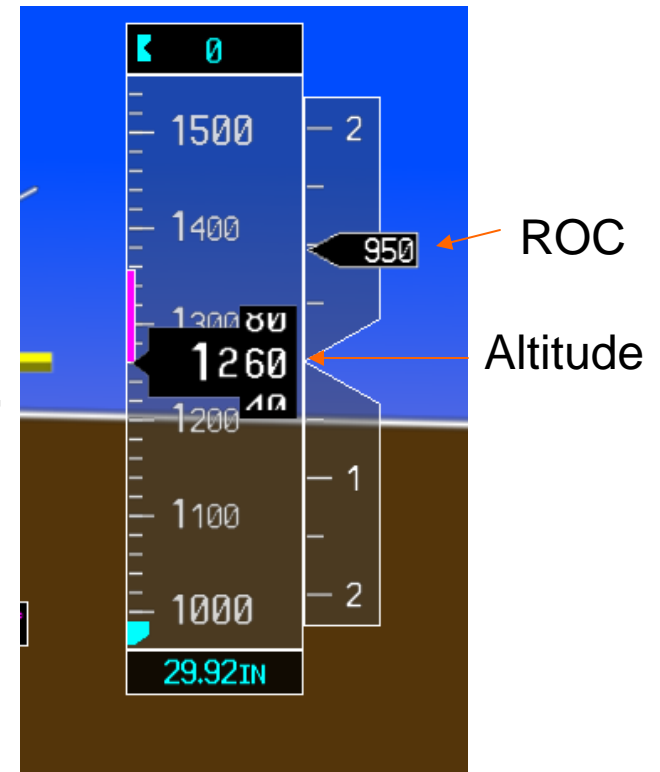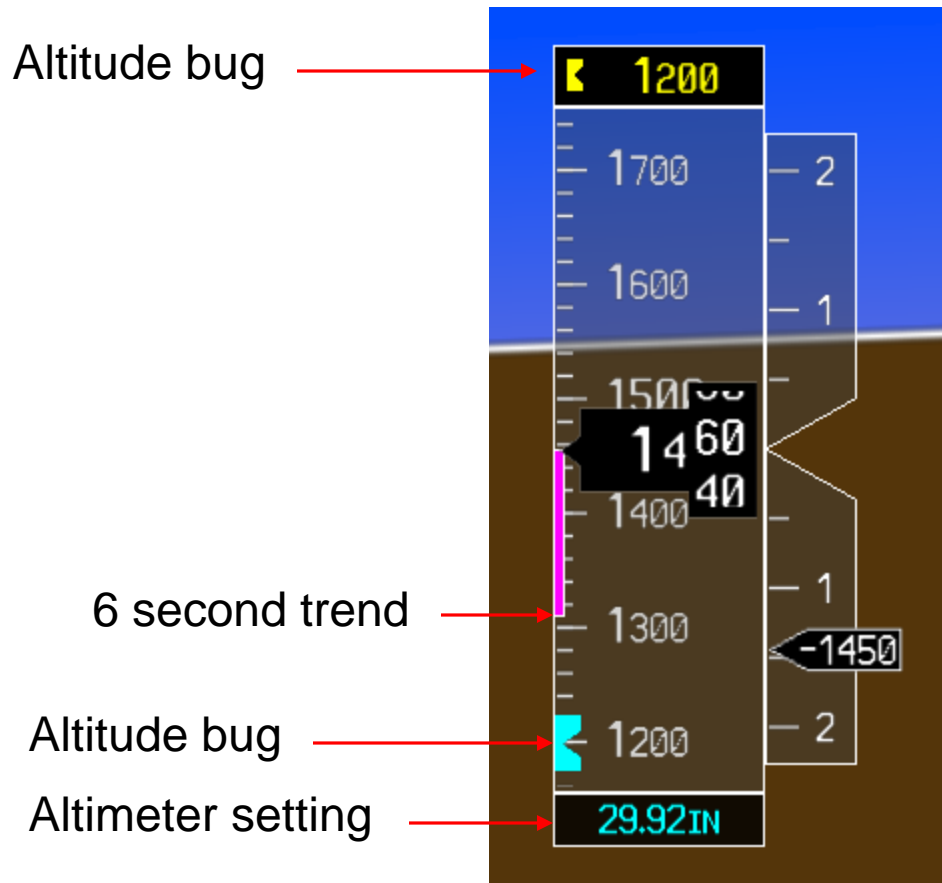# In the G1000 flight data are measured by remote sensors and displayed on the PFD.

=

GDC74A air data computer

+

ROC

Altitude

29.92IN

Solid state electronic pressure sensors replace mechanical instruments.
Sensor and display are separate.

In addition we have an altitude bug and a 6-second trend vector.

Altitude bug ——→ 1200

The altitude bug is not integrated with the KAP140 autopilot. It has to be set independently.

In the C172S/G1000/KAP140, there are three altimeters to set!

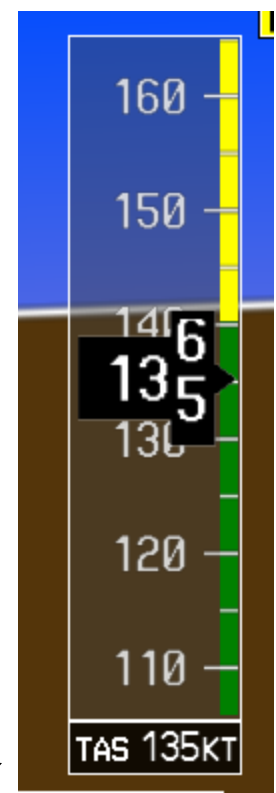*Garmin has recently introduced its own integrated autopilot.*

6 second trend ——→

Altitude bug ——→ 1200

Altimeter setting ——→ 29.92IN

The altimeter is set with the outer knob of the OBS course selector on the RH bezel.

Garmin GFC700 A/P

The airspeed indicator is also replaced with a tape.
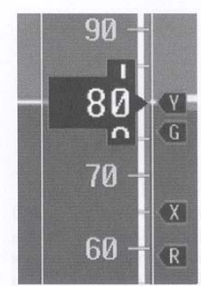
TAS is computed automatically.
Vr, Vx, Vy bugs can be adjusted from the defaults.

Attitude and heading data comes from the AHRS

GRS77 attitude and heading reference system
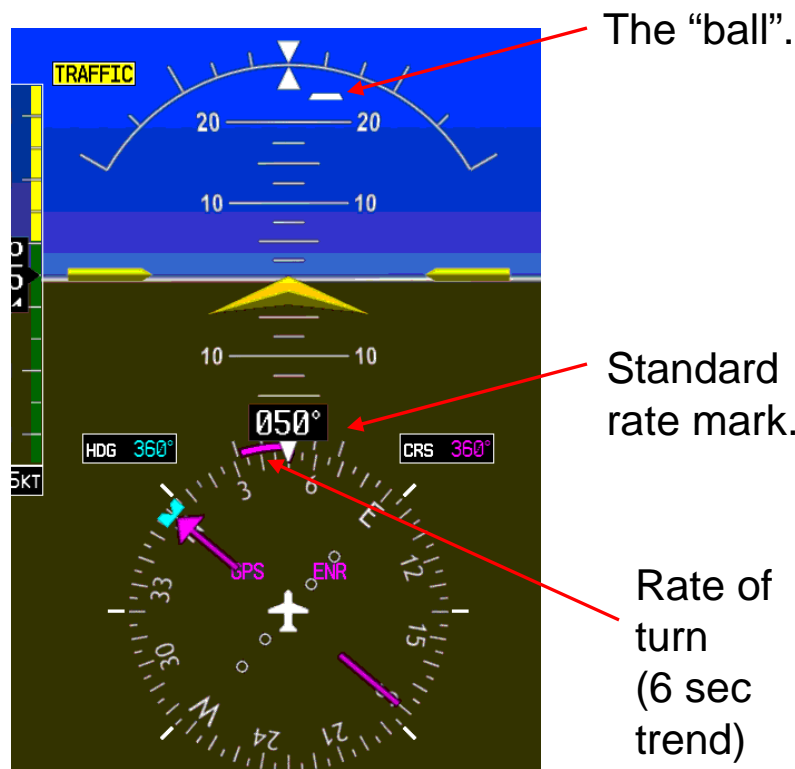

3-axis magnetometer

AHRS has MEMS accelerometers rate-of-turn and tilt sensors in all three axes to provide an inertial reference system (IRS).

Magnetometer, GPS and air data input are used for initial initialization and to assist in attitude determination.

Unlike a traditional gyro-based IRS, the AHRS can re-erect while in motion and even in flight. (Even in a 20 degree bank!)

The AHRS will degrade into a reversionary mode if external inputs are lost. It has some redundancy…

AHRS Mode	Available AHRS Functions			Available Sensor Inputs		
	Pitch	Roll	Heading	GPS Input (At least one)	GMU 44 Magnetometer	GDC 74A Air Data Computer
Normal/Primary	X	X	X	X	X	X
Reversionary: No GPS	X	X	X	-	X	X
Reversionary: No Magnetometer	X	X	-	X	-	X
Reversionary: No Magnetometer No Air Data	X	X	-	X	-	-

The "ball".

Standard rate mark.

Rate of turn (6 sec trend)

Normal AHRS
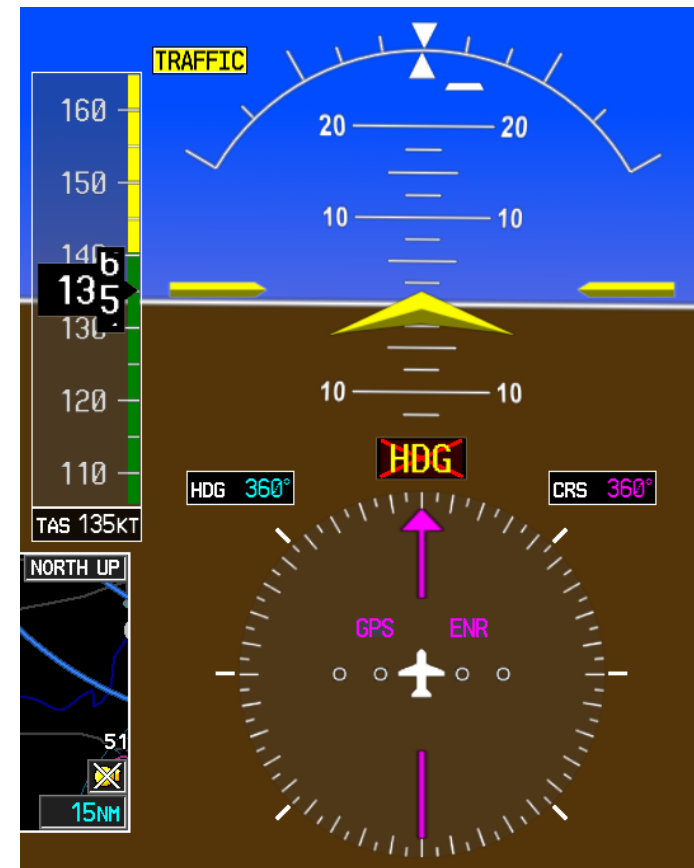
AHRS w/o magnetometer

The heading display incorporates an HSI for the primary navaid (GPS, VOR or ILS).
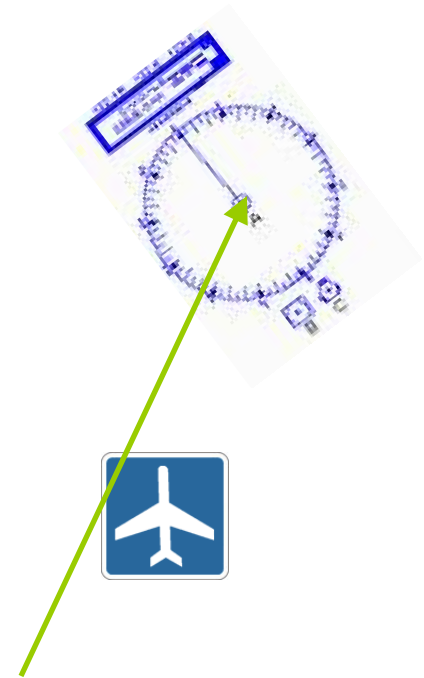
NAV1 active is 111.4 (RIS)
Standby is 117.95.

Inner knob sets the "OBS" course pointer. Pressing gives "direct-to".

Primary nav on the HSI toggled with the CDI soft-key

We are intercepting the 071° bearing to RIS VOR on a 042° heading.

To simultaneously display *secondary* nav info you can display RMI pointers

obs 072° → KTRX | DIS 19.5NM BRG 071°

Waypoint annunciator strip

HDG 033°

034°

CRS 072°

9KT

GPS   TERM

OBS

58.0 NM
RIS
NAV1 ←

21.5 NM
BQS
NAV2 →

CRS line to GPS
Waypoint 072 °

Bearing to BQS
160°
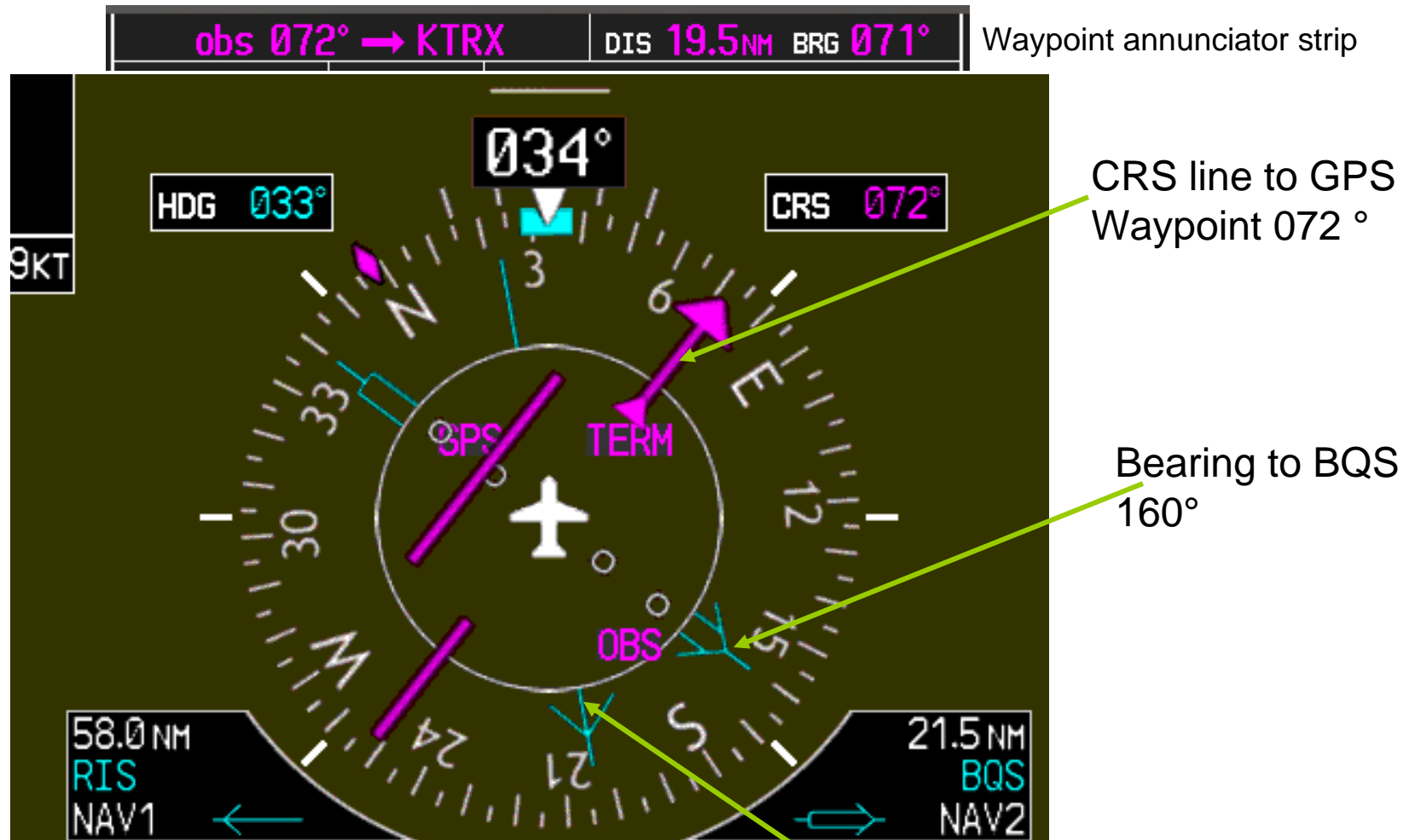
Bearing to RIS
203°

Our primary nav, on the HSI, is the 072°
GPS course to KTRX. RMI pointers show
bearings to NAV1&2 VORs.

Here we show the whole Primary Flight Display…

It's all electrical except for three standby instruments

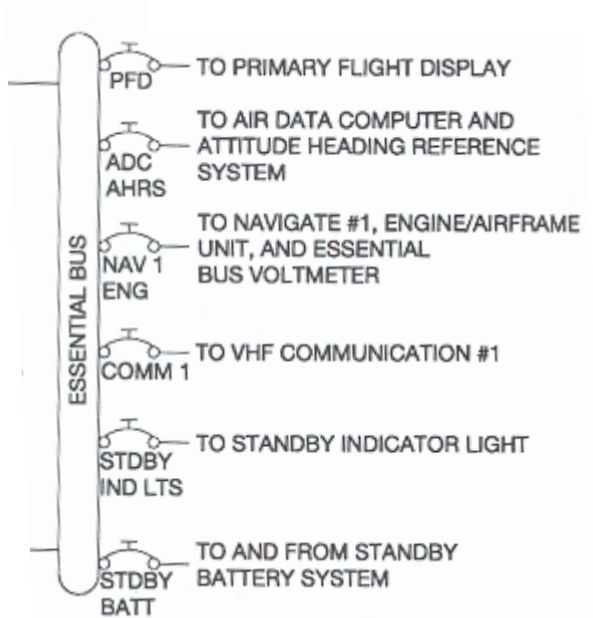Cessna 182

Airspeed, Attitude & Altimeter

If a panel fails, the remaining panel can operate in *reversionary* mode. (Automatic or the red button.)

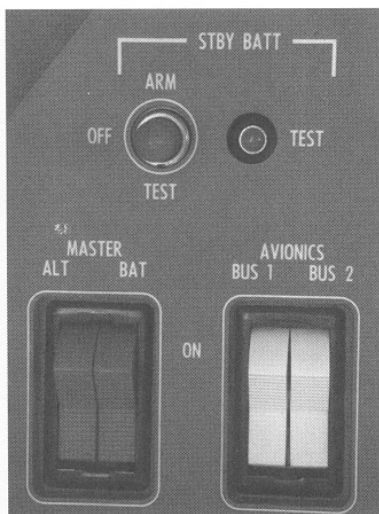# In reversionary mode, the PFD display adds engine instrumentation.

Normally, engine data only shows on the MFD.

In the C172/Garmin 1000 a standby battery can power the essential bus.

ESSENTIAL BUS

- PFD — TO PRIMARY FLIGHT DISPLAY
- ADC / AHRS — TO AIR DATA COMPUTER AND ATTITUDE HEADING REFERENCE SYSTEM
- NAV 1 / ENG — TO NAVIGATE #1, ENGINE/AIRFRAME UNIT, AND ESSENTIAL BUS VOLTMETER
- COMM 1 — TO VHF COMMUNICATION #1
- STDBY IND LTS — TO STANDBY INDICATOR LIGHT
- STDBY BATT — TO AND FROM STANDBY BATTERY SYSTEM

(excerpted from the C172S manual)

- *Essential* bus powers PFD, AHRS, engine/airframe sensors, #1 Nav-Com and 1 GPS.

- If the alternator fails, turning off the master switch and leaving the stand-by battery switch *armed* will allow you to preserve main battery capacity for later in the flight.

- The standby battery has little or no power remaining once the essential bus voltage drops to 20V.

STBY BATT

ARM

OFF TEST

TEST

MASTER
ALT   BAT
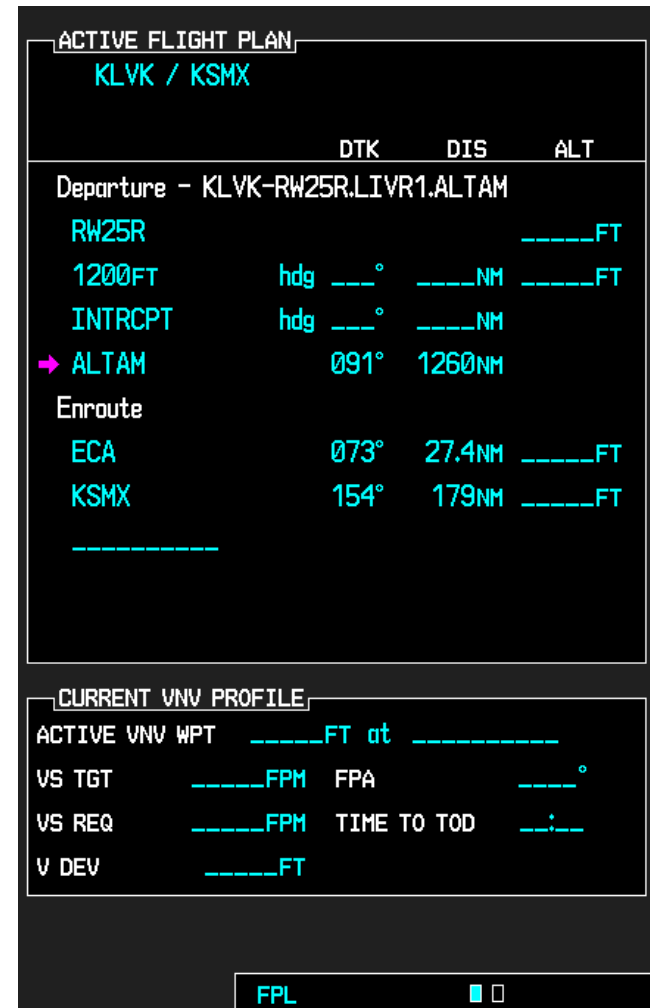
AVIONICS
BUS 1   BUS 2

ON

From the starting checklist:

4. STBY BATT Switch – TEST (hold for 20 sec, verify the green test lamp does not go out), then ARM (verify PFD comes on)

checks the condition of the standby battery.

The GPS interface will be familiar to Garmin 430/530 users.
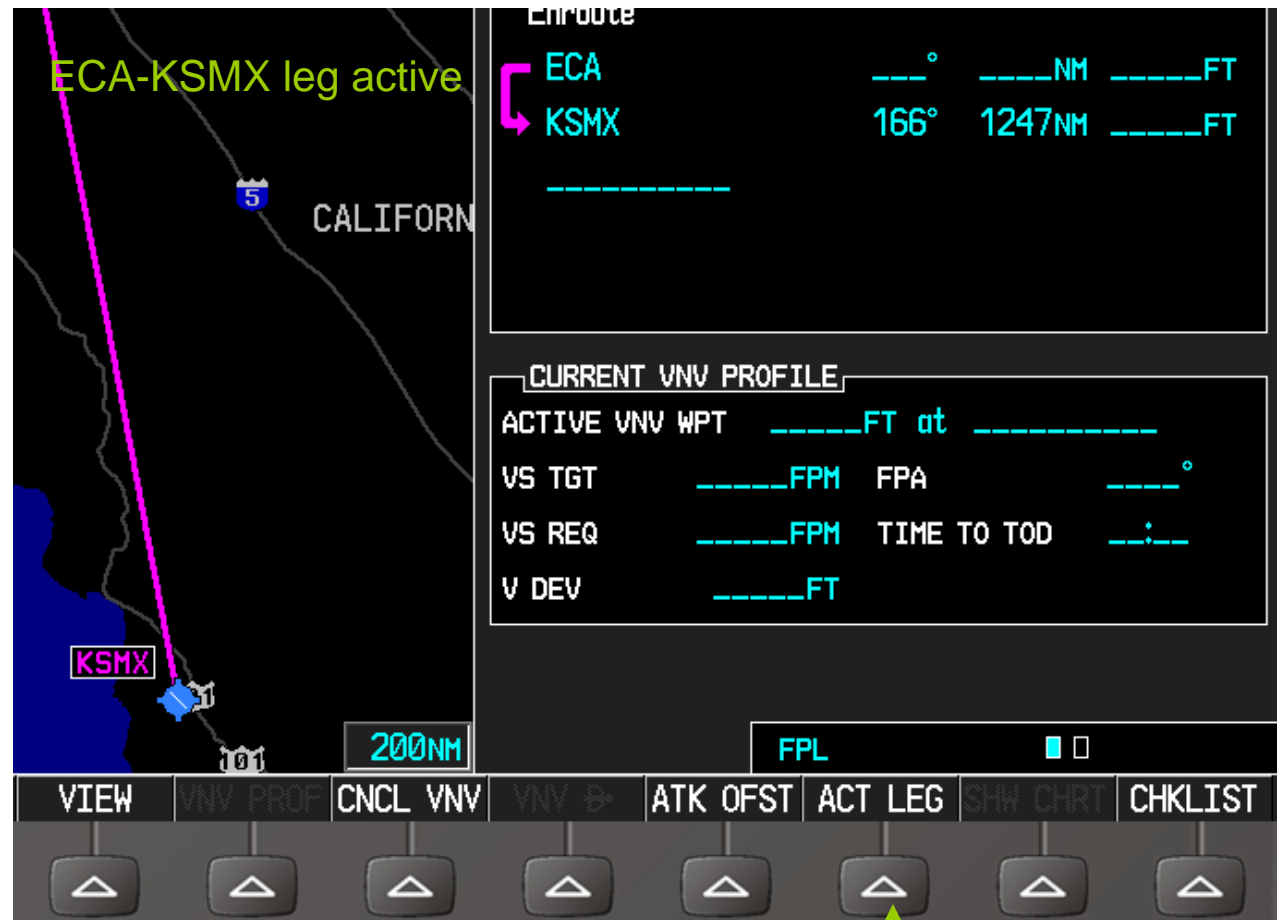

FPL on the PFD

More extensive planning options on the MFD page.

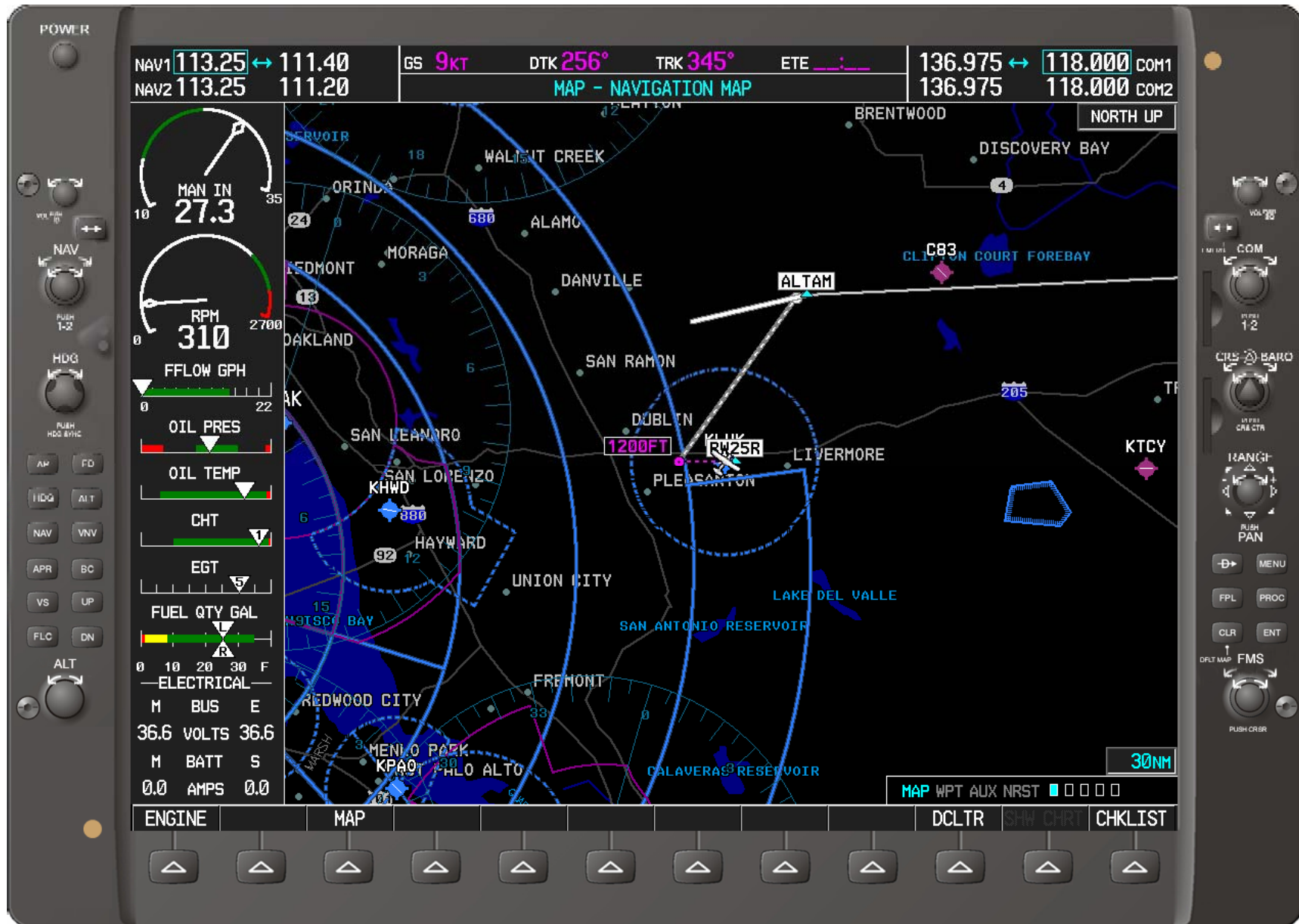# Curiously, the direct/direct shortcut for activating a flight plan leg is absent on the G1000.

PAGE MENU

OPTIONS

Activate Leg

Store Flight Plan

Invert Flight Plan

——————

You can still use *activate leg* via the *menu* key, or on the MFD only, use the *act-leg* soft-key.

Enroute

ECA-KSMX leg active

ECA	___°	____NM	_____FT
KSMX	166°	1247NM	_____FT

——————

CALIFORN

5

CURRENT VNV PROFILE

ACTIVE VNV WPT   _____FT at _____

VS TGT   _____FPM   FPA   ____°

VS REQ   _____FPM   TIME TO TOD   __:__

V DEV   _____FT

KSMX

200NM

FPL

VIEW   VNV PROF   CNCL VNV   VNV ▷   ATK OFST   ACT LEG   SHW CHRT   CHKLIST
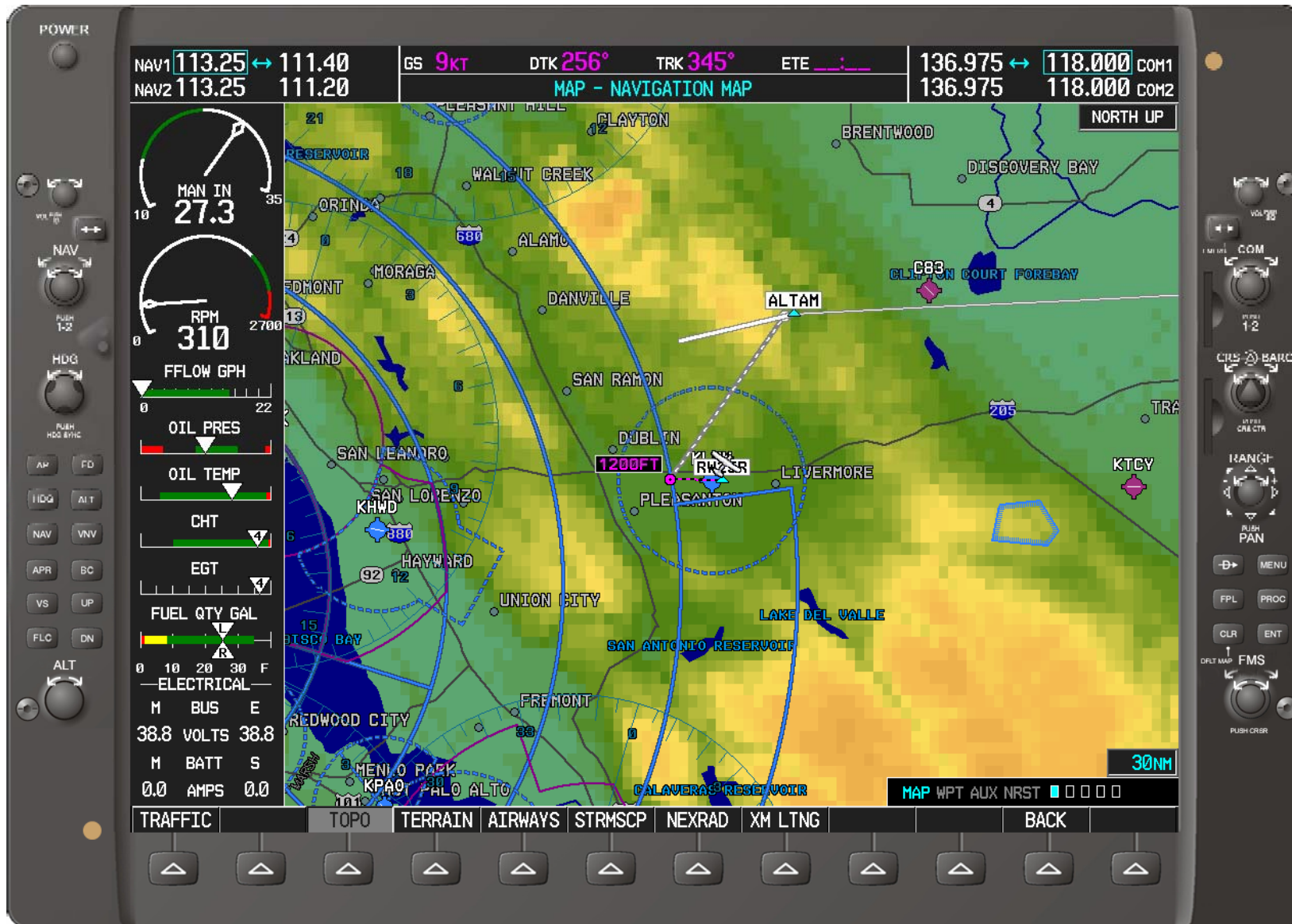
Soft key.

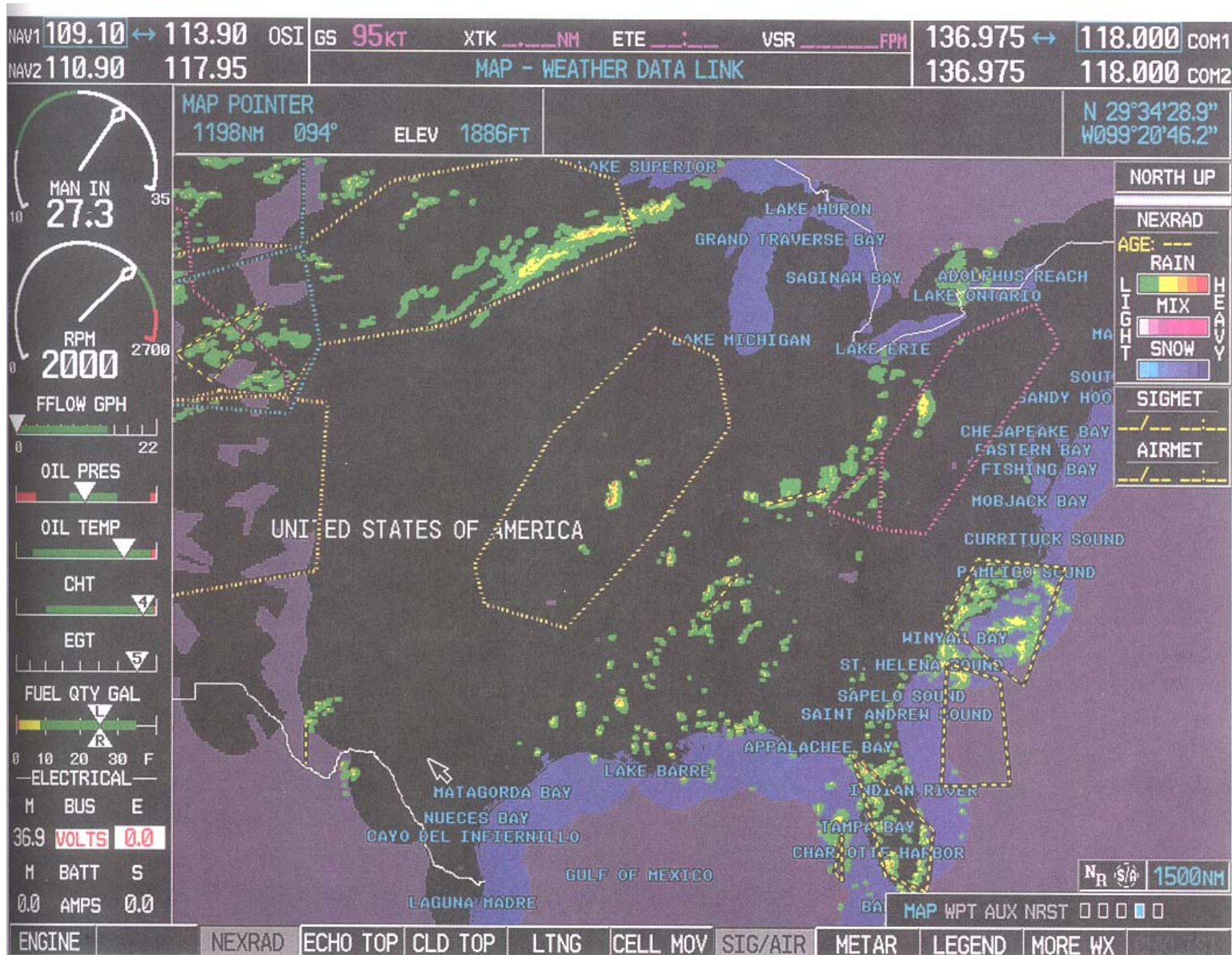# The MAP page on the MFD shows the flight plan and position.

The MFD map can display terrain, traffic, nexrad, lightning

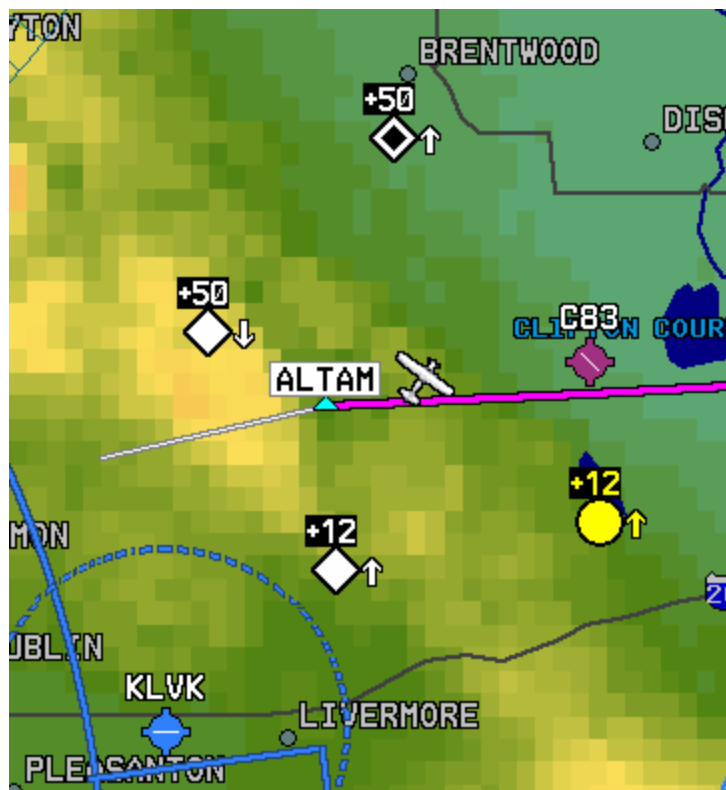*with the necessary optional equipment installed…*
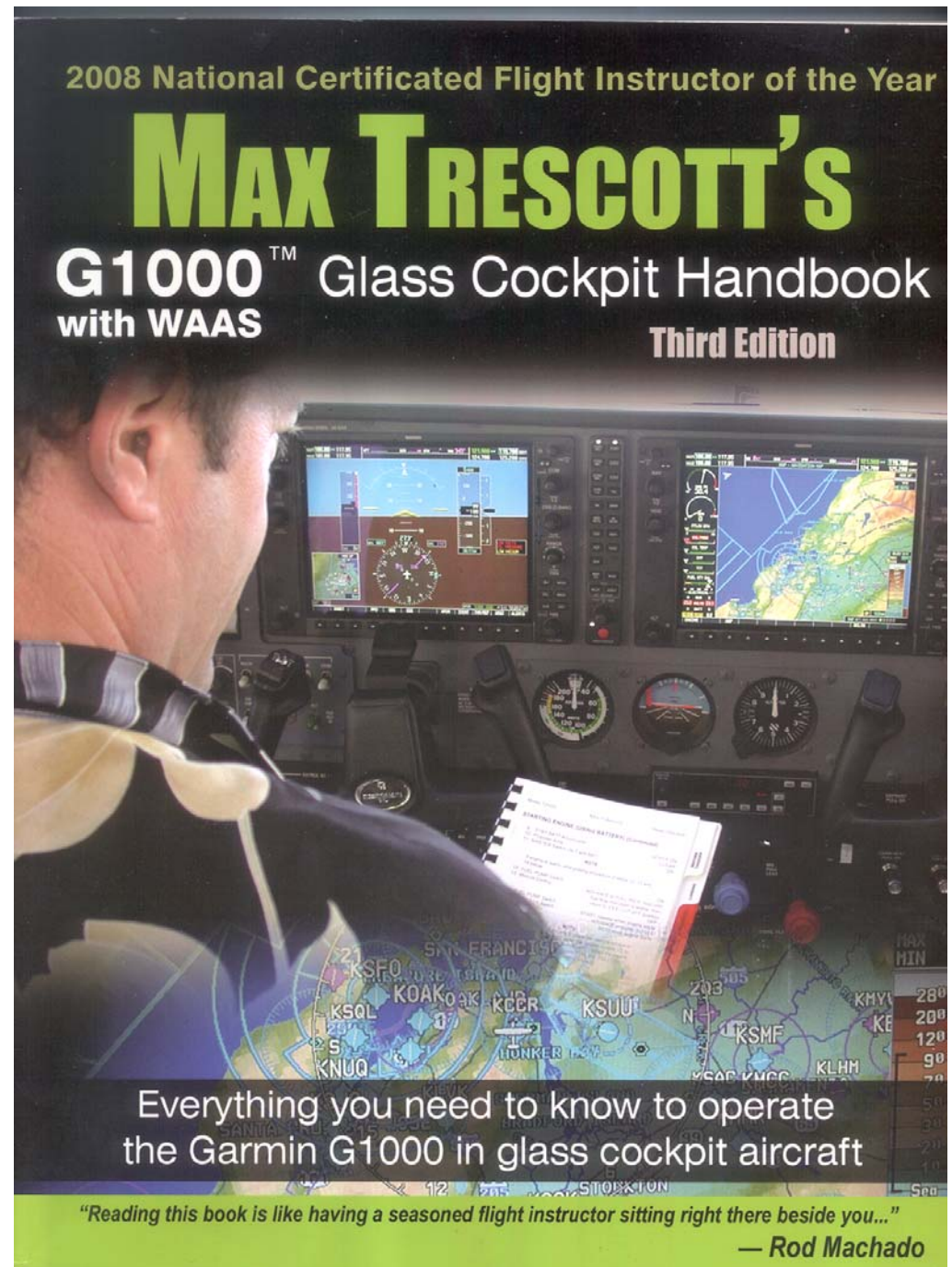
The MFD is showing XM NEXRAD data.

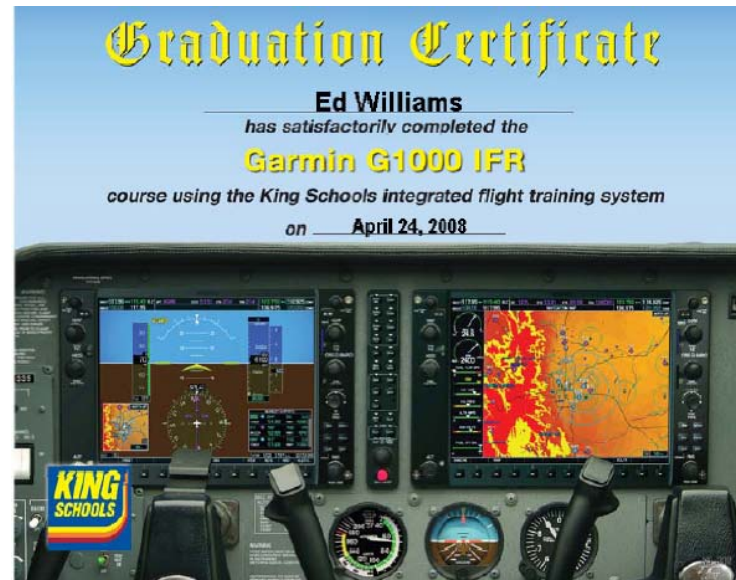# Traffic advisories are shown on the MFD and on the PFD map inset

PFD map inset

I highly recommend this book…

2008 National Certificated Flight Instructor of the Year

MAX TRESCOTT'S

G1000™ Glass Cockpit Handbook
with WAAS

Third Edition

Everything you need to know to operate
the Garmin G1000 in glass cockpit aircraft

"Reading this book is like having a seasoned flight instructor sitting right there beside you…"
— Rod Machado

The King School is a good overview -- but is $249

The Garmin simulators are faithful and essential

Harder to "fly" than the 430/530 simulators IMO
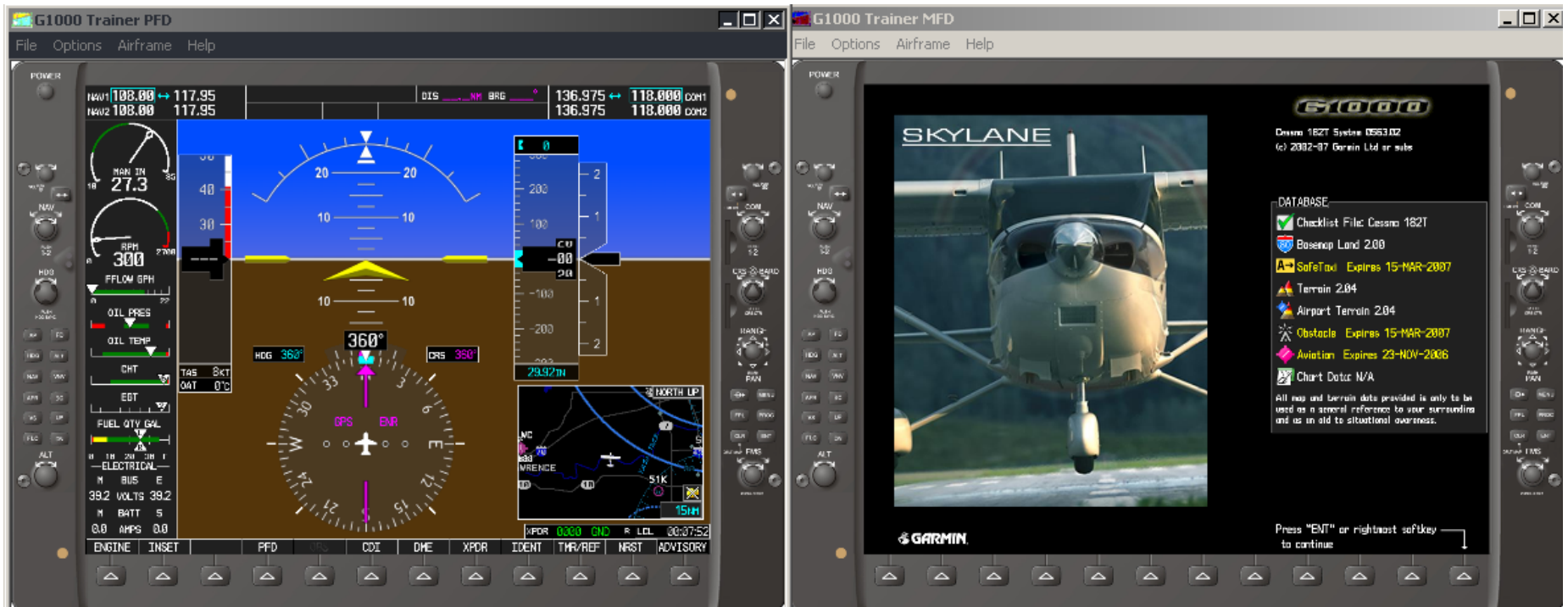Dual screens add realism.

FS –X supposedly has a partial simulation.

G1000 PC Trainer for Cessna NAV III, version 8.20
010-10596-04
$ 24.95 USD

If you've not flown a glass panel, give it a try.

- I found the instrument display intuitive – easy to transition to.

- Practice with the simulator was greatly rewarded.

- The GPS is easy if you know the 430/530.

- Keep looking out the window!!