## A. Overview

The MGL Gen2 Odyssey/Voyager and IEFIS have now been integrated with the NAVWORX ADSB ADS600-B UAT (Universal Access Transceiver) system to provide traffic and weather. The ADS600-B can connect into what the FAA calls the Next-Gen Air Traffic system that is implementing avionics and ground systems to improve safety and traffic control as we move into the next decade. This Next-Gen system provides the capability for MGL EFIS systems to receive and display free weather and local air traffic uplinked via a ground based FAA provided 1.04 Mbps 2-way datalink. The UAT can also communicate directly with other UAT equipped aircraft exchanging position data when outside of airspace not equipped with FAA en-route/terminal /IFF-Interrogator radar surveillance.

The abbreviated description of Aircraft ADSB system equipment is as follows. There are 2 basic levels of ADSB systems, IFF-Transponder) based systems, and UAT systems (978 MHz datalink) . To keep things confusing the FAA calls everything ADSB, but there are significant differences between these two equipment categories. The Mode-S transponders with ES or Extended Squitter (also called ADSB-OUT or 1090 ES) is the basic level of Next-Gen ADS-B equipment and along with providing normal Mode-3 (4 digit) transponder codes and altitude reporting they also data-link your aircraft GPS position and an unique A/C code to ground Terminal or enroute radars, or directly to other aircraft equipped to receive this ADS-B signal (ADSB-IN). Aircraft with Mode S-ES have the option (but not a requirement) to also receive the Next-Gen TIS or Traffic Information Service Broadcast uplinked from a Ground Radar station or the ES broadcast from other Mode S-ES equipped aircraft (also called ADSB-IN). The TIS traffic can be data-linked from an up-link capable FAA radar site (not all radar sites are able to do this) or from other Mode S-ES equipped aircraft. Mode-S (ES) equipment out is a Next-Gen requirement by 2020. Due IFF frequency saturation Mode S-ES equipment does not provide any other information (Weather etc.) other than TIS traffic and then only within range of specific radar sites mostly around large metropolitan airports (33 major airports plus some others).

UAT (978MHz) datalink systems are what the FAA is installing nationwide (USA only) with some 700 systems to be installed by ITT, the prime contractor by 2014. UAT equipment provides

ADS-B Issues: For a UAT equipped aircraft to see Non-UAT aircraft equipped only with a regular transponder or a Mode-S-ES equipped transponder there needs to be what is called ADSB-R or Automatic dependent surveillance-rebroadcast (ADS-R). The 700 UAT
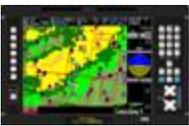
Gnd stations do this routinely for UAT equipped aircraft but to
support Mode S-ES (ADSB-IN) only equipped aircraft this is required
on both links.
        - ADS-R will not support as robust a set of ADS-B In
applications as those that would direct
reception of ADS-B; this is because of ADS-R service status and
coverage continuity limitations.
        - ADS-B In equipped aircraft using 1090 ES cannot see ADS-B Out
equipped aircraft using UAT,
without ADS-R.
        - ADS-B In equipped aircraft using UAT cannot see ADS-B Out
equipped aircraft using 1090 ES,
without ADS-R.
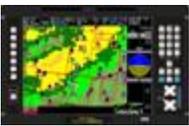
B. Wiring NAVWORX ADS600-B UAT to Odyssey/Voyager

     The ADS600-B communicates with the MGL Odyssey/Voyager via
Serial RS-232 at 115200K Baud through the EFIS High Speed Serial
Port-1. This port allows the MGL to both control the UAT and send it
ICARUS formatted Pressure Altitude inputs while receiving UAT TIS-B
Traffic and FIS-B Weather information. This single Serial port
interface allows MGL to fully integrate with the ADS600-B while using
only a single Serial Port (connection)helping to simplify cockpit
wiring. Reference the MGL-UAT wiring diagram (below), the ADS600-B
still requires a number of additional connections to complete
installation with some notes as follows: Recommended for EFIS Port-1
the use of 3-conductor twisted and shielded wiring with the shield
connected at only one end of the run. The ADS600 should come from
NAVWORX with two lengths of RG400 coax, use them but keep your UAT
antenna (UAT bottom antenna) at least 5 feet away from your
transponder antenna, and if possible use RG400 for all antenna
connections on your aircraft. I highly recommend you include in your
wiring and make it easily accessible the UAT Mntc. Port Connection
(DB-9 Female Connector). This connector will be used to program and
update your NAVWORX UAT via any Windows Laptop with a Serial
connection including a USB to Serial interface connector using
the NAVWORX UAT Console SW that is available from NAVWORX.


MGL G2 EFIS to ADS600 UAT Example Wiring
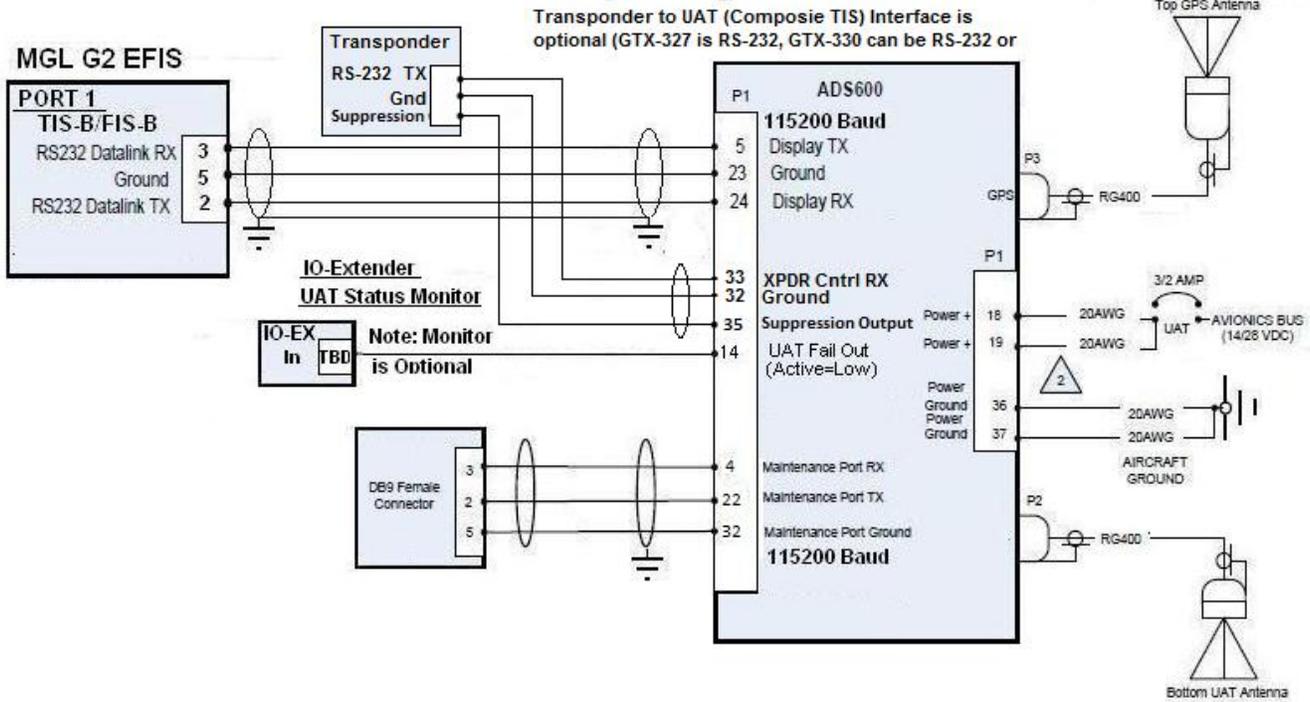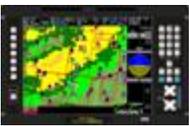
C. NAVWORX UAT Console Program Configuration Settings for MGL EFIS

      Included with the ADS600-B should be the Windows XP/7 UAT
Console configuration program that uses the NAVWORX UAT
Maintenance communications port DB-9 connector (if you followed
the recommended wiring). Information below should help you use UAT
console to configure your UAT for the MGL EFIS. If you have a
G400/500W NavRadio and you purchased the UAT-ARINC option the wiring
diagram for this configuration is shown above and discussion below is
included for MGL EFIS.
      Follow UAT Console instructions for SW install and initial
communications setup. If/when NAVWORX includes MGL configuration
instructions those should superseded these instructions for UAT
Console setup. UAT must be ON during UAT Console configuration so
follow NAVWORX instructions for UAT operations (UAT antenna must be
connected).

1) **Select Identification** and enter your Callsign, UAT console should fill in the ICAO address. UAT CONGIGURED will FLASH RED while information is being sent to the UAT.
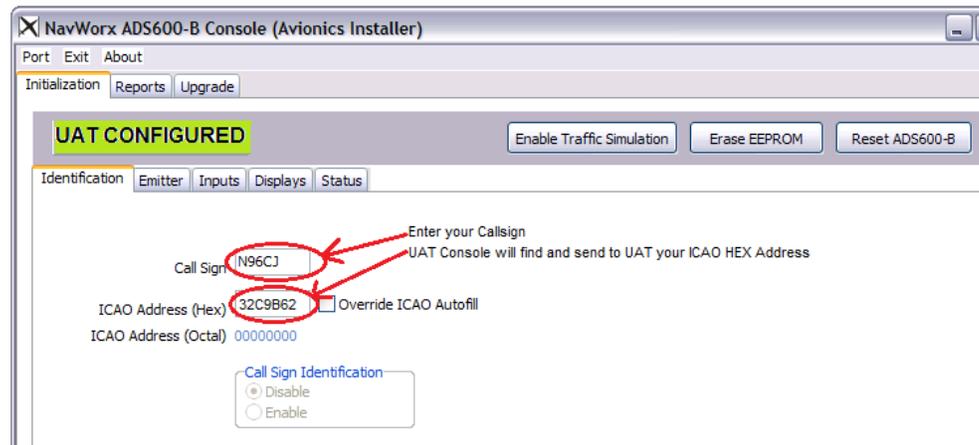
2) **Select Emitter** and enter you aircraft configuration details. For initial operation recommend "6" UAT Uplink Messages, this may change over time. Again UAT CONGIGURED will FLASH RED while information is being sent to the UAT.
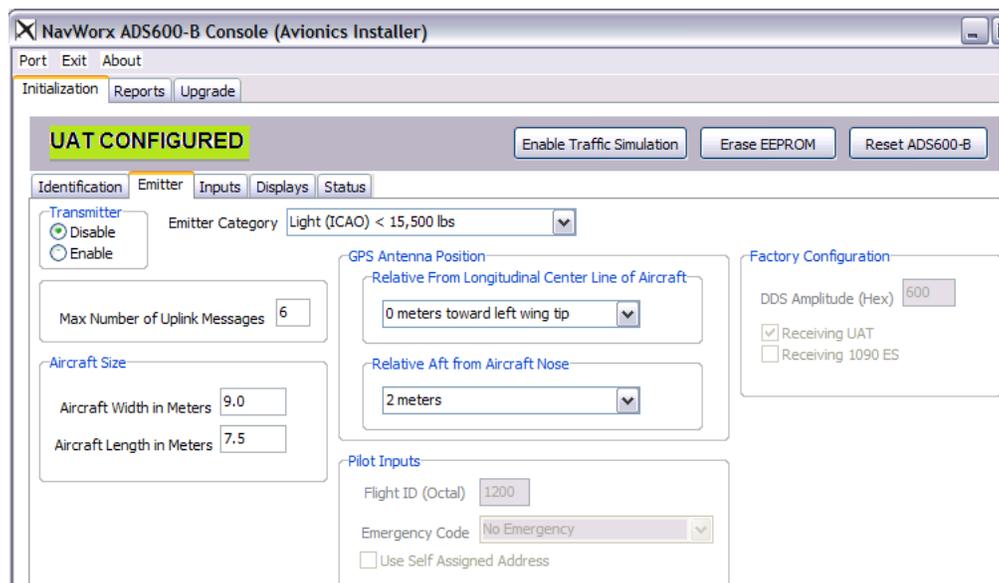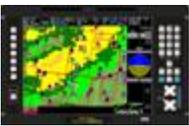
3) **Select Inputs** and enter information as shown. Unless you have a wired an external GPS to the UAT you will be using the internal ADS600-B GPS.

4) **Select Displays** and select information as shown. As discussed above if you have the UAT optional ARINC interface select ARINC in this menu.

D. Odyssey/Voyager Setup (I-EFIS TBD) and NAVWORX ADS600-B UAT (Software B 1.0.3.2 or later) (For Simulator see Appendix XX)

Press Menu Twice →Main menu level 2

Main menu level 2
1 System setup menu
2 3D view setup

Serial port routing (Must be "Port 1")

Serial port routing/allocations
1 RS232 port 1 (Internal): Navworx ADS-B
2 Serial port 1 (External): Not used
3 Serial port 2 (External): Not used
4 Serial port 3 (External): Not used
5 Serial port 4 (External): Not used
Restart system for changes to take effect

System Setup Pages 3 & 4

System setup menu
1 Setup Autopilot (Internal AP and ARINC AP)
2 Autopilot servo test & checks
3 Serial port routing/allocations
4 Radio stack setup
5 NAVWORX ADS-B setup
6 Transponder setup menu
7 ARINC setup
8 ARINC label TX setup
9 Flap indicator and control setup

Radio stack setup
1 Radio stack display enable ☑
2 VHF COM 1 enable ☐
3 VHF COM 2 enable ☐
4 VHF NAV 1 enable ☐
5 VHF NAV 2 enable ☐
6 Transponder enable ☐
7 ADSB OUT enable ☑

Select 1 for NAVWORX/UAT XMIT (In/OUT)

NAVWORX ADSB Setup
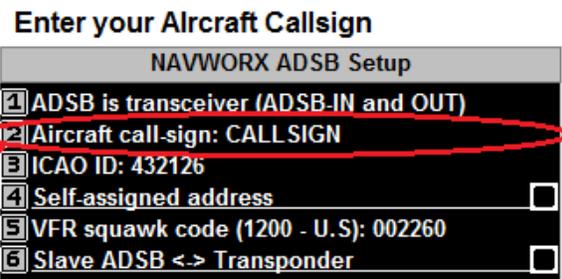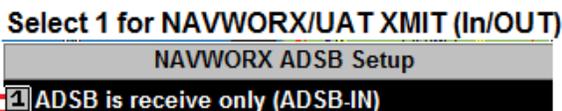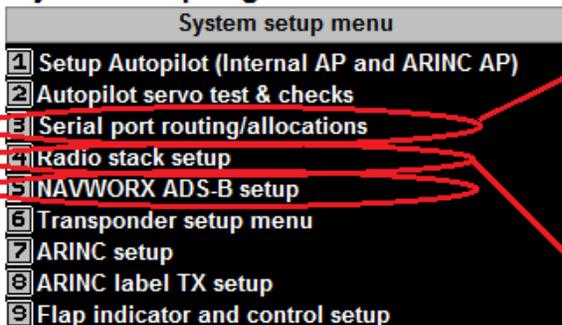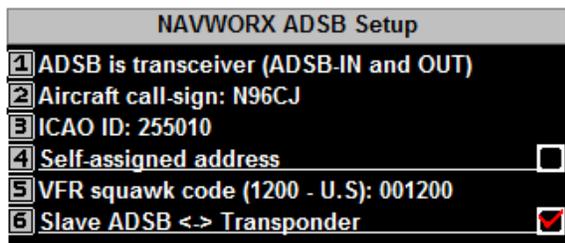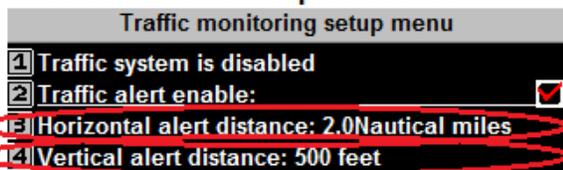1 ADSB is receive only (ADSB-IN)

Enter your Aircraft Callsign

NAVWORX ADSB Setup
1 ADSB is transceiver (ADSB-IN and OUT)
2 Aircraft call-sign: CALLSIGN
3 ICAO ID: 432126
4 Self-assigned address ☐
5 VFR squawk code (1200 - U.S): 002260
6 Slave ADSB <-> Transponder ☐

Keypad Control for Text Editing

Letter/Number Entry for ADSB

Move-Left/Rt

Delete-(Left)

NAVWORX ADSB Setup
1 ADSB is transceiver (ADSB-IN and OUT)
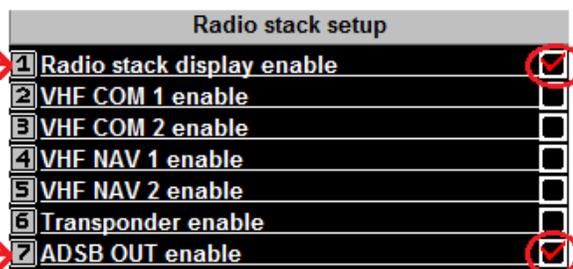2 Aircraft call-sign: CALLSIGN

Enter call-sign (max 8 chars)

N96CJ

→Let UAT Assign ICAO ID
→Enter USA VFR 1200 Squawk
→ Select "6" if EFIS Wired to Control both XPDR & UAT

NAVWORX ADSB Setup
1 ADSB is transceiver (ADSB-IN and OUT)
2 Aircraft call-sign: N96CJ
3 ICAO ID: 255010
4 Self-assigned address ☐
5 VFR squawk code (1200 - U.S): 001200
6 Slave ADSB <-> Transponder ☑

Horizontal alert distance: 2.0Nautical miles

Units = Nautical miles

02.0

UAT Traffic is automatic
→ Select "2" and setup as desired

Traffic monitoring setup menu
1 Traffic system is disabled
2 Traffic alert enable: ☑
3 Horizontal alert distance: 2.0Nautical miles
4 Vertical alert distance: 500 feet

Vertical alert distance: 500 feet

Units = Feet

1000

E. Screen Design requirements for ADSB-UAT operation
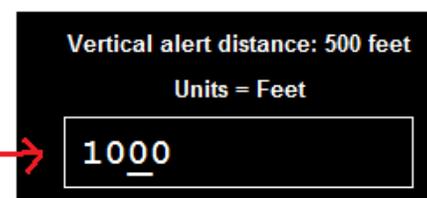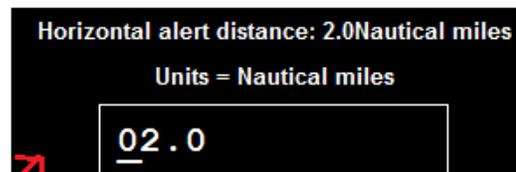
Each EFIS Screen page (all screens that you want to control the UAT from) need to have the "MGL Radio stack" function added to one of the screen design modules (recommend "Flight Module) from the item library. This is simple to do. Next you should add the new function "Simple Status Indicator ADSB", this will give you an alert ("ADSB"/ "ADSB") that the EFIS is receiving active ADSB Data. You will need to position and size either the Square or Circle at each desired Screen and Screen Location and then add Overlay UniText:
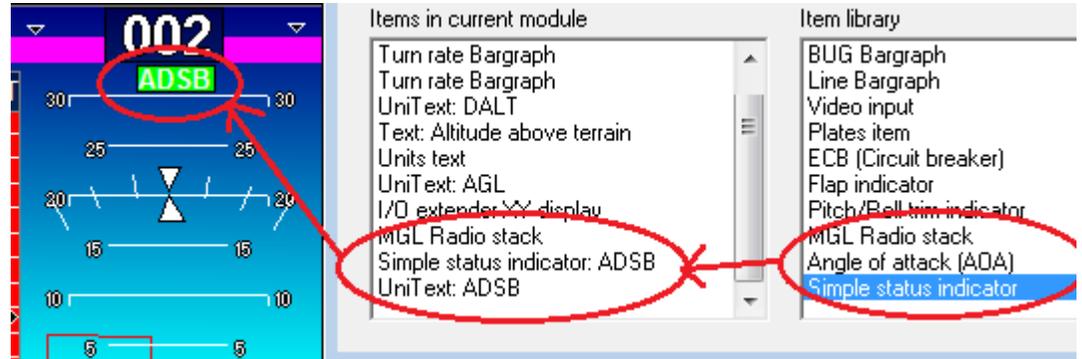
F. EFIS Start Up Operation with the NAVWORX UAT

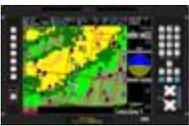System PowerOn and Initialization. When properly configured there should be no particular order for EFIS or UAT power on, but make sure the UAT has its own separate and fused electrical circuit (it has a 40Watt DataLink Transceiver). When the EFIS sees the UAT data connection (you included in your screen design) the ADSB Status Indicator should change from Red to Green.
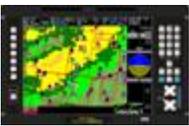
ADSB set up prior to takeoff. The diagram below shows that XMIT operation requires use of the F6 (RF) function key. If you don't see "RF" next to the F6 function key your unit is not set up correctly. Check to make sure you have Radio Stack included in the screen design and

enabled in the EFIS set up menu. As described in this diagram XMIT operation can be awkward. Press F6 Twice then the Keypad Down Arrow to get to ADSB Operations Menu, then Press "Hold" several times to turn on UAT and select ALT, then enter VFR for 1200 (1200 should be preset during ADSB setup) or assigned IFR Squawk code for your flight.

==It is important that you keep your ADSB & TRANSPONDER Squawk codes the same at all times.== If these Codes are not kept the same then a Collision alert will activate at your ATC controllers console and he will at least start asking questions if not give you evasive maneuvers trying to separate your ADSB unit from your Transponder. If your Transponder can send its Squawk Code (Via RS232 or ARINC) to your ADSB unit (see wiring diagram for Garmin or MGL compatible Transponders) then you only have to enter the Squawk Code once in your EFIS or Transponder and the UAT will change automatically. Otherwise it will be up to you the operator to keep them synchronized. To Exit the ADSB (RF) menu press F6 a third time. No other EFIS operations are available during use of the F6 (RF) Function key.

For normal operations at most airports you will not be within line-of-sight of an ADS-B GBT (Ground-Based Transceiver) so you will likely not see any ADSB weather or Traffic until you are airborne and within range of the GBT. UAT Traffic (TIS) will be available if a UAT equipped aircraft is flying within range of your UAT. During testing UAT air-to-air "TIS" data exchanges were observed from over 150NM's away.

G) Normal UAT Flight Operations: Now the fun part begins. If set up as described above airfield weather and accurate Traffic displays will become a routine part of flight operations. Airports reporting weather (FIS) via WX ASOS, METARS & TAF when available via ADSB datalink will be indicated with small Colored Triangles to the left of the Airport on the Vector or Raster Map. Nearby Traffic (TIS) will automatically appear at the correct Azimuth and Range on the Moving Map and are indicated with small Yellow Squares that include the Altitude Delta in Hundreds of feet above (+) or Below (-) your aircrafts altitude when received and processed by the EFIS. properly configured there should be no particular order for EFIS or UAT power on. When the EFIS sees the UAT data connection you should see words ADS-B NEXRAD on your Map display.

For NEXRAD weather to appear on your EFIS you must have "ADS-B NEXRAD on appear in the upper right of your Map display. If it's not there then you can turn it on by selecting F4 (MAP) or Shift→Map "2" (Enable ADS-B FIS). This allows you to turn NEXRAD Weather Graphics On or Off when desired.

Weather Colors: If an Airfield is reporting a METAR, or Special weather report per FAA & NOAA guidance there will be a colored Triangle next to that airport with the WX color & definitions as follows;
• Green (Triangle) = VFR (Visibility >5SM and/or Ceiling >3000
• Blue (Triangle)= Marginal VFR (Visibility is 3 to 5 SM and/or Ceiling 1000ft to 3000ft AGL
• RED (Triangle)= IFR (Ceiling 500 to 1000ft AGL and/or Visibility 1 to 3 Statue Miles)
• Hot (Pink Triangle)= LIFR (Low IFR (Ceiling <500ft and/or Visibility <1 SM)

To see the actual Weather Report and also possibly the stations TAF (Terminal Advisory Forecast) press the Zero Key (Nearest Airport) until the Nearest airports menu appears. Press the "Number" on the Keypad associated with that airport to see the details, if the airport you want is not there then either enter Next page (Down Arrow) or Directly using the "Ent" key to search for that Airport. There is presently no connection between your MGL Flight Plan Route and the ADSB Weather data so each airport on your route that has weather will have to called up one at a time using the nearest airports display or via the Open Search Window.

By pressing the Down Arrow several tomes we find KPNS our alternate and we can check the current and forecast weather. Follow the diagram here to see how this functions. As you can see the weather is presented in original

Nearest airports, Region A,A

1	N KCEW,	BOB SIKES	6.2nm
2	N 18FD,	SKY RANCH	6.7nm
3	N FL81,	TRIPLE B AIRPARK	6.9nm
4	N FD03,	FIVE OAKS ESTATE	7.2nm
5	N 55FD,	DOTSON	8.4nm
6	N 0FD5,	BREEZY KNOLL	10.7nm
7	N 69FD,	UNICORN PLACE	13.5nm
8	N KEGI,	DUKE FIELD,(EGLIN AF AUX NR	13.8nm
9	N 0J4,	FLORALA MUNI	15.3nm
0	N FD93,	YELLOW RIVER AIRSTRIP	15.8nm

↓ Next page   Ent Open search window

Press "0" Several times till KPNS shows up, then Selet "4"

Nearest airports, Region A,A

1	N FA55,	GARNAIR	40.2nm
2	N KEDN,	ENTERPRISE MUNI	41.4nm
3	N KG7H.	MIDDLETON FIELD	41.3nm
4	N KPNS,	PENSACOLA GULF COAST RGNL	41.4nm
5	N 03FD,	THARPE	41.8nm
6	N FL04,	PATE LAKE	41.9nm
7	N FD89,	COLLIER/PINE BARREN AIRPARK	42.2nm
8	N FD35,	REDHEAD	43.0nm
9	N 3AL1,	FLYING H RANCH	45.2nm
0	N AL62,	STRIPLIN AIRFIELD	45.7nm

↑ Previous page
↓ Next page   Ent Open search window

KPNS had Green Highlight so it was "VFR", Select --> Metar/TAF to Read Details

Frequencies for KPNS Elev: 121ft

1	A/D	118.600	APCH/P DEP/P CLASS C
2	A/D	119.000	APCH/P DEP/P CLASS C IC
3	CTAF	119.900	CTAF
4	A/D	120.650	APCH/P DEP/P CLASS C
5	ATIS	121.250	ATIS
6	EMR	121.500	EMERG
7	GND	121.900	GND/P
8	UNIC	122.950	UNICOM
9	CLD	123.725	CD/P

↑ Previous page   hkl View plates
↓ Next page   Ent GOTO this airport   → Metar/TAF

KPNS Special Report, not great but VFR, TAF is also available

Metar for KPNS

SPECI KPNS 020408Z 33004KT 10SM FEW006 OVC110 17/17 A3016 RMK AO2 DRAE01 P0000 $=ÿBT01780167 $=ÿ T01720167 $=ÿ

→ TAF available

TAF says airport going Marginal VFR soon

TAF for KPNS

TAF KPNS 012336Z 0200/0224 22003KT 4SM -RA BR BKN015 BKN060 OVC080FTEMPO 0205/0207 15008KT 5SM -TS RA BKN015CB OVC025EFM020700 VRB03KT 1/2SM FG VV002EFM021400 09005KT 3SM BR OVC005=ÿ
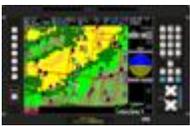
NOAA cryptic format so some interpretation is required to fully understand.

NEXRAD Weather display: The FIS ADSB NEXARD weather graphics has two Geographic areas of NEXRAD, Regional and National. Regional is supposed to be updated every 6 minutes, basically the same time schedule as a NEXRAD Radar rotation/update cycle (roughly 250NM radius from your current aircrafts location), and the less detailed but National NEXRAD radar picture shows the entire continental USA and limited parts of CANADA on a 15 minute update cycle. In the Regional example to the right you can see close to the seven Rainfall colors used by the FAA/NOAA to represent intensity;

Light Green → Light Rainfall
Dark Green → Lgt-Med Rainfall
Yellow → Med Rainfall
Amber → Med-Heavy Rainfall
Red → Heavy Rainfall
Magenta → Very Heavy Rainfall
Cyan → No Rainfall Data Available

The EFIS has about a 15 minute timeout period if no new weather data is received.

The Regional and National Weather pictures can be seen by Zooming out on the ADSB Map Scale. The Map scales can be zoomed from as low as 6NM's out to the entire USA. Since the weather data is based on geographic cubes, as you zoom in you will see small squares that represent the average weather seen in that map area but this average will appear as square pixilated graphics, this is a compromise as to the level of data the ADSB system is able to transfer to any single aircraft, but the weather should represent about 1NM square and outside of ADSB latency should remain accurate.

Currently the EFIS does not show your entire route against the weather display on the moving map (only the current route leg), and it also does not show Winds Aloft, NOTAMS, plus other available ADSB information, these items will be added at a later date.
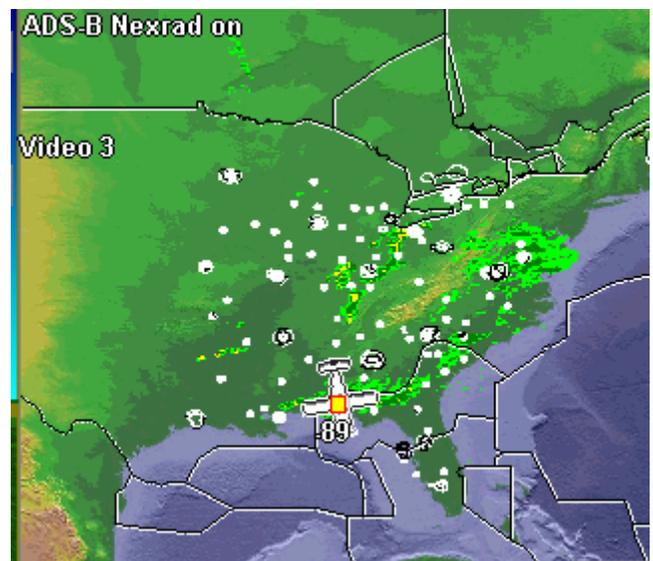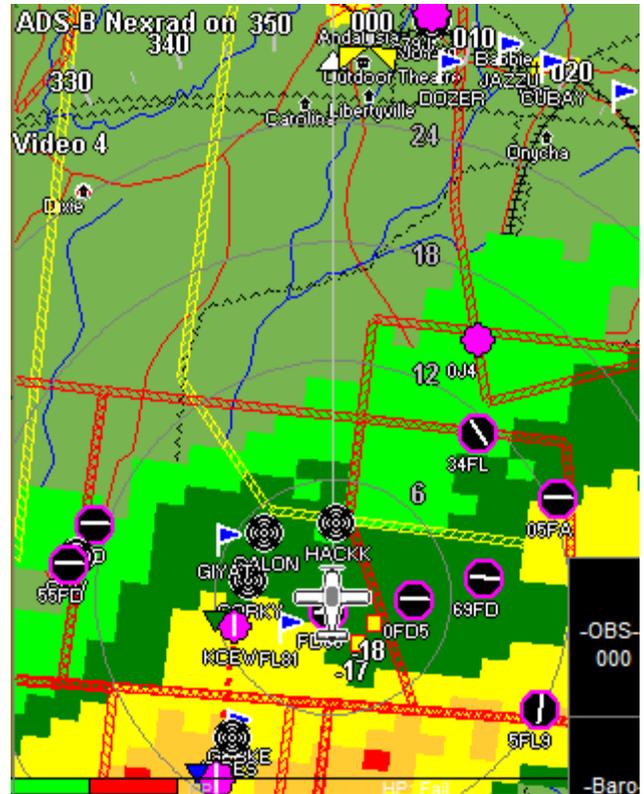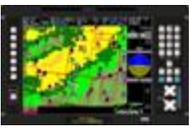
Appendix: ADS-B Frequently Asked Questions

What is ADS-B? Automatic Dependent Surveillance-Broadcast, or ADS-B, is a technology implementation by the FAA to provide surveillance and improved situational awareness simultaneously to pilots and air traffic controllers.
Automatic = No interrogation by external system, and no pilot input required.
Dependent = Position dependent on own ship's navigation—Global Positioning System (GPS)
Surveillance = Provides aircraft call sign, position, type, heading, altitude, velocity vector, emergency status, plus other information.
Broadcast = Data transmitted to all ground and airborne receivers, nominally once per second.

What is NextGen?
Next Generation Air Transportation System, Federal Aviation Administration website on Next Generation Air Transportation System, or NextGen, defines the plan for a new national airspace system in the United States, and outlines its operational characteristics, implementation and benefits. The goal of NextGen is to move away from ground-based radar control and toward autonomous self-reported positioning for aircraft using satellite-based (GPS) equipment. The long-term objective is a more efficient and precise air traffic control system yielding increases in fuel economy, utility and safety.

What is TIS-B?
Traffic Information Services-Broadcast, or TIS-B, provides free traffic reporting services to UAT equipped aircraft. TIS-B is a major component of ADS-B technology enabling pilots and controllers to enhance communications and increase levels of safety in the cockpit and on the ground. TIS-B allows yesterday's non-ADS-B Mode A/C/S transponder equipped aircraft that are tracked by radar to have their location and track information broadcast to ADS-B equipped aircraft. TIS-B allows UAT and 1090ES equipped aircraft to see each other.

What is FIS-B?
Flight Information Services-Broadcast, or FIS-B, provides free weather and aeronautical products to UAT equipped aircraft. FIS-B is a major component of ADS-B technology enabling pilots and controllers to enhance communications and increase levels of safety in the cockpit and on the ground. Download a listing of Free FIS-B Weather and Aeronautical Products.

What is a UAT?
Universal Access Transceivers, or UAT, are the aircraft or ground installed radio receivers and transmitters designed to utilize ADS-B
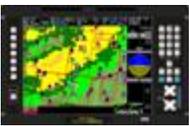
services.

What is a GBT?

Ground-Based Transceivers, or GBT, support broadcast data link services through a network of radio transmission equipment installed to support nationwide ADS-B services. Service range of each station is approximately 200 miles. GBT service requires line-of-site reception and only airports with co-located GBT will provide services while on the ground. For more information go to www.faa.gov.

What does ITT have to do with ADS-B?

ITT and ADS-B, ITT Advanced Engineering & Sciences division, a private company, is the primary government contractor for the implementation of ADS-B and NextGen technology. The company will design, deploy, and support the infrastructure that allows participants in the national airspace system in the United States to utilize the functionality of ADS-B technology.

NAVWORX Weather Simulation (MGL G2 V1.0.3.2 or Later)
(Use CJones Recorded ADSB Data)

Set Simulator to Approximate GPS Location of N30Deg 50 Min, W 086 Deg 32 Min

1) ADSB.dat data file loaded in current Sim-Project Folder= Project-->Flash-->Other Folder
2) After loading the ADSB.DAT file Exit Simulator Then Restart Simulator
3) Select F4-MAP --> 2 ADS-B FIS is Enabled
4) Menu-Menu 2 --> System Setup --> Per this ADSB Integration Guide

As an option for an interactive Moving Map within the recorded weather area you can load a Recorded ARINC Flt data file from the FTP Site into the Simulator, and set up simulation per the G400/500W ARINC Set up guide.
     In Menu-Menu 2 --> System Setup -->Setup GPS-NEMA port operations under (1) Use external GPS on ARINC channel 1, this will let the ARINC playback move the aircraft around. The in the Sim Select Sensor Simulation --> ARINC simulator --> Browse and load the downloaded ARINC Data file, (Select a CEW file).

A) Turn Weather On/Off with F4-MAP --> 2 ADS-B FIS is Enabled/Disabled
B) On Map Observe Levels of Weather Intensity (Green-->Yellow-->Red)
C) Notice a Yellow Square Traffic Symbol with +2500 Next to your aircraft, this is a NAVWORX Traffic report (Simulated traffic in this data file)
D) Only the current leg of your Flight Plan route shows up on the
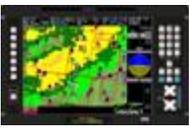
EFIS, it would be difficult to see

ftp://ftp.mglavionics.com/Schematics Guides/MGL ODY G430 ADSB Integration/ADSB NavWorx Data Schematics/SimulatorData/