# MGL EFIS – Garmin G400/500 Integration & Operations Guide

1 April 2014 (V6)

**iEFIS/Odyssey/Voyager G2 ARINC INTEGRATION GUIDE 1 April 2014**

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EFIS System Applications:  This ARINC Integration and Operation Guide applies to MGL G2 iEFIS and G2 Odyssey/Voyager to GARMIN 400/500W series units.  This guide is based on the iEFIS G2 A1.0.2.1 (Jul13) and Odyssey/Voyager G2 SW Release G2 1.110 (Jul13).  The graphics are based primarily on the use of Default Screens.

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This guide prepared for the MGL Users Group by Cecil Jones

RV-6A MGL Odyssey G2 & iEFIS,
G430W, NavWorx ADSB

</div>

## A. OVERVIEW

The iEFIS and G2 Odyssey / Voyager MGL EFIS displays among other external systems are also integrated via the ARINC 429 interface with the GARMIN G400/500W series avionics units. The ARINC integration provides the iEFIS and Odyssey/Voyager with a FAA approved IFR certified GPS/WAAS navigator that provides global enroute and precision terminal Lateral and Vertical approach navigation, and in some models both VHF communications and VOR/ILS navigation and precision approach capabilities.

The primary function of the G430W is to provide FAA approved IFR GPS, Localizer, & VOR Lateral Enroute and Terminal guidance and Lateral + Vertical approach guidance for ARNAV/GPS and ILS approaches. The G430 also provides navigation guidance in the form of course and waypoint information. Both the approach and navigation guidance is passed via ARINC to the EFIS. During integrated ARINC operations the GARMIN at the option of the user may provide its GPS navigation present position, ground track, and ground speed to the EFIS, or as we have found out the iEFIS & G2-Odyssey/Voyager internal GPS present position function supports the MGL autopilot operation much better due to its tight integration with the MGL Autopilot. Also during integrated ARINC operations the EFIS provides Magnetic Heading, pressure altitude, True Airspeed, Outside Air Temperature and "VOR" Course Select (OBS) information back to the G4500/500W avionics. All G400/500W Mode/function changes are selected through the GARMIN **CDI** Key which changes the system between "**GPS**" Enroute, Terminal or ARNAV based approaches to "**VLOC**", by selecting VOR based route navigation or VOR, ILS, or Localizer based approaches. The EFIS displays the current navigation and approach modes also selected by the **CDI** Key. At start up only the Garmin Bit test will display on the EFIS until a valid route has been selected on the Garmin. Current EFIS SW requires the Pilot to select "NAV" → "Use External NAV Source" during startup to ensure that the G430 ARINC data provides the active route input into the EFIS. The EFIS will then receive and display the G400/500 route (Flight Plan/Approach) as selected by the **CDI** Key on the Garmin Navigator. The EFIS in GPS mode will receive and display GPS navigation and approaches routes, and approach lateral and vertical guidance. In the VLOC Mode the EFIS will switch between VOR or ILS display modes by following whether the pilot has selected a VOR or ILS/Localizer frequency on the Garmin display, and will then only display this information on the EFIS if the Garmin Navigation is receiving a valid VOR or ILS signal. During VLOC Mode the Garmin still generates GPS/ARNAV route information with waypoints, this rout data is displayed on the EFIS.

Physical integration between the G430/530W and the iEFIS (iBOX) and Odyssey/Voyager requires only 6 wires (or 4 if the Garmin G400/500W or G420/520W has no ILS/VOR receiver installed), 2 each ARINC twisted pair TX wire pairs connect the Garmin GPS and NAV (VOR/ILS) receivers (TX-Out) to the iBOX or Odyssey ARINC "RX-IN" Ports 1 and 3 respectively (ARINC RX Port 1 only if No VOR/ILS receiver).

For autopilot operations the EFIS can use the GARMIN navigation routes/waypoints and HSI needle outputs to drive the MGL internal EFIS autopilot or can provide the pilot the option to use the G400/500 ARINC Label 121 (roll-steering) autopilot output to provide direct EFIS Lateral autopilot guidance. Using Label 121 will allow the MGL autopilot to fly a complete Garmin

route or approach including holding patterns. The ARINC Label 121 message can also now be passed through the EFIS to an external ARINC capable autopilot.

All ARINC system setup menus are selected using the iEFIS or Odyssey/Voyager menu screens, and the G400/500W Maintenance mode. Once the systems are set up, switching from normal EFIS operation to Integrated GARMIN operation is performed on the iEFIS or Odyssey/Voyager via the "NAV" function switch and the "Internal" or "External" NAV Source. Currently the EFIS "External" Nav source cannot Display or Track (via ARINC Needle outputs) G400/500W IFR Holding patterns on the iEFIS or Odyssey/Voyager. But the holding patterns are still displayed on the G400/500W screen and if the EFIS MGL Autopilot is using the Arinc Label 121 (as discussed above) the autopilot should fly the depicted Garmin holding pattern. Using the ARINC Label 121 should more easily support EFIS integration with older (Non-WAAS) G400/500 units. Currently the iEFIS/Odyssey/Voyager treats all G400W route segments as straight line points.

Additionally the iEFIS/Odyssey/Voyager includes an ARINC flight data recorder using the Micro-SD or SD card which allows for a playback capability in the iEFIS and ODYSSEY/VOYAGER simulator (can be used in either simulator).

A) To record ARINC data on the Odyssey/Voyager goto Menu-2 → "Pg-DWN" → 9-Systems diagnostics → 9-Start ARINC label recording (or STOP as required)

B) To record ARINC data on the iEFIS select Menu → "Pg-DWN" → Systems diagnostics → "Pg-DWN" → Start ARINC label recording (or STOP as required)

C) This recording can then be downloaded from the SD card and played back and or analyzed using the EFIS simulator. This is very useful when designing IFR screens useful for instrument approaches as you can test how different display designs will present the same information, or this will allow you to re-fly (re-live) a flight or approach worth remembering!! Detailed ARINC Simulator playback instructions are included below.

## B. Garmin 400/500W to Odyssey/Voyager & iEFIS (iBOX) wiring details

ARINC 429 is the predominant data bus used by commercial and business aircraft today. The ability of the iEFIS/Odyssey to use ARINC 429 to communicate with the GARMIN 400/500W series avionics for 2-way data communications brings a level of sophistication not commonly found in the cockpits of Experimental Aircraft. As described above the G430/540W requires 6 ARINC 429 wires (3 pairs) to connect the iEFIS (iBOX) and Odyssey/Voyager ARINC interface to the GARMIN unit. ARINC 429 uses unidirectional transmission of 32 bit words (called Labels) over 2 wire twisted pair cables. The ARINC unidirectional data bus is transmitted at either 12.5 or 100 kilobits per second. While the iEFIS (iBOX) can operate at either speed, this integration uses the 12.5 kilobits per second or Low Speed ARINC mode since this speed is more than adequate for the required ARINC communications.

Notes; (1) NO ARINC input is required into the Garmin P4006 NAV connector as needed EFIS to Garmin NAV communications is available through the Garmin P4001 GPS connection. (2) While not required these twisted pair cables are best installed shielded with "Only One End of the Cable Shield Grounded". When wiring up the ARINC connectors it is best to not unwind more than about 2 inches of the twisted pair from each end of the cable, this helps to minimize possible EMI on the data connection.

A) Odyssey/Voyager: GARMIN shows these twisted wire pairs as A and B while the Odyssey/Voyager ARINC connection shows RX1+ and RX1-. The GARMIN A connection corresponds to the Odyssey + connection, B to -.

The 3 (or 2) ARINC twisted pair wire data cables connect the iEFIS (iBOX DB25 female) & Odyssey/Voyager ARINC (DB-9 female) connectors to the Garmin P4001 GPS connectors (all G400W/500W units) and Garmin P4006 NAV connectors (G430W & G530W only).

Connect as follows;
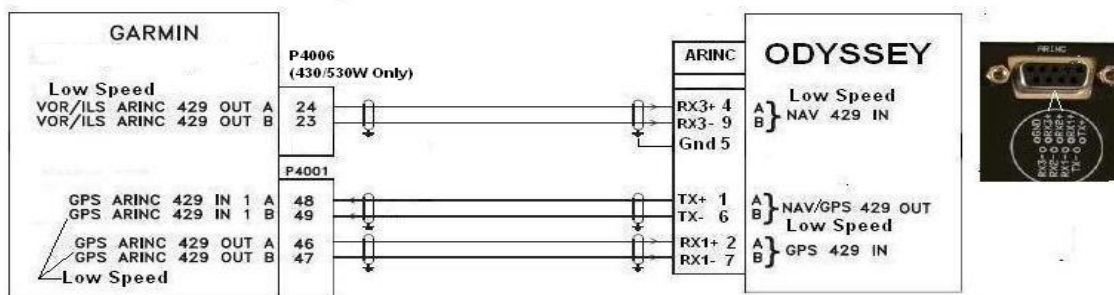
**ODYSSEY/VOYAGER to GNS-400/500W ARINC 429 Interconnect**

**GARMIN GPS P4001 (78 Pin Connector) to Odyssey ARINC DB-9 (all G400/500W)**

GPS ARINC Out A (Pin # 46) → Odyssey RX1+ (Pin #2)
GPS ARINC Out B (Pin # 47) → Odyssey RX1- (Pin #7)
GPS ARINC In (1) A (Pin # 48) → Odyssey TX1+ (Pin #1)
GPS ARINC In (1) B (Pin # 49) → Odyssey TX1- (Pin #6)

**GARMIN NAV P4006 (44 Pin Connector) to Odyssey ARINC DB-9 (G430/530W)**

VOR/ILS ARINC Out A (Pin # 24) → Odyssey RX3+ (Pin #4)
VOR/ILS ARINC Out B (Pin # 23) → Odyssey RX3- (DB #9)

**GNS-400/500W to ODYSSEY/VOYAGER ARINC wiring diagram**

B) iEFIS (Discovery-Explorer-Challenger); Connect your iBox ARINC receive connections 1 & 3 and single ARINC TX connection as shown below to your Garmin GNS 400/500 series avionics. Note early iBox software had the ARINC Receive (A/B) connections backwards, this issue has been corrected and should be wired as shown below.

**iEFIS (iBOX) to GNS-400/500W ARINC 429 Interconnect**

**GARMIN GPS P4001 (all G400/500W - 78 Pin Connector) to iEFIS → iBOX ARINC (DB-25)**

GPS ARINC Out A (Pin # 46)  →  Pin#4, (iBOX – 1A)  (iBox Pin# 4 is now correct)
GPS ARINC Out B (Pin # 47)  →  Pin#3, (iBOX – 1B)  (iBox Pin# 3 is now correct)
GPS ARINC In (1) A (Pin # 48)  →  Pin#1, (iBOX – TA) (Correct on iBOX)
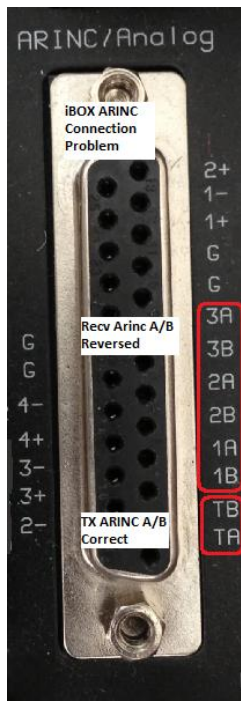GPS ARINC In (1) B (Pin # 49)  →  Pin#2, (iBOX – TB)  (Correct on iBOX)

**GARMIN NAV P4006 (G430/530W - 44 Pin Connector) to iEFIS → iBOX ARINC (DB-25)**

VOR/ILS ARINC Out A (Pin # 24)  →  Pin#8, (iBOX - 3A) (iBox Pin# 8 is now correct)
VOR/ILS ARINC Out B (Pin # 23)  →  Pin#7, (iBOX - 3B) (iBox Pin# 7 is now correct)

**iBOX to GNSZ00/500W ARINC wiring diagram**
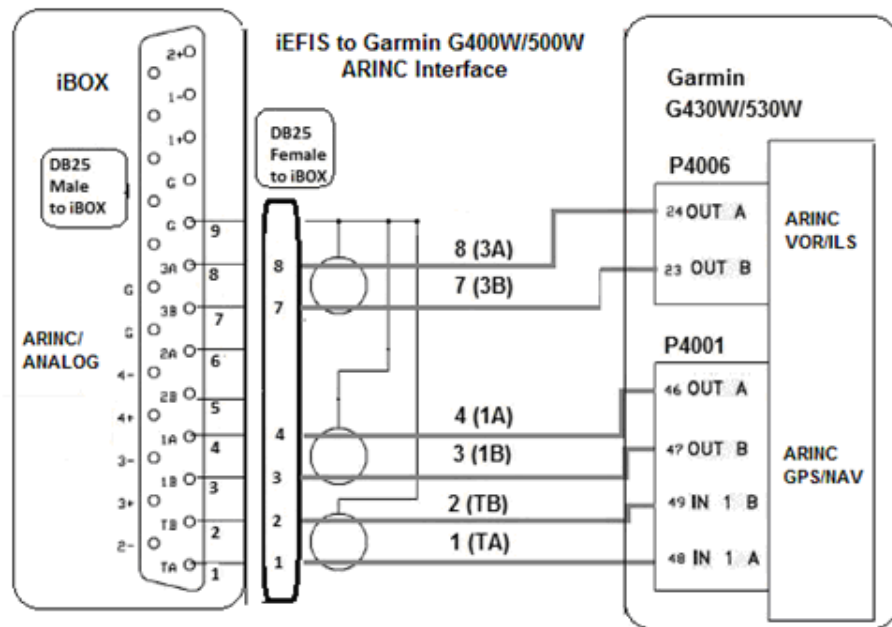
### Garmin 400/500W ARINC Configuration Details

- Tobegin G400/500W configuration enter Maintenance Mode by pressing and holding the ENTER key during POWER ON sequence, then go to;.
- "MAIN ARINC 429 CONFIG " Menu
    - In 1 → LOW  EFIS/AIRDATA
    - In 2 → Low   Off
    - Out → Low   GAMA 429 (or ARINC 429 Graphics)
    - SDI → Common (SDI = 0)

VNAV → Enable Labels  (Allows GPS Vertical NAV

- "MAIN  CDI/OBS CONFIG"
    - CDI → GPS Only
    - OBI Source → ALWAYS GPS
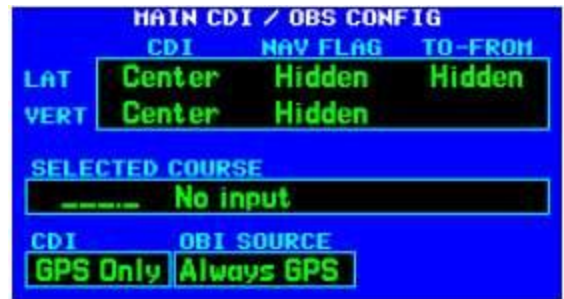
- "VOR / LOC / GS ARINC 429 Config" menu
    - SPEED → RX: LOW   TX: LOW
    - SDI → Common (SDI = 0)
    - DME: → N/A

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**D. Odyssey/Voyager ARINC Configuration and Setup Details**

1. To configure the Odyssey/Voyager unit first turn the Odyssey/Voyager on and put it into normal operations. Text description below is duplicated in the screen shot diagrams that follow the text. Press Menu twice to select "**Main menu level 2**";

In Main menu level "2", Select Down Arrow (Page 2) "then button 1" **System setup menu**"

A. On Pg 2, as an option select "**Setup Navigation**" → then select recommended mode of **Draw airspace over raster map**, then on Page2 you have the Option of (Button 3) for GPS-HSI to always point at the next waypoint, or GPS-HSI to be Locked to the GPS-OBS . Press **Menu** once to back out to System setup menu

B. Select "**Setup GPS & NEMA port ops**", here is the option to use the "**Use Internal GPS**" from the Odyssey/Voyager GPS, or "**Use external GPS on ARINC channel 1**" (G400 GPS via ARINC). *For best Odyssey/Voyager Autopilot operation it is __recommended to use the Internal GPS__*, for simulator setup select External GPS on ARINC Channel 1". This selection does not affect FAA requirements for use of the G400 for IFR flight as the G400 still uses its Internal GPS to provide all courses and approach guidance. Press **Menu** once to back out to System setup menu

C. Select "ARINC setup" → press button 1 until it says "ARINC RX 1 and RX 3 are composite device". This is required for G430/530 ARINC integration using 2 Odyssey RX channels (1 & 3) as shown in the included wiring diagram. For G400/500W with No VLOC receiver then set up accordingly for Odyssey RX channel (RX 1). → press buttons 2 to select "ARINC GPS nav uses ARINC HSI" and button 3 to select "ARINC GPS nav uses ARINC VDI", This sets the ARINC Data input for the EFIS HSI (Lateral) & VDI (Vertical) Needles. If these buttons are not set correctly then you will not get any GARMIN ARINC data to drive your route the or Lateral and Vertical Approach Needles. Settings 4 & 6 should be set automatically. Setting 7 is optional depending on what type of autopilot you have and how you want the G400/500W to drive it. Since the Odyssey/Voyager can now process the G400/500 ARINC Label-121 roll steering message to drive the Lateral guidance for the internal autopilot it is recommended setting 7 "ARINC lateral steering passthrough" be checked (Red Check).

D. Press Menu once to return to System setup then press "ARINC label TX setup". Make sure Labels 100, 320, 212, 204, 203, 210, 211, and 312 are all selected. Press Menu to back out to normal EFIS screen.

E. Press Menu once to return "Main menu level 1", then select function button "**F1**" (NAV) → Button "6", until it reads "Using external NAV source" (Garmin must be running with a route enabled). This concludes ARINC setup for the Odyssey. Press Menu once to back out to normal EFIS screen.
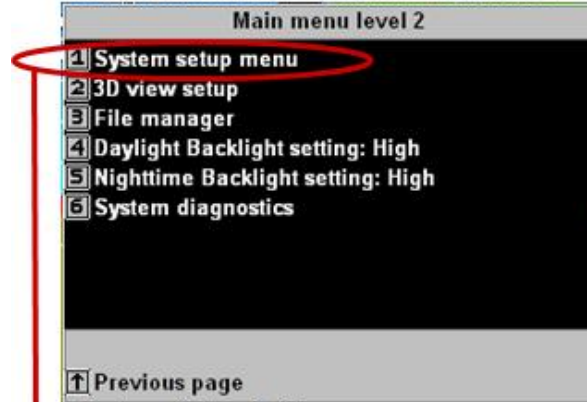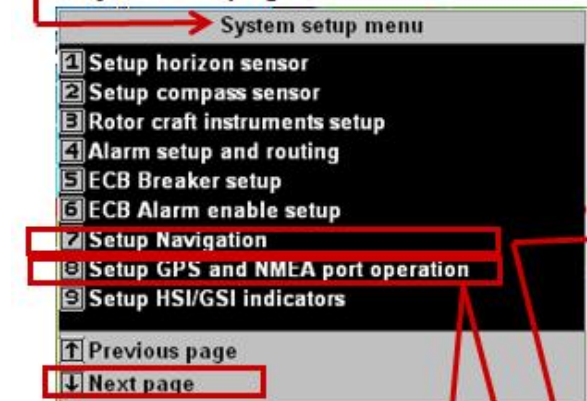
**To Begin  - Odyssey/Voyager ARINC Setup - Main Menu level 2 → System Setup**

Press Menu Twice → Main menu level 2

**Main menu level 2**
1 System setup menu
2 3D view setup
3 File manager
4 Daylight Backlight setting: High
5 Nighttime Backlight setting: High
6 System diagnostics

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System Setup Pg 2

**System setup menu**
1 Setup horizon sensor
2 Setup compass sensor
3 Rotor craft instruments setup
4 Alarm setup and routing
5 ECB Breaker setup
6 ECB Alarm enable setup
7 Setup Navigation
8 Setup GPS and NMEA port operation
9 Setup HSI/GSI indicators

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Navigation Menu recommended settings.

**Navigation setup menu**
1 Current primary Navidata Region: A
2 Current secondary Navidata Region: A
3 Current Vector map (VMAP) Region: A
4 Waypoint intercept: 1.7 Nautical miles
5 Automatic route advance
6 Geographic position units: DDD,mm,dd
7 Draw airspaces over raster map
8 Airspace alerts enable
9 Notify leaving airspace

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**Navigation setup menu**
1 Airspace look ahead is disabled
2 Airspace look ahead distance 60nM
3 Enable audio airspace alert
4 0 key shows nearest airports
5 GPS HSI points to waypoint
6 HSI heading source is GPS if available

Button 6 recommended HSI setting for Flight.

Button 5 has no affect.

Button 1 GPS setting for flight (MGL Autopilot)

**GPS operation setup menu**
1 Use internal GPS
2 GPS sensitivity: Normal
3 GPS WAAS/EGNOS/MSAS enabled
4 Enable NMEA autopilot messages
5 Enable NMEA VNAV (PGRMH message)
6 Enable Ikarus altitude on NMEA port

1 Use external GPS on ARINC channel 1
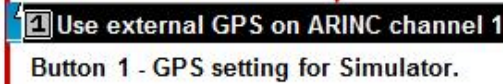
Button 1 - GPS setting for Simulator.
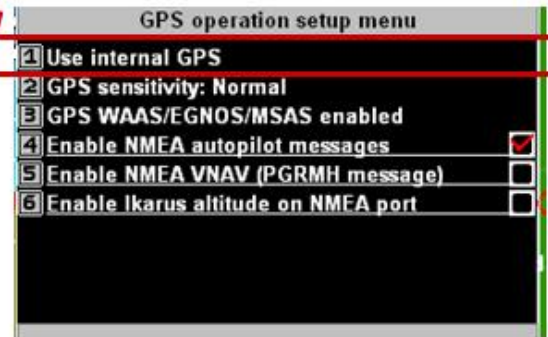
**System Setup Pg 4**

**Continued – EFIS ARINC Setup - Main menu level 2 → System Setup Pg-4**

### Main Menu 2 - System Setup - Pg 4

**System setup menu**
1. Radio stack setup
2. ARINC setup
3. ARINC label TX setup
4. Flap indicator and control setup
5. Pitch trim indicator and control setup
6. Roll trim indicator and control setup
7. Select a built in default system
8. System initialization

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**ARINC setup menu**
1. ARINC RX 1 and RX 3 are composite device
2. ARINC GPS nav uses ARINC CDI
3. ARINC GPS nav uses ARINC VDI
4. ARINC1: Labels 100 and 34 set Mode
5. ARINC2: Accept any nav
6. ARINC3: Labels 100 and 34 set Mode
7. ARINC lateral steering passthrough ☑

Garmin ARINC Label 121 Roll Steering Autopilot Mssg

Set Buttons 1, 2, & 3 (& 7) on this menu. Press button 1 several times until text as shown appears for G430/530W. Use buttons 2 & 3 to select ARINC Data input for HSI (Lateral) & VDI (Vertical) Needles. Settings 4 & 6 should be set automatically.
Button 7 provides ARINC roll-steering autopilot data for Lateral Navigation.

ARINC label TX setup (select all)
**ARINC label TX enables**
1. 100 Selected track (OBS) ☑
2. 320 Compass heading (M) ☑
3. 212 Vertical rate ☑
4. 204 Altitude (Baro corrected) ☑
5. 203 Altitude (1013.25mB) ☑
6. 210 True airspeed ☑
7. 211 OAT ☑
8. 312 Ground speed ☑

**Main Menu 2 Pg 2, ARINC Diagnostics Option**
Lets you know that G400 and EFIS are receiving and Transmitting ARINC Labels (Messages).

**Main menu level 2**
1. System setup menu
2. 3D view setup
3. File manager
4. Daylight Backlight setting: High
5. Nighttime Backlight setting: High
6. System diagnostics

**Diagnostics menu**
1. General diagnostics 1
2. General diagnostics 2
3. Master/slave debug
4. Wind speed/direction calculation diagnostics
5. ARINC 429 bus analyser
6. ARINC 429 activity
7. Traffic file viewer
8. Start ARINC label recording

### ARINC 429 EFIS Bus Analyzer

| Filters | Label | sdi | ssm | data | sys time | |
|---------|-------|-----|-----|----------|------------|---|
| 1 Off | 174 | 00 | 00 | 00000000 | 0:11:05.85 | 3 |
| 2 Off | 173 | 00 | 01 | 00010000 | 0:11:05.85 | 3 |
| 3 Off | 303 | 11 | 11 | 00000665 | 0:11:05.85 | 1 |
| 4 Off | 304 | 11 | 11 | 00057B54 | 0:11:05.85 | 1 |
| Inputs | 305 | 00 | 11 | 00020408 | 0:11:05.85 | 1 |
| 5 1 on | 306 | 11 | 11 | 0000ADD4 | 0:11:05.85 | 1 |
| 6 2 on | 307 | 10 | 11 | 00062001 | 0:11:05.85 | 1 |
| 7 3 on | 113 | 01 | 11 | 00066BE7 | 0:11:05.85 | 1 |
| | 116 | 00 | 01 | 00000000 | 0:11:05.85 | 1 |
| | 117 | 00 | 01 | 00000000 | 0:11:05.85 | 1 |

ARINC Bus Analyzer, you should see continuous activity. You can select 1 to 3 message labels to monitor, or all, and can look at 1 or 3 EFIS ARINC Recv channels from G400 (2 not used for G400).

Start/Stop ARINC 429 Data Recordings. Data is stored to SD Card with same name, so must use multiple SD cards for multiple recordings. Replay on SIM.

→**After EFIS & Garmin have booted up & BIT check is complete Select & Load Garmin FPL (FlighPlan/Route)**
→ **Select "F1"-NAV Function key, & Select** → **"Using external NAV source", EFIS will then use Garmin Route**
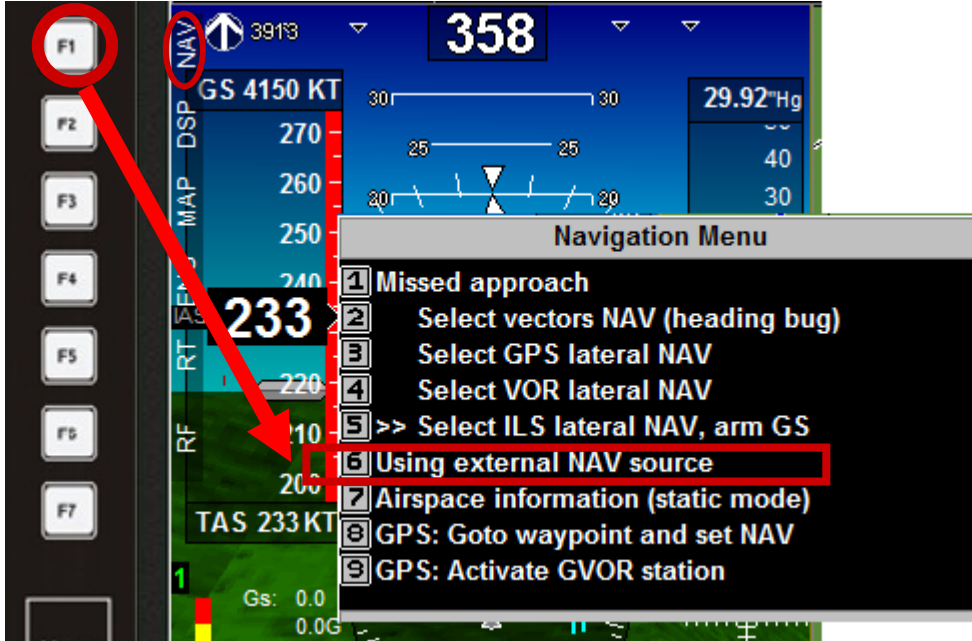


To view Garmin ARINC route (after Garmin route has been activated and external NAV source has been selected, follow directions below.

**E. iEFIS ARINC Configuration and Setup Details**

1. To configure the iEFIS units first turn the iEFIS on and put it into normal operations. Text description below is duplicated in the screen shot diagrams that follows the text.
   A. Press MENU – **System setup menu** → Dwn-Arw → **Setup Navigation** → Dwn-Arw → **HSI heading source is GPS if available** : **GPS Gnd Track for heading** (needed for Simulator ARINC Playback - Recommend for A/C)
   B. Press MENU – **System setup menu** → Dwn-Arw → **Setup GPS/NEMA Port ops** → **External ARINC GPS** (for Simulator Only) or **Internal GPS Only** (recommended for A/C) (EFIS using internal GPS for present position does not affect IFR certified output of G400/500W, it computes its approach guidance based on its own internal GPS WAAS Navigation solution)
   C. Press MENU – **System setup menu** → Dwn-Arw X2 → **ARINC Setup** → **ARINC RX1 & RX3 are Garmin G400/500**
   D. Select iEFIS "NAV" Function Button → **Using external NAV source**
   E. To check Active ARINC Route Select iEFIS "ROUTE" → **LIVE Flightplan**
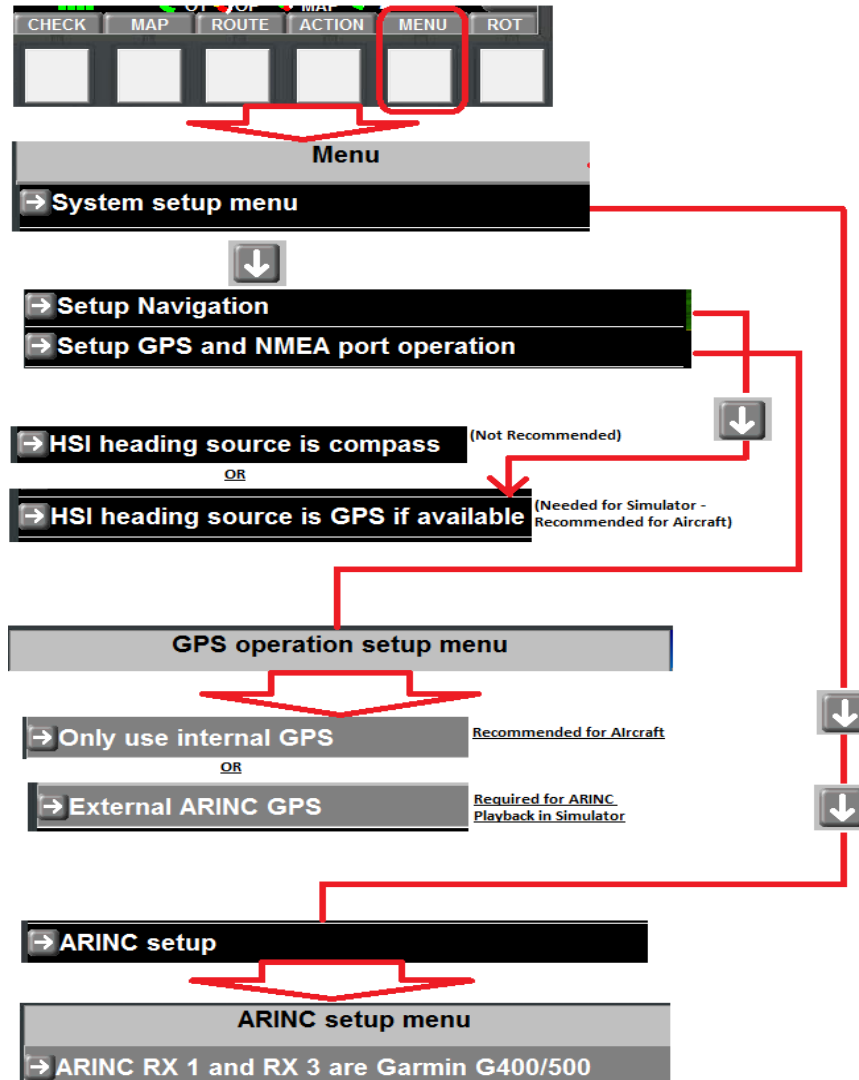
**F. Switching between ARINC or EFIS NAV, & between ARINC Route & Heading Bug**
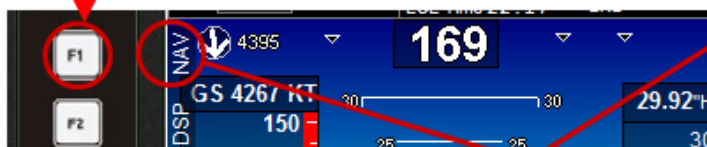
1.  Once the EFIS has been configured for Integrated ARINC operation you have the option of switching between G400/500 (ARINC) or internal EFIS commanded routes and HSI/Glideslope approach guidance via onscreen menus, and between ARINC directed Autopilot operation or Pilot selected vectors NAV (Heading Bug). These selections can be made or changed at any time, but to keep cockpit operation simpler once a NAV source has been selected (External or Internal) its recommended to stay with this selection. This integration guide assumes the pilot is using the Garmin for his route and approach operations, and the decisions will be to use vectors (manual Heading Bug) or ARINC route/approach guidance and whether the autopilot is engaged or not. But the internal EFIS GPS route option remains available for secondary or emergency purposes.

    D.  **IMPORTANT:** To use Garmin for ARINC Route input select EFIS Route Menu. ("Shift" → 4 "Route" or Function 1-NAV, then select "Using external NAV source.

    E.  **Normal Flt operations:** Graphic shows option for Autopilot operation between HBUG (vectors) or G430W ARINC Route.



For Autopilot operation select between Heading Bug or ARINC. The EFIS will automatically select the correct Garmin ARINC HSI selection (GPS/ARNAV, ILS, VOR)

Bring up NAV Menu with NAV Function Key (or Keypad) then select mode or ACK to Exit Menu.

HSI display with vectors – Heading Bug Selected!
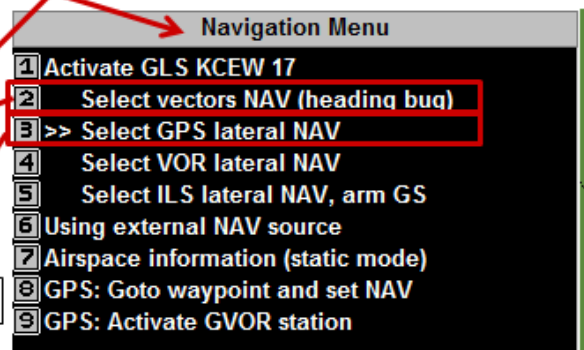
HSI display with ARINC (GPS) Selected!

**Navigation Menu**
1. Activate GLS KCEW 17
2.    Select vectors NAV (heading bug)
3. >> Select GPS lateral NAV
4.    Select VOR lateral NAV
5.    Select ILS lateral NAV, arm GS
6. Using external NAV source
7. Airspace information (static mode)
8. GPS: Goto waypoint and set NAV
9. GPS: Activate GVOR station

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**G. Garmin 400/500W ARINC EFIS Logic with iEFIS or Odyssey/Voyager**

1. GARMIN 430/530WAAS navigation and instrument approach operations center around three functions, first is finding and tracking enough GPS (& WAAS) satellites to provide a precise 3-D navigation fix for WAAS navigation calculations and if selected an acceptable VOR/ILS signal for conventional radio navigation, second is selecting and entering a route, either a user created/stored route, or an Instrument Procedure (arrival or departure) also represented in the EFIS unit as a route, and the third operation is the navigation or use of GPS position to navigate the selected route. This guide assumes the pilot is familiar with how the Garmin 400/500W works to include loading and selecting waypoints, routes, and approach/departure procedures. Once a route or procedure has been loaded and activated the pilot two primary controls on the GARMIN 430/530W to control which navigation data is transmitted to the EFIS, first is the Garmin **CDI** Key, and second is the NAV – VLOC Frequency selector button.

2. When the EFIS is in ARINC NAV mode the GARMIN produced route becomes the active EFIS Flightplan route (assumes "**External NAV source**" has been selected, see section E). All changes to the active GARMIN route including selection and activation of an IFR approach will be automatically processed and displayed on the EFIS display. The ARINC route will also be stored and can be displayed. On the iEFIS Select ROUTE → Live Flightplan, on Odyssey/Voyager select "Shift" → "(4)-Route" →"(1) Live Flightplan",

3. Live Flightplan will show each route waypoint, Course (True&Mag), leg fuel, plus ETE and ETA. This GARMIN provided route is called "ARINC route". But unlike EFIS routes ARINC routes "Cannot" be changed or saved by the EFIS. All route changes in ARINC mode must be performed on the Garmin.



| Live Flight AOA: ARINC route | |
|---|---|
| 6.6nm to FLD2 / ARINC waypoint FLD2 BRG: 034°T, 035°M | Cannot calculate ETE/ETA |
| 12.5nm to KCEW / ARINC waypoint KCEW CRS: 340°T, 341°M | Cannot calculate ETE/ETA |
| 15.8nm to 0J4 / ARINC waypoint 0J4 CRS: 000°T, 001°M | Cannot calculate ETE/ETA |
| End of route | |

   A. If "**External NAV source**" has been selected for the Navigation input then current Garmin position, ground track, ground speed, etc. will be provided through the ARINC input to the EFIS, but the recommended setup is to use the EFIS Internal GPS for improved Autopilot operation.

4. During IFR flight it is important to keep Pilot switch actions to a minimum; this reduces the opportunities for switch confusion when using complicated electronic displays and to optimize Pilot-Vehicle Interaction. A primary goal for G400/500W MGL EFIS Integration is to keep switchology as simple as possible. With this in mind the pilot selects the navigation or approach information source by using the Garmin G430/530W **CDI** Key, this single switch action also directs the EFIS as to which of the ARINC approach modes (GPS or VLOC) has been selected on the Garmin and should then be displayed on the EFIS HSI and Glide Slope. Once an approach mode is selected no data HSI/VSI course data will be displayed on the EFIS unless actual ARINC Navigation data is being received from the Garmin. EFIS NAV/Approach examples are shown next;

**iEFIS_G430/530W ARINC NAV/Apch Data Examples** (Default Screens)

If G430W Receives No VOR/Loc/Glide Slope Signal or No GPS Apch Guidance is created then EFIS will present No ARINC Data (In Fact the HSI/VDI will not appear if no ARINC is being Sent)          ARINC NAV Source

**VOR=Green**

VOR Station: A=VOR Station Location relative to Nose of Aircraft (not affected by OBS)
OBS: Rotates Green VOR HSI, One Green Course Error Line

**ILS/GPS/AF NAV = Blue Needles**

GPS/ILS Course: Double Blue Error Course Line on HSI, Adjust OBS for Final Appch Course. ILS shows Standard Glide Slope Symbology, GPS shows MGL Alternative in most Default Screens (Fly Plane to Course, reverse from Traditional Needles), can be changed in Screen Designer.

5. EFIS NAV/Approach examples are shown above;
    A. If the VLOC mode is selected on the Garmin CDI Key then the EFIS looks to see if the VLOC frequency is either a VOR or ILS frequency and if there is ARINC data.
    B. If **External NAV source** (ARINC) data is selected and being received, and the Garmin CDI Key is set to GPS, but No GARMIN route has been selected on the Garmin (FPL is blank), then the text **NO CDI** will appear in the middle of the EFIS display, or depending on screen design, the HSI will not be displayed at all and No Route will be displayed on the EFIS Map. If the Garmin **CDI** Key is set to **VLOC**, but there is still No active ARINC route from the Garmin (FPL remains blank), and NO ARINC VOR or ILS data (signal) being received, then the text **NO CDI** will appear or No HSI display will be present. With the Garmin **CDI** Key set to **VLOC**, but No VOR, or ILS signal is being received the EFIS will still receive and display Garmin route waypoints, but will show No HSI Course information because the course information is expected to come from a valid VOR or ILS signal. Changing the **CDI** Key back to GPS would then show the HSI GPS route or approach course again.
    C. MGL screen designs will determine exactly what information will/or will not appear during Garmin operation. But with most EFIS default Screen Designs the basic VOR, ILS, or GPS Needle indications should not be present if the Garmin is not receiving a valid signal or computing a GPS route or approach. If good

ARINC VOR information is being received, then a VOR radial pointer will appear and point toward the VOR station, and (depending on screen design) VOR Radial Text would show the Current VOR radial. The EFIS VOR-OBS knob and TO/FROM text will be active (TO/FROM will depend on the OBS selected course and screen design).

D. If GARMIN CDI Key is VLOC and an ILS NAV frequency is selected, but **No ARINC ILS** data is being received then the EFIS will show the text NO CDI or No HSI will be displayed. If **good ARINC Localizer** information is being received then the HSI will show only a Blue Course Indicator and course needle over the attitude indicator, if both Good ARINC Localizer and Glideslope data is being received then the EFIS will indicate both Lateral and Glideslope information as seen above. The EFIS ILS OBS course selector knob will be active, and should be set to the active ILS course. The GARMIN should remind you as to Final Approach Course via its DTK turn point text just before FAF arrival, and the MSG indicator may Flash if the EFIS OBS is not set to the correct course.

E. If GARMIN CDI Key is set to GPS, and a normal Garmin "Route" is active (Garmin shows ENR or TERM in lower Left of screen above GPS/VLOC text), then the HSI will show a Pink Course Line, there will be No large Blue Lateral Steering Needle over the Attitude indicator, and (depending on Screen design) there will be alternating Text showing GPS/ENR or GPS/TRM next to the HSI display window, On the **iEFIS** & **Odyssey/Voyager** the HSI will auto rotate toward the current magnetic course and the Lateral Course will indicate if aircraft is left or right of the course (OBS does not rotate the HSI in this GPS route mode). In ARINC operations the HSI is controlled entirely by the Garmin ARINC data so no HSI scale is shown. If you select the Garmin Default NAV window it will show you the current HSI cross track scale. Normally it will be a 2.0 NM HSI scale (ENR) or 1.0 NM (TERM), but NAV Default page will always give you the correct scale. This course scale will change automatically during approaches for both the EFIS and the G430 NAV Window. Since no Glideslope is associated with routes no "GS" flag should be seen on the VDI during Enroute Navigation. The VDI will become "Active" when the Garmin receives a valid glideslope signal, or a GPS approach with Vertical Guidance (VNAV) has been initiated. If Flight Plan Parallel course is selected (in Garmin FPL Menu) then the Garmin will send parallel course route information to the EFIS (Right or Left), the EFIS will show this parallel route as the same active route as seen on the Garmin (the original route can only be seen on the Garmin). Garmin Parallel route is designed to keep multiple airplanes with precision Enroute navigation flying the exact same route (same 10 foot cube).

F. If GARMIN **CDI** Key is set to GPS, and a Garmin Instrument Approach is selected and activated this route will be sent and displayed automatically on the EFIS as the active route. If the Approach includes any holding patterns they will

be displayed only on the Garmin screen. Due to MGL ARINC SW processing development priories only straight route segments are currently displayed on the EFIS. All Garmin Instrument approaches whether GPS, VOR, or ILS will be downloaded and displayed on the EFIS Moving Map as a normal EFIS route. Specific approach unique route protocols have not been implemented yet, an example is that during all approaches the Garmin identifies the runway touchdown point as waypoint "RWxx" (RW17). The EFIS treats this waypoint as a routine waypoint, and will give an arriving Waypoint alert at whatever distance has been set for normal waypoints (like 1.7 NM).

G. The EFIS 2-way ARINC interface with the GARMIN also provides the G400/500W with critical EFIS generated flight data. The EFIS OBS course is provided back to the GARMIN during ILS and VOR modes, and must be set correctly by the pilot for the VLOC approach course being flown during ILS and VOR flight modes. The EFIS also provides Pressure Altitude, Outside Air Temp, Magnetic Heading, and True Airspeed to the Garmin. When stationary on the ground, the EFIS Magnetic heading will correctly orient the Garmin moving map screen.

### H. Garmin 400/500W ARINC Turn On and BIT tests

At turn on the Garmin400/500W unit will automatically go into a BIT test routine. Goal of the BIT test is to establish 2-way ARINC communications and check system with the EFIS
.
GARMIN; "INSTRUMENT PANEL SELF-TEST" or BIT (BUILT IN TEST)



**Note:** OBS may appear as No Course on GARMIN OBS BIT window until EFIS OBS course is changed for the first time after Garmin boot up.

EFIS: During G430W BIT (Built In Test) EFIS HSI/GSI and GPS position data should indicate your present position, but will have the waypoint as Garmin and will compute a distance to the Garmin Headquarters in Kansas (USA) from your present location. ETA to GARMIN will be at a GS of 149K. HSI will show a Pink ½ Left Course Error and GSI will show a ½ Course Low Vertical error.
**NOTE:** If there is **NO ROUTE or HSI display** for the BIT then check function switch "NAV" → "**using External NAV source**", if not set correctly then set to "**external NAV**". When this happens you must also → Select GPS lateral NAV" even though it will likely



already show as being selected **select GPS lateral NAV "AGAIN".** → >> Select GPS lateral NAV
If BIT test is still not correct check the other EFIS and/or GARMIN interface settings. If there is no indication of ARINC communications between the two units then check the EFIS ARINC Bus Analyzer (shown below). If BIT test is successful then press the GARMIN "ENTER" key and resume normal operations.

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## I. EFIS and Garmin 400/500W normal operations via ARINC Communication

### 1. Cross Country Navigation using the Garmin 400/500W

Now for the fun stuff, using your EFIS as a smart display/interface with the GARMIN G400/500WAAS COMM and Global Navigation units.  Once the EFIS has been set up to operate correctly with the GARMIN the EFIS is used for flying, navigating, situation awareness, engine and fuel management, autopilot operations, and displaying approach information and the GARMEN G400/500W is used for communications, route and approach selection and management.  Since both the EFIS and Garmin have moving maps, and additional GPS based navigation data, either or both are available for pilot use, but IFR route and approach selection and guidance should only be performed using the GARMIN.  The GARMIN should also have a current IFR data base for the area being flown if it is to be used for actual IFR Enroute and Approach Navigation.  If you need IFR training approaches that are not available in the GARMIN/JEPPESEN data base the EFIS covers this capability in other parts of the instruction manual.

After the BIT test, the pilot should program, or select and load the GARMIN route from the GARMIN data base.  Details on GARMIN route creation, storage, and activation are covered in the GARMIN pilot's manual.  GARMIN operation is not changed when using the EFIS.  This can include SIDS (departure routes), ordinary cross country routes, STARS (Standard Terminal Arrival Routes), and approaches.  Using the FPL button and Cursor Knob on the GARMIN the pilot selects the route, and after pressing the "ENTER" button this route is transmitted to the EFIS for display and navigation.  Since the GARMIN is an FAA-IFR approved WAAS



GPS Enroute: When Garmin sequences to the a new waypoint  the momentary pop up alert "ARINC WP Active FLD2" appears.  As created  by the screen designer active ARINC Waypoint, ETA, and Distance shows in the Active waypoint window on the moving map.  The HSI shows aircraft right of course.  OBS can set a course but it does not affect HSI during G400/500 Enroute NAV.  Highway in The SKY follows G400 Course. Alt set by Alt Bug. All NAV routes and approaches are selected on the G400, then when entered or activated they will transfer over to EFIS.  Waypoint arrivals are Announced (display/audio) at defined distance.

navigation system, it may be used for any type of Enroute or Approach Navigation, at most any altitude, anywhere in the USA today, and in most other countries with appropriate data bases.



In the figure to the left a 4 waypoint route has been selected via the Garmin FPL (Flight Plan

page), entered in the GARMIN, and transmitted to the EFIS.  This figure shows the EFIS display with the pilot navigating toward the 2nd route waypoint (user waypoint FLD2).  The pilot has set the GARMIN navigation mode as GPS (selected by Garmin CDI Key) and is shown on the EFIS as a Pink HSI course on the HSI course display.  The OBS is set to the Track to Waypoint course of 172 DegsM, but in GPS mode the OBS is automatically slaved to the GPS Gnd Track so setting the OBS has no direct effect on navigation.  To the right side of the HSI are the alternating words **GPS & TRM** which indicates that the EFIS is displaying Garmin GPS



"Terminal" route information.  Further along the flight in the screen shot below the HSI indicator shows the aircraft to the right of the Garmin route 341 Deg course between FLD2 and KCEW, the Ground Track shows 321 Degs which indicates the aircraft is tracking toward the next waypoint (KCEW) but should intersect the 341 Deg course on this track prior to the waypoint. Below the Map Display at the right of the EFIS screen you can see the KCEW waypoint information, the Distance is 2.8 NM's, the airspeed and GS (Ground Speed) are not shown on this display, the ETE is 1:33 (min:secs) with the ETA to the final route waypoint (#4) as 22:17 (hrs:mins).  As mentioned above, this graphic is an example of what the pilot may have available if this or a similar screen design is used.  To check the route progress the pilot selects (on iEFIS) ROUTE → Live Flight Plan, or Odyssey "Shift" → "Route"  then presses button "1"→ "Live Flight Plan".  This brings up the "**Live Flightplan: ARINC route**" display screen that shows the remaining 2 waypoints.  Data displayed includes ETE, ETA, Course (True/MAG), and Fuel information along the route.  To return to normal screen display press "DONE" or the "ENTER" Key.

## 2. ILS Approach with GPS routing using the Garmin 400/500W

As the plane approaches the KCEW waypoint the pilot elects to shorten the flight and fly several approaches at the Crestview, FL (KCEW) airport.  Using the GARMIN FPL Key the pilot first Highlights the KCEW waypoint (with the GPS rotary knob), then selects Direct→ KCEW → ENTER on the Garmin.  This will change KCEW from the next waypoint to a destination.  The pilot then selects the Garmin PROC Key (Procedure) and scrolls through available KCEW approaches and selects the ILS 17 approach.  The pilot also uses the EFIS OBS to dials in the "171" Deg ILS final Approach course.  Once the Garmin ILS17 approach is "Activated" the approach routing (waypoints) are sent to the EFIS as a new route, and are immediately displayed on the EFIS map.  If the ILS approach waypoints are not in the EFIS Navigation data  there will only be a course line to an un-named point on the map but this will not impact the EFIS route display.  The new waypoint name will appear on the EFIS but the waypoint location can only be seen on the Garmin display.  In the example to the left the pilot has selected VLOC on the GARMIN "CDI" Key, and has switched the NAV receiver to the KCEW ILS localizer frequency, and finally with the Garmin receiving a good ILS signal it is being displayed (both Localizer and Glideslope) by the EFIS.  All of this can be confirmed by looking at the HSI display which shows a Blue Course line on the HSI display and the large Blue Localizer and Glideslope needles superimposed over the attitude display.  While a Garmin GPS/ARNAV overlay approach will always be displayed (assuming good GPS signal availability), ILS or VOR approach's requires good ARINC signal data.  Check section "F" for indications during loss of VOR or ILS signals.  Since both good ARINC HSI and VDI data is being received both the Localizer and Glideslope are displayed.  On the moving map displayed route you can see that the pilot has already passed the FAF of "GIYAT", and the aircraft is descending on the approach path to the airfield.

The HSI shows the aircraft on the Localizer course, and the Glidepath indicator (White Circle) shows the aircraft very slightly above the Glidepath.  The NAV Info window under the map display on the EFIS screen displays the next approach waypoint as RW17, and the DIST to the runway is 2.0 NM's.  All of this information comes from the GARMIN ILS-17 approach route data base.

In the attitude display is the Large Blue Localizer and Glide Path Needles, knowing exactly where the center of these needles are (On Course and Glidepath) can be a little difficult at times so its recommended to also add a small Square at the center as a Target for the Needles.  If the flight path marker, DTED, and airfield data are correct, the pilot should see the ILS Needles superimposed over the flight path marker and centered on the electronic touchdown point over the approach end of runway during a correct stabilized approach.

### 3. VOR Approach with GPS routing using the Garmin 400/500W

The pilot completes a touch and go from the ILS approach and elects to fly a 2nd KCEW approach, this time the VOR circling approach to runway 17. Selection of this approach is again similar to the previous approaches with the pilot first confirming the CDI Key is still set to VLOC then selecting and activating the VOR-A approach. The GARMIN locates and loads the CEW VOR 115.90 MHz frequency into the Garmin VLOC standby NAV frequency window, displays the VOR-A approach on the Garmin may display (as shown above) and sends the VOR ARINC approach route to the EFIS also for display. The pilot must then press the Garmin VLOC frequency Key which moves the CEW VOR frequency from the standby to the active NAV frequency. The pilot should then see the EFIS HSI display go active when the Garmin receives a valid VOR signal, the Green EFIS VOR station indicator should point toward the VOR station. The pilot should set the OBS indicator to the 106 Deg inbound VOR course and start the approach. This approach begins with the pilot flying to the VOR station and then either entering holding or after a procedure turn beginning the approach. On the EFIS you will see the Green VOR station indicator at station passage swing from in front of the aircraft to behind the aircraft, the Garmin will countdown the distance to the VOR station till it hits zero then the NOTME waypoint will appear on the EFIS as the next waypoint, and the waypoint distance will indicate this new waypoint. As mentioned before the holding pattern will only appear on the Garmin, but not the EFIS. The EFIS display above shows both the CEW to Crestview GPS approach route (Red dashed line) and the VOR 106 Mag course (Yellow solid line) as well as the Green VOR Station locator (behind aircraft). At the end of this approach the pilot confirms he has Visual contact with the runway environment and circles to the runway.

### 4. GPS/ARNAV approach using the Garmin 400/500W

The pilot completes a touch and go from the VOR approach and elects to fly a 3rd KCEW approach, this time the GPS ARNAV approach. Selection of this approach is nearly the same as the VOR approach except the pilot switches from VLOC to GPS using the Garmin CDI Key, then selects and activates the GPS ARNAV 17 approach. The GARMIN sends the approach route (waypoints) to the EFIS and the pilot gets an alert message on the EFIS announcing a new "ARINC WP Active: GIYAT". The Pilot then fly's the ARNAV 17 Approach similar to the ILS 17 approach. If the pilot selects Vectors there will be a course displayed on the EFIS to the FAF (GIYAT) but the routing wil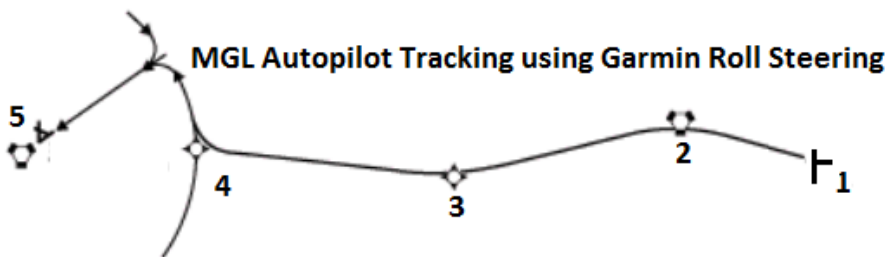l likely be by ATC vectors before flying toward GIYAT. An additional option is to select and fly to the IAF to initiate the approach, for this approach WEDOM would appear as the next waypoint on the EFIS route and from the KCEW airport the Garmin would provide a procedure turn available only on the Garmin display north of the WEDOM IAF to reverse direction back toward the GIYAT FAF and place you on the GPS 17 approach. At the end of this approach the pilot makes a full stop landing.

### J. EFIS Autopilot Operations using and Garmin Roll Steering (Internal/External A/P):

#### 1. EFIS Autopilot Operations:

The MGL autopilot can either track the HSI lateral steering needle or if selected in AP setup it can now follow the Garmin roll steering commands provided by the ARINC Label 121 message. Roll steering is more correctly called GPSS (GPS Steering). Using GPSS allows the Garmin 400/500 to drive the AP directly vs. driving the HSI which then drives the AP. In GPSS mode the Garmin directs the MGL AP through GPSS commands to stay on the Garmin programmed route or approach by anticipating waypoints (as shown in the graphic to the left) and will lead turn most waypoints with smooth turns to arrive back precisely on your next flight leg on course with a wind corrected heading. The big advantage is for flying complex flight plans including holding patterns and procedure turns (and likely perfectly), all using the Garmin (Jeppessen) data as depicted on the Garmin display. GPS/ARNAV approaches should be able to be flown "automatically" without having to touch vector (HBUG) mode or the stick (manual) mode. Using GPSS for AP steering you can potentially start the AP after takeoff and disconnect at landing. The pilot would select the Garmin 400/500 route and the Garmin would compute the flight plan and provide the
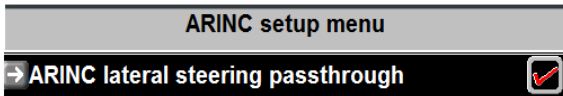
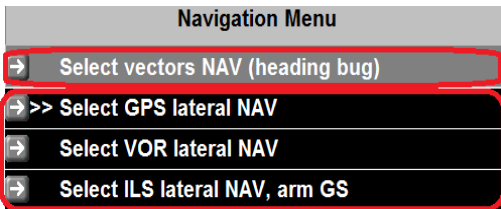**MGL Autopilot Tracking using Garmin Roll Steering**

GPSS AP commands with all heading changes to the MGL A/P for the entire flight. Using the HSI for tracking a NAV source (the previous way), the autopilot can act in less desirable and often unpredictable ways (you can be surprised, or as I have seen the AP can act up so badly it will disconnect itself) usually when flying over waypoints. GPSS works by providing the AP with the rate of turn that is required to make the desired turn.

2. **A/P Setup with Garmin G400/500**:

If the MGL (internal) A/P is used: With external ARINC navigation selected, the internal AP will use the Garmin supplied GPSS lateral steering label 121 as cue (regardless of state of the local HSI). Note: In ARINC setup you need to enable lateral steering passthrough or else this is disabled. If this label is not received valid, the AP will use the HSI. If the EFIS is setup for External A/P operation then also in ARINC setup you need to enable lateral steering passthrough or else the external A/P would use an EFIS internally generated GPSS label 121 steering cue which would not support any Garmin holding patterns or procedure turns (only what can be displayed on the EFIS moving map). In the NAV menu for A/P operations you have two choices the vectors (HBUG) mode directs the A/P to follow the pilot commanded yellow Heading Bug as entered via the "HEAD" rotary knob, or the Garmin Route input either with the just discussed GPSS commands or by the A/P following the HSI inputs also via the GARMIN ARINC labels.

## K.  Emergency Operations:

During Aircraft Emergencies its recommend to use the Garmin emergency Navigation functions as designed. All emergency airfields or routes selected on the Garmin will transfer and operate as normal waypoints on the EFIS. If the MGL EFIS internal GPS fails the Garmin GPS may be used for navigation after the EFIS GPS NAV Data Sources is switched back to the External GPS on ARINC channel 1. If No GPS is available (loss of adequate GPS satellite signals) the Garmin VOR receiver if still operating should still be able to send ARINC radial data to the EFIS HSI, and the ILS could support ILS approaches, but NO Garmin ARINC Approach routes would be available.

## L.  EFIS display options

The EFIS has an infinite number of EFIS display options since the pilot can create his own displays. For normal VFR flight this is not an issue, but for IFR flight the display screens do make a difference. It is critical that the IFR pilot acquire or create IFR display screens that display required data in easily usable formats. The optimum EFIS screen will display all the information a pilot needs to fly the airplane, monitor its critical engine and electrical systems, navigate, and fly an approach in a single display. Screen designs that separate critical information between multiple screens, or is confusing in any way, increase the possibility that information mis-understandings can distract a pilot during critical phases of IFR flight and compromise safety.

### M.  Summary:

Despite all the extensive documentation and detailed discussion in this guide, once set up correctly the MGL EFIS unit when connected via ARINC to the Garmin G4500/500W series avionics should be intuitive to operate and will leverages the power and flexibility of the MGL avionics to provide a new level of capability for the Experimental Aviator.  This is the third release of this manual and adds both the iEFIS display series along with the changes and increased functionality provided by several significant SW releases.  But as always Pilot in Command is still responsible for ensuring the ARINC integrated screen displays, EFIS modes, GARMIN approach and route types, and commands are adequate to before and flight and especially IFR flight is attempted.

## Appendix A: Troubleshooting Integration using the Simulator - ARINC Playback function.

If after a careful setup the system does not work as it should use the ARINC Data Recorder to record about 1 minute of G430W startup test Data. Then follow the ARINC Data playback instructions in Appendix B and compare your recorded data with what's shown below. Graphic below shows correct Sim BIT indication for ARINC playback.

The following text example is from an integration with a good VOR ARINC connection and a bad GPS connection; The SIM playback will show a "G" for Good data coming from the G430 into the EFIS. If you only see the G430W-VOR port OR ARINC out (P4006 #23 & #24) providing good data then the VOR connection is good. Note: (Labels 34 (VOR-Freq will show "G" during BIT but VOR labels 173, 174, 222 will show nothing during a BIT test, so if Label 34 is "G" then VOR is OK). But if the P4001 ARINC Out data is showing "F" (Failed) like Label 100 then this port is likely at the wrong Speed (High instead of Low) or Not configured for GAMA 429, or the A/B wires are reversed. Note: (label 117 may still show "G" with a P400a Port issue). So using the G400/500 recorded BIT data and the Simulator you should be able to do some good troubleshooting. If you have an issue start by double checking G430W Main ARINC Configuration Page, trouble shoot from there to the EFIS. For questions contact me.



**G430W Bit Check Data** — Playing ARINC.REC file — Playback position 9559 0000BAB3

| Label | Value | | Label | Value |
|---|---|---|---|---|
| 100 | G 6D4A0C40 1 808364 | | 326 | G E001D8D6 1 808364 |
| 34 | G 8564181C 3 808352 | | 327 | G 60C800D7 1 808364 |
| 173 | - 2000007B 3 808364 | | 74 | G 6000023C 1 808364 |
| 174 | - A000007C 3 808364 | | 75 | G E120023D 1 808346 |
| 222 | - BFC20092 3 808364 | | 113 | G 74D2EA4B 1 808364 |
| 116 | G 6000EC4E 1 808364 | | 261 | G 608000B1 1 808358 |
| 117 | G 7FF3804F 1 808364 | | 303 | G 600156C3 1 808364 |
| 310 | G 637901C8 1 808358 | | 304 | G E81020C4 1 808364 |
| 311 | G F7908DC9 1 808358 | | 305 | G 681020C5 1 808364 |
| 306 | G E37B3AC6 1 808364 | | | |
| 307 | G F79046C7 1 808364 | | | |
| 312 | G E09600CA 1 808364 | | | |
| 313 | G 6C0000CB 1 808364 | | | |

'-' No computed data
'T' - Functional test
'F' - Failure warning
'G' - Normal operation

| Label # | Parameter Name |
|---|---|
| 034G | VOR/ILS Frequency (BCD) |
| 035G | DME Frequency (BCD) |
| 100G | Selected Course #1 |
| 173 | Localizer Deviation |
| 174 | Glideslope Deviation |
| 222 | VOR Omnibearing |
| 371G | Specific Equipment ID |
| 377 | Equipment Hex ID Code |

1. ARINC 429
2. GAMA 429
3. GAMA 429 Graphics
4. GAMA 429 Graphics w/In.
5. GAMA 429 Pro Line 21
6. GAMA 429 Sextant

| Label # | Parameter Name | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| 001 | Distance to Go (BCD) | • | • | • | • | • | • |
| 002 | Time to Go (BCD) | • | • | • | • | • | • |
| 012 | Ground Speed (BCD) | • | • | • | • | • | • |
| 074G | Data Record Header | | • | • | • | • | • |
| 075G | Active Wpt From/To Data | | • | • | • | • | • |
| 100 | Selected Course 1 | • | | | | | |
| 100G | Selected Course 1 | | • | • | • | • | • |
| 113G | Message Checksum | | • | • | • | • | • |
| 114 | Desired Track (True) | • | • | • | • | • | • |
| 115 | Waypoint Bearing (True) | • | • | • | • | • | • |
| 116 | Cross Track Distance | • | | | | | |
| 116G | Cross Track Distance | | • | • | • | • | • |
| 117G [1] | Vertical Deviation | | • | • | • | • | • |
| 121 | Horizontal Command (to Autopilot) | • | • | • | • | • | • |
| 125 | Greenwich Mean Time (BCD) | • | • | • | • | • | • |
| 147G | Magnetic Variation | | • | • | • | • | • |
| 251 | Distance to Go | • | | | | | |
| 251G | Distance to Go | | • | • | • | • | • |
| 252 | Time to Go | • | • | • | • | • | • |
| 260G | Date (BCD) | | • | • | • | • | • |
| 261G | GPS Discrete Word 1 | | • | • | • | • | • |
| 275G | LRN Status Word | | • | • | • | • | • |
| 300G | Station Declination, Type, and Class | | • | • | • | • | • |
| 303 | Message Length/Type/Number | | • | • | • | • | • |
| 304G | Message Characters 1-3 | | • | • | • | • | • |
| 305G | Message Characters 4-6 | | • | • | • | • | • |
| 306G | NAV/Waypoint/Airport Latitude | | • | • | • | • | • |
| 307G | NAV/Waypoint/Airport Longitude | | • | • | • | • | • |
| 310 | Present Position Latitude | • | • | • | • | • | • |
| 311 | Present Position Longitude | • | • | • | • | • | • |
| 312 | Ground Speed | • | • | • | • | • | • |
| 313 | Track Angle (True) | • | • | • | • | • | • |
| 314 | True Heading | • | • | • | • | • | • |
| 315 | Wind Speed | • | • | • | • | • | • |
| 316 | Wind Angle (True) | • | • | • | • | • | • |
| 320 | Magnetic Heading | • | • | • | • | • | • |
| 321 | Drift Angle | • | • | • | • | • | • |
| 326G | Lateral Scale Factor | | • | • | • | • | • |
| 327G [1] | Vertical Scale Factor | | • | • | • | • | • |

**Appendix B: Instructions for Recorded MGL Forum ARINC flights & Data**

1. Download and Install current iEFIS or Odyssey/Voyager G2 Simulator
2. Create ARINC File in the iEFIS File Manager under Explorer SIM
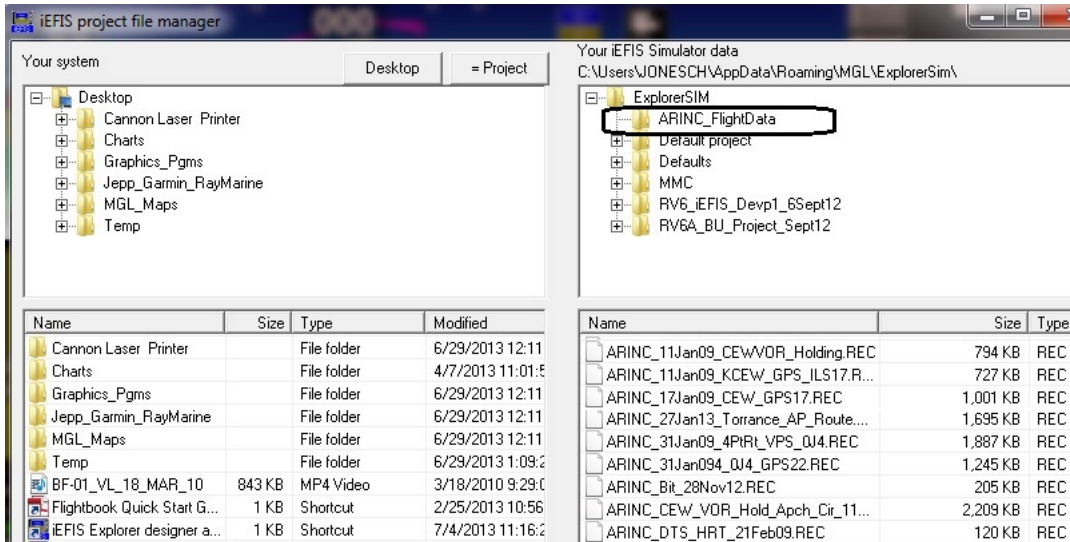


3. Follow guide below and find Arinc_G430_Recorded Files (To download Recorded ARINC data files from MGL Forum you must be Logged In). Copy the Recorded ARINC Flight Data Files into the → "ARINC_FlightData" folder you created (above) in the Simulator.
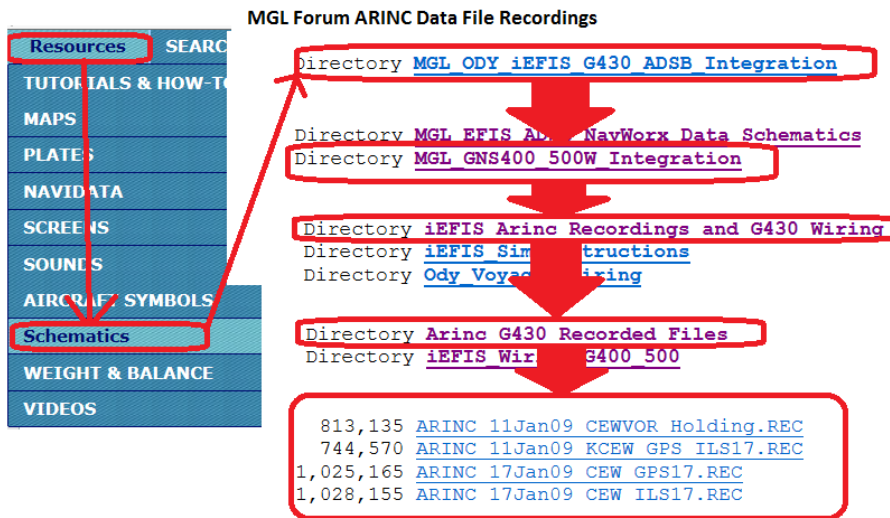


4. Close the Simulator File Manager

5. Select Sensor Simulation Menu
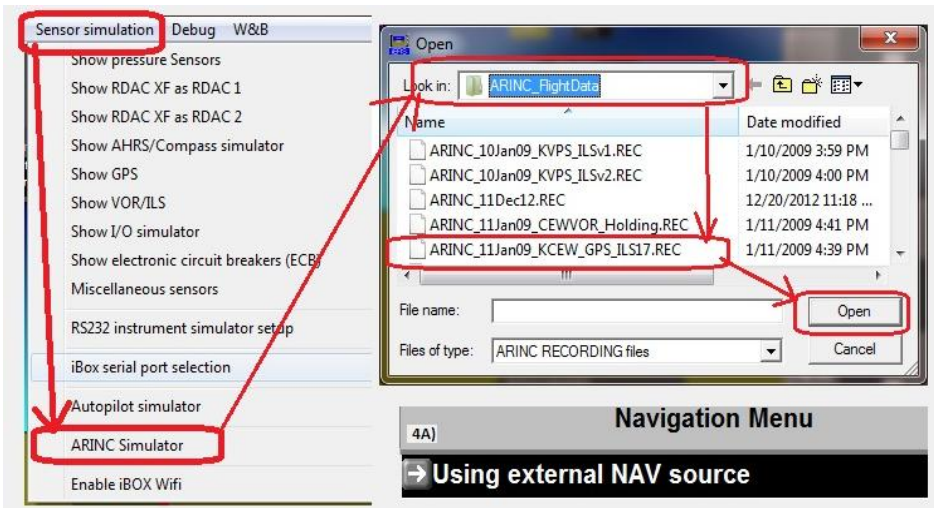


6. Select ARINC Simulation
7. Then Look In (Select) your ARINC Flight Data Folder
8. Select a ARINC File you want to replay (its really not a simulation, its a actual recorded ARINC Flight Data File Replay)

9. Select Open --> This actually starts the Data File Replay

10. Most all these flights are around FtWalton Beach and Crestview FL, 1 file from Oshkosh, several files from Torrance CA (USA MGL Office location), and the G430 BIT files are near the Garmin Headquaters in Olathe KA.
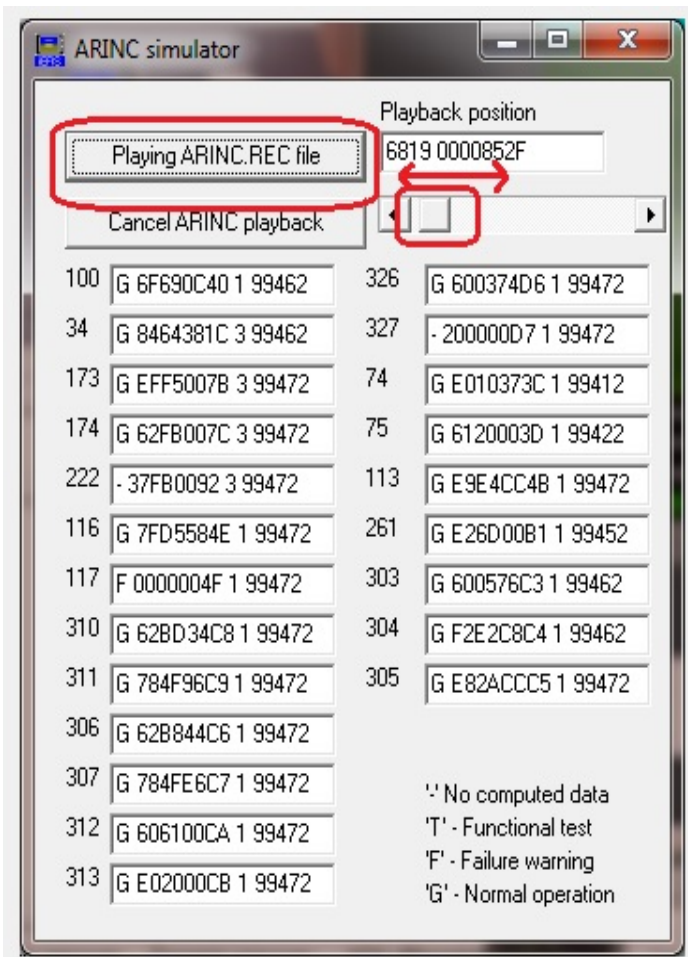


11. To replay the ARINC files you must have the iEFIS or Odyssey/Voyager Simulation configured just like in the aircraft. To setup for ARINC playback follow sections D and E in this guide. Some specific details most useful for the Simulator follow; A) Menu-->Sys Setup-->GPS NEMA Op--> External ARINC GPS (use Ext ARINC GPS for ARINC Sim Data Playback only-Not for Flight, for Flt use EFIS internal GPS) B) Menu-->Sys Setup-->Navigation Setup-->Dwn Arow-->HSI Hdg GPS C) From EFIS NAV Selection select--> Use External NAV Source
12. Except for Bit Check which does not move plane the Arinc Replay Files will take the plane for a Simulated Flight using recorded ARINC data with either a route, or a GPS ARNAV (Lat/vert Guidance), ILS (Lat/Vert Guidance) or VOR approach (look up KCEW or other Arpts to see the approach plates for these approaches).