

VLA Report 2018\_11

PDR Review Report

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# Avionics and BFI

## Avionic Selection

G5 ve GTX345 tablolarda yok,

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Definition** | **Chosen Avionic** |
| ODTÜ-VLA-SRD-017 |  | Garmin G500-Garmin GTN 750 |
| ODTÜ-VLA-SRD-018 |  | Garmin G500-Garmin GTN 750 |
| ODTÜ-VLA-SRD-019 |  | Garmin G500-Garmin GTN 750 |
| ODTÜ-VLA-SRD-020 |  | Garmin G500-Garmin GTN 750 |
| ODTÜ-VLA-SRD-021 |  | Garmin G500-Garmin GTN 750 |
| ODTÜ-VLA-SRD-022 |  | Garmin GTN 750 |
| ODTÜ-VLA-SRD-023 |  | Garmin GTN 750-Garmin GTX 335 |
| ODTÜ-VLA-SRD-024 |  | Garmin GMA 340 |
| ODTÜ-VLA-SRD-026 |  | Garmin GTN 750 |
| ODTÜ-VLA-SRD-027 |  | Garmin GTN 750 |
| ODTÜ-VLA-SRD-028 |  | Garmin GTN 750 |
| ODTÜ-VLA-SRD-029 |  | Artex ME406 ELT |
| ODTÜ-VLA-SRD-030 |  | Garmin GTX 335 |
| ODTÜ-VLA-SRD-025 |  | Garmin GMA 340 |

|  |  |
| --- | --- |
| **Required Equipment** | **Chosen Avionic** |
| Seyrüsefer Ekipmanı | Garmin GTN 750 |
| Transponder | Garmin GTX 335 |
| Hız/İrtifa Göstergesi | Garmin G500 |
| Motor &Yakıt Kontrol Paneli | Garmin G500 |
| Elektrik Kontrol Paneli | Garmin G500 |
| Saat | Garmin G500 |
| ELT (Emergency Locator Transmitter) | Artex ME 406 ELT |
| Magnetic Compass | Garmin G500 |
| Statik Port | Garmin G500 |
| Pitot Tube | Garmin G500 |
| Stall Uyarısı | Garmin G500? |
| Haberleşme Sistemi | Garmin GMA 340 |

## Avionics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Avionic | Configuration | Functionality | Width | Height | Dept |
| G500 TXI | 10.6” | Display | 11.4” | 7.25” | 3” |
| G500 TXI | 7” | EIS | 5.5” | 7.25” | 3” |
| GTN 750 | - | GPS/NAV/COMM/MFD | 6.25"  (159 mm) | 6.00"  (152 mm) | 11.25  (286 mm) |
| GTX 345 | - | ADS-B & Transponder | 6.30”  (160 mm) | 1.65”  (42 m) | 10.07”  (256 mm) |
| GMA 345 | - | Audio Panel | 6.30"  (160 mm) | 1.33"  (34 mm) | 8.09"  (205 mm) |
| G5 | - | Attitude Indicator | 3.4”  (86.4 mm) | 3.6"  (91.4 mm) | 3.0”  (76.2 mm) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Avionic | Configuration | Functionality | Weight | Weight with Additions |
| G500 TXI | 10.6” | Display | 6.49 lbs. | 7.25 lbs. (with integral ADAHRS) |
| G500 TXI | 7” | EIS | 3.99 lbs. | 4.45 lbs. (with integral ADAHRS) |
| GTN 750 | - | GPS/NAV/COMM/MFD | 9.3 lbs.  (4.24 kg) |  |
| GTX 345 | - | ADS-B & Transponder | 3.1 lbs. (1.41 kg) |  |
| GMA 345 | - | Audio Panel | 1.78 lbs. (807.4 g) |  |
| G5 | - | Attitude Indicator | 13.3 oz (377.0 g) |  |

### Garmin G500 TXI

The G500 TXi is a display and sensor system available in three display options:

* GDU 1060 – 10”display
* GDU 700P – 7”portrait display
* GDU 700L – 7”landscape display

Display options can be seen at Figure 8. Depending on system specifics one or more of the following functions may apply:

1. **Primary Flight Display (PFD)** – provides attitude, heading, air data, and navigation information to the pilot
2. **Multi-Function Display (MFD)** – provides pilot awareness of factors that may affect the overall conduct of a flight
3. **Engine Indicating System (EIS)** – provides engine and airframe operating parameters to the pilot

Due to its natural support to EIS, we decided to use G500 TXI over G500. With an integrated EIS at Figure 9, G500 TXI can simply display any vital engine information on its screen. Considering the display configurations for the 1060, 700P and 700L at Figures 10, 11 and 12 respectively, we decided to use 10” configuration and 7” configuration of the G500 TXI instead of dual 7” option. Using MFD/PFD configuration of 10” configuration and EIS only mode of 7” configuration, pilots can be informed about the plane from two screen.



Figure 1 GDU 1060 Display Configuration

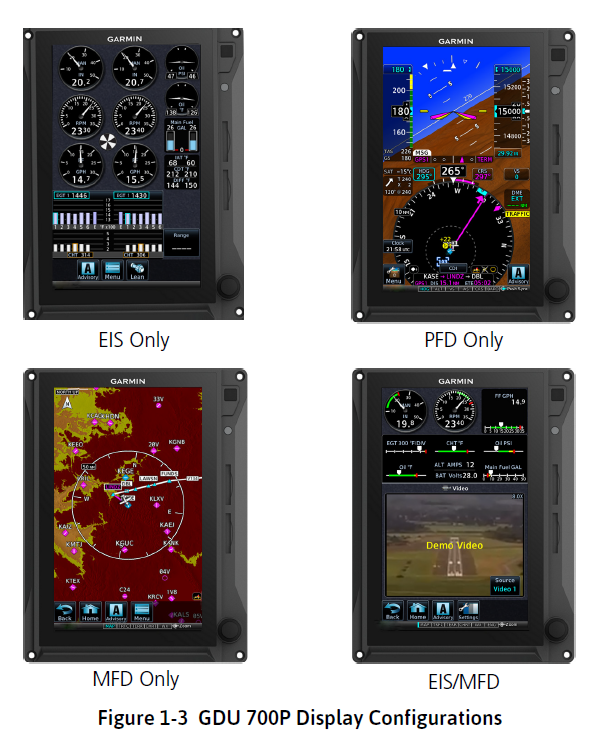


Figure 2 GDU 700P Display Configuration

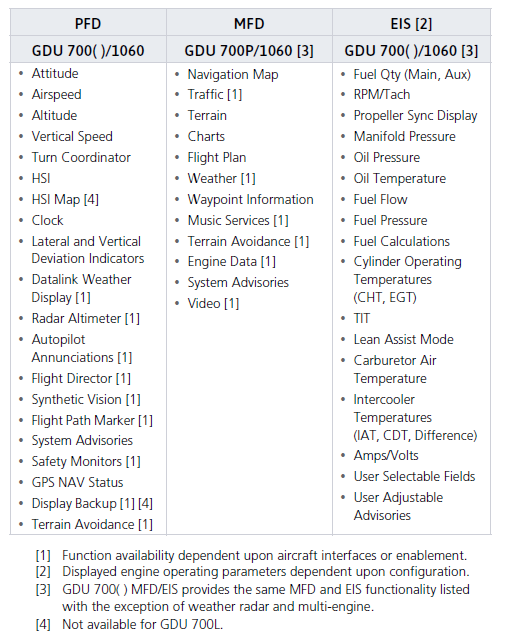


Figure 3 System Functions

System functions of G500 TXI can be seen at Figure 13 while electrical loads of subsystems of G500 TXI can be seen at Figure 14.

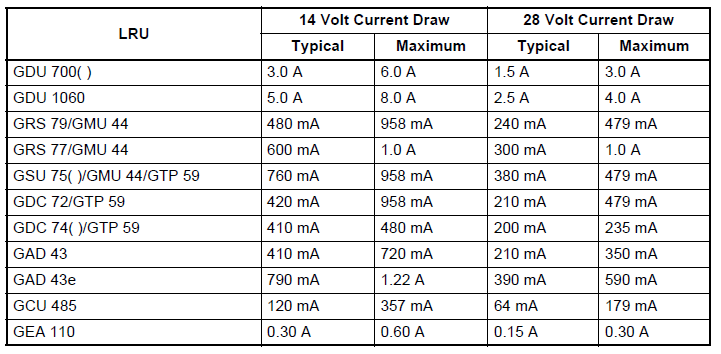


Figure 4 Electrical Load of Subsystems of G500 TXI

### Garmin GTN750



Figure 5 Garmin GTN750

### Garmin GMA345



Figure 6 Garmin GMA 345

### Garmin GTX345



Figure 7 Garmin GTX 335/345

### Garmin G5

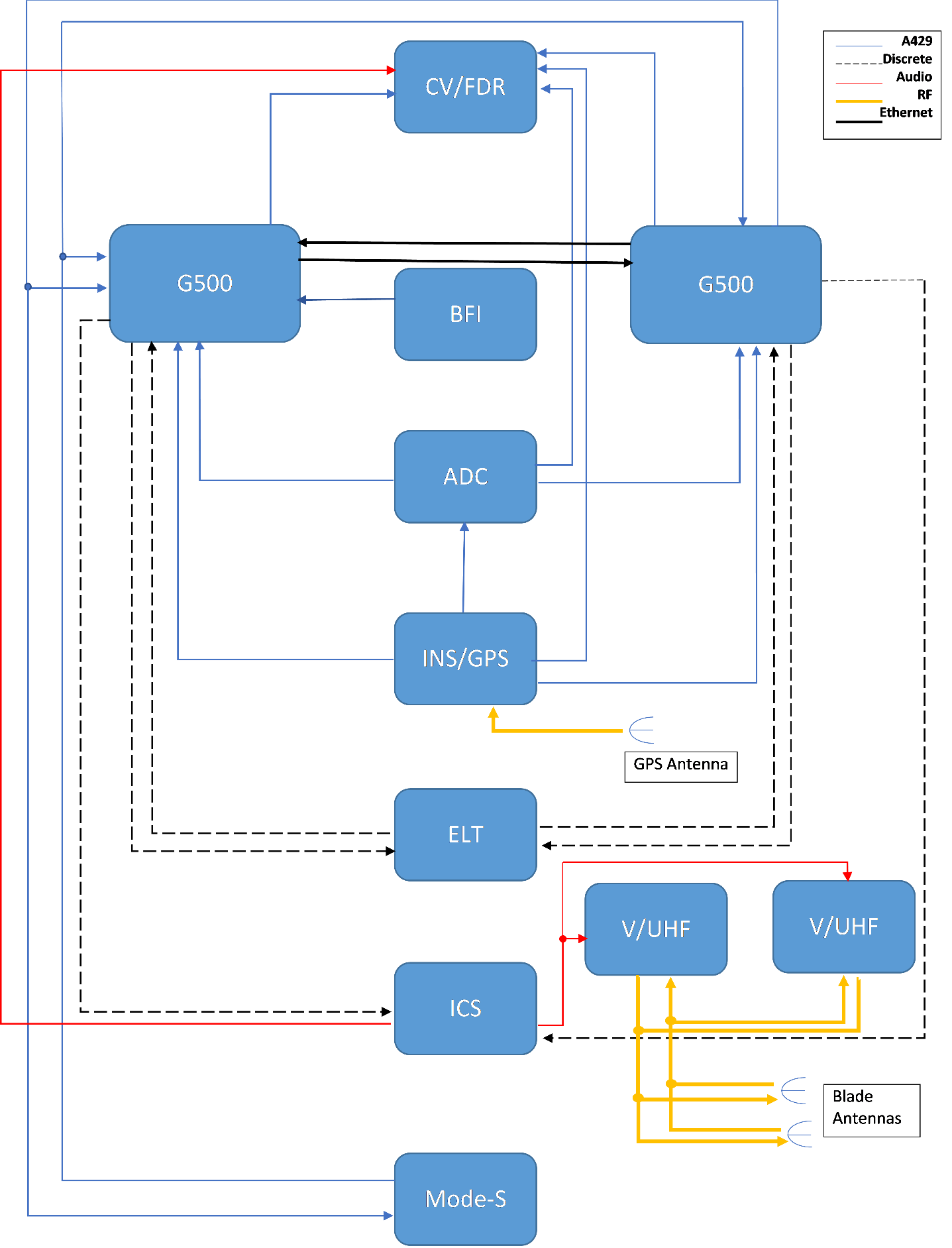


Figure 8 Garmin G5

## Proposed Avionic Architecture

Figure 22 shows our design for the avionic architecture. The avionic architecture relies mainly on ARINC-429 standard, which is well known to be wide spread in non-military avionic applications. However, the system also employs discrete and Ethernet connections. To denote briefly the individual components on the architecture:

* **CV / FDR** stands for “Cockpit Voice / Flight Data Recorder”, is the black box of the aircraft.
* **G500** represents Garmin G500 dual screen electronic display.
* **BFI** or more commonly BFS is the “Backup Flight System”.
* **ADC** is the air data computer.
* **INS / GPS** stands for the Inertial Navigation System and the Global Positioning System.
* **ELT** is the Emergency Locator Transmitter.
* **ICS** is the Intercom equipment.
* **V/UHF** is the Very High and Ultra High Frequency Radio.
* **Mode-S** is the Mode-S Transponder.



**Figure 9 : The proposed avinoic architecture. Notice the legend.**

## Garmin StarBus

Garmin icin CAN Busdan baska bus gormuyorum

Star genel bir bus baglantisi terimi bir componenttan bir suru bus cikiyor ve herkes one to one baglaniyor buna star denir

Ayrica bir starbus tanimi bulamadim

ARINC 664 topolojisi star gozukuyor

https://www.aviationtoday.com/2017/04/12/avionics-becoming-networked/

# Cockpit Design

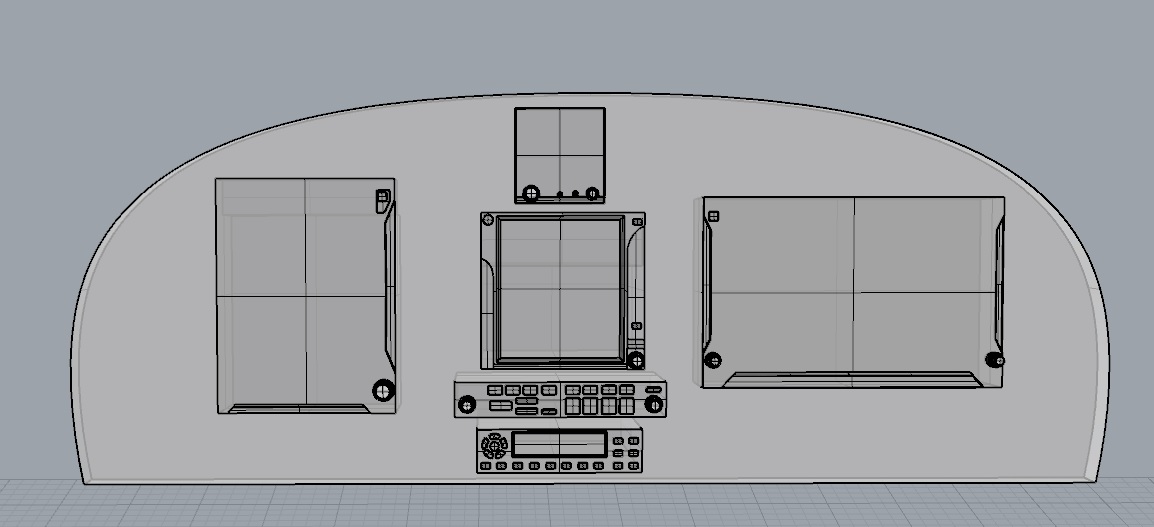


Figure 10 Proposed Cockpit Design

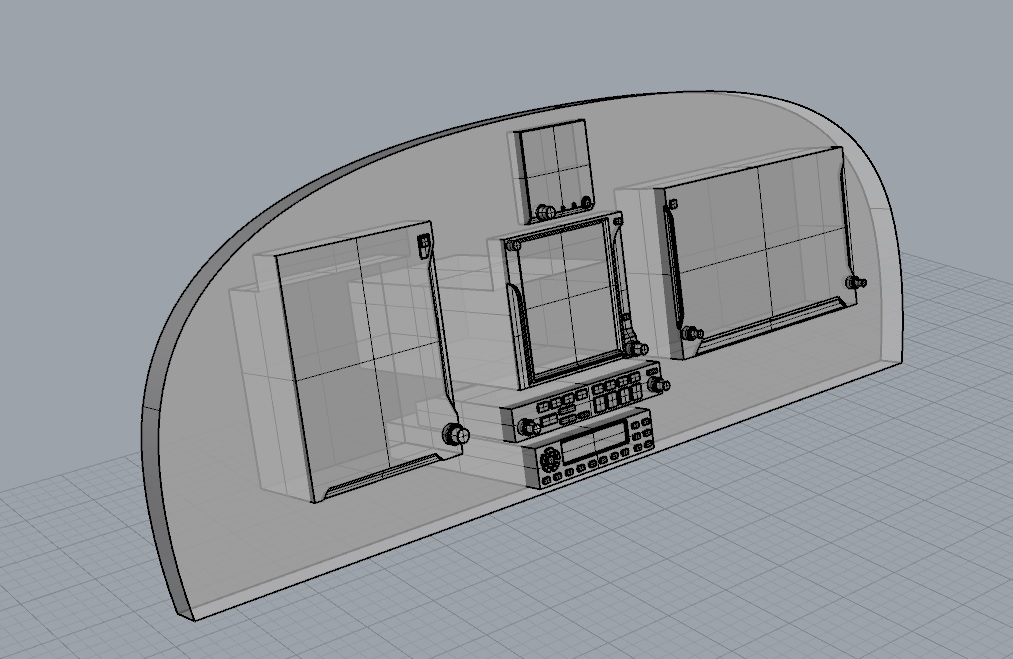


Figure 11 Proposed Cockpit Design

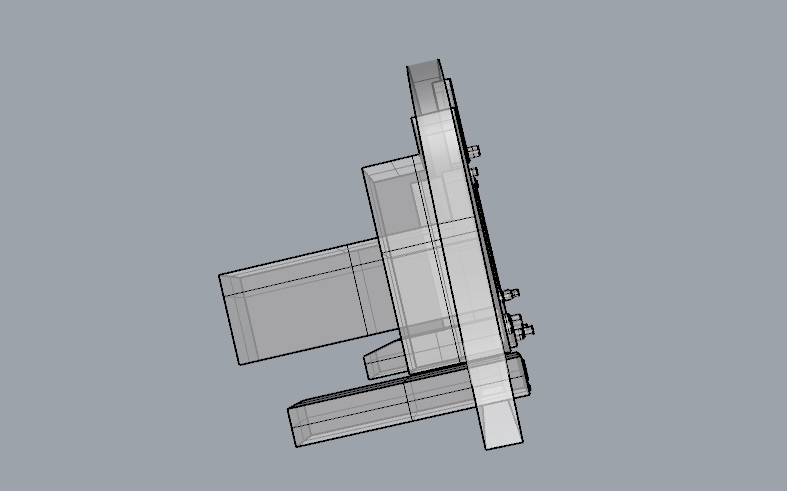


Figure 12 Proposed Cockpit Design

# Motor Interface

## GEA 110 Engine Interface

The GEA 110 is a remote mount engine interfacing and monitoring module used for gathering sensor input parameters from the engine and processing the signals for the G500/G600 TXi system. The GEA 110 can be mounted to the back assembly of the GDU 1060 or it can be remotely mounted in the fuselage or in the engine compartment. The GEA 110 communicates with the G500/G600 TXi using an RS-485 digital interface. Device can be seen at Figure 26.



#### Figure 13 GEA 110 Engine Interface

## EIS Components

### Engine Annunciator

An engine annunciator will only be installed if the EIS display is not installed within 8 inches of the center of the pilot’s field-of-view.

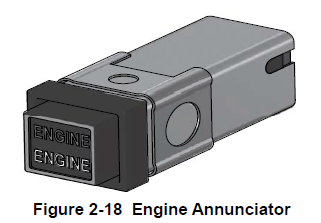


Figure 14 Engine Annunciator

### Carburetor Temperature Probe

The carburetor temperature probe is a Type-K thermocouple (Chromel and Alumel) probe.

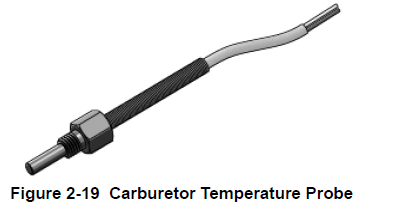


Figure 15 Carburetor Temperature Probe

### Oil Temperature Probe

The oil temperature probe is a Type-K thermocouple (Chromel and Alumel) probe.



Figure 16 Oil Temperature Probe

### Fuel Flow Sensors

The fuel flow sensor is incorporated in an aluminum housing that is installed in-line to the engine fuel supply. There are two STC approved options available for installation to suit most aircraft applications.

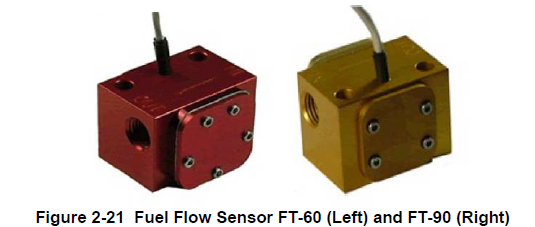


Figure 17 Fuel Flow Sensor FT-60 (Left) and FT-90 (Right)

### Brass Pressure Sensors

The brass pressure sensors are small sensors that are supplied with a compatible plug. Depending on the installation, these sensors may be used to measure oil, fuel, and manifold pressure.



Figure 18 Brass Pressure Sensors

### Stainless Steel Pressure Sensors

The stainless pressure sensors are unamplified, high-reliability sensors for harsh installation environments. There are four sensors available to measure oil, fuel, and manifold pressure.

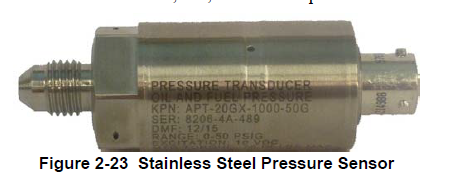


Figure 19 Stainless Steel Pressure Sensors

**P-Lead RPM Pickup**

A wire with two parallel resistors in-line connects from each P-lead, at the Magneto or the ignition switch, to the GEA 110 to sense RPM.

## Rotax 912 Connection

**Will be detailed with an information regarding exact connection between engine and EIS system.**

# Sensors

**This section will not be included in the 16.10.18 Report. But, the research about topic continues for the following report including wiring.**

## GPS Antenna Installation on AQUILA AT01 (A21)

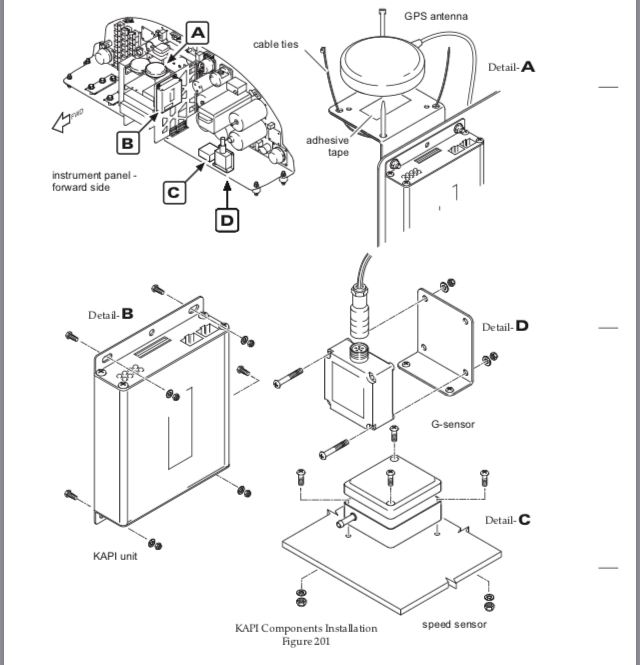


Figure 20 A

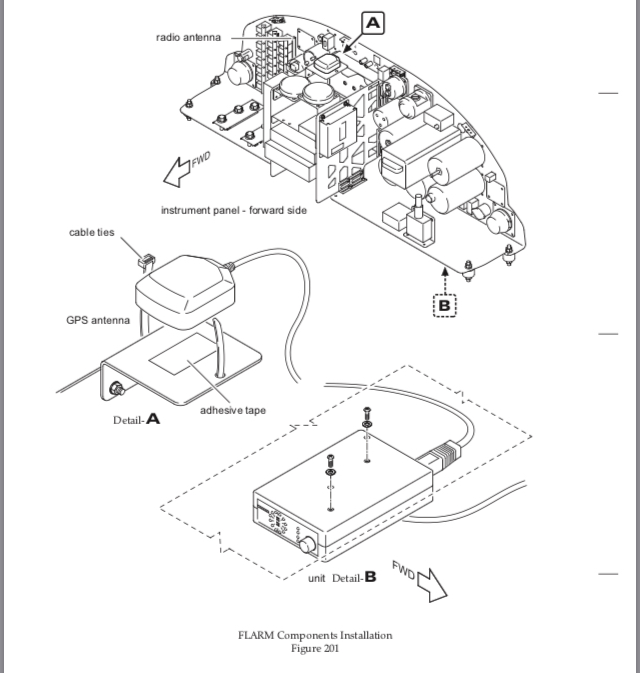


Figure 21 B

* Put gasket and antenna from outside,
* Install washers and nuts securing antenna to fuselage. Simultaneously connect ground cable to backing plate.
* Seal the antenna and gasket to fuselage using a good quality electrical sealant (Sikaflex-221 or equivalent, silicone-free).
* Connect antenna cable.
* Close baggage compartment door and install access / inspection plate 211 KC (refer to 25-12-00).

## GPS Antenna Installation on SLING 2

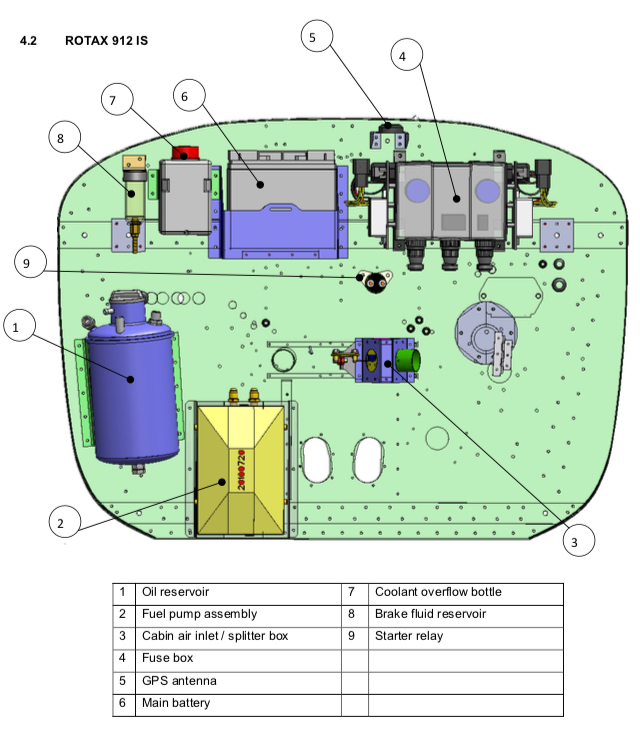


Figure 22 C

* The GPS antenna is mounted in the engine compartment on a bracket attached to the firewall.

## General Light Aircraft Sensors

On light aircraft, the comm, nav, GPS, and the transponder antennas are generally in the same locations.

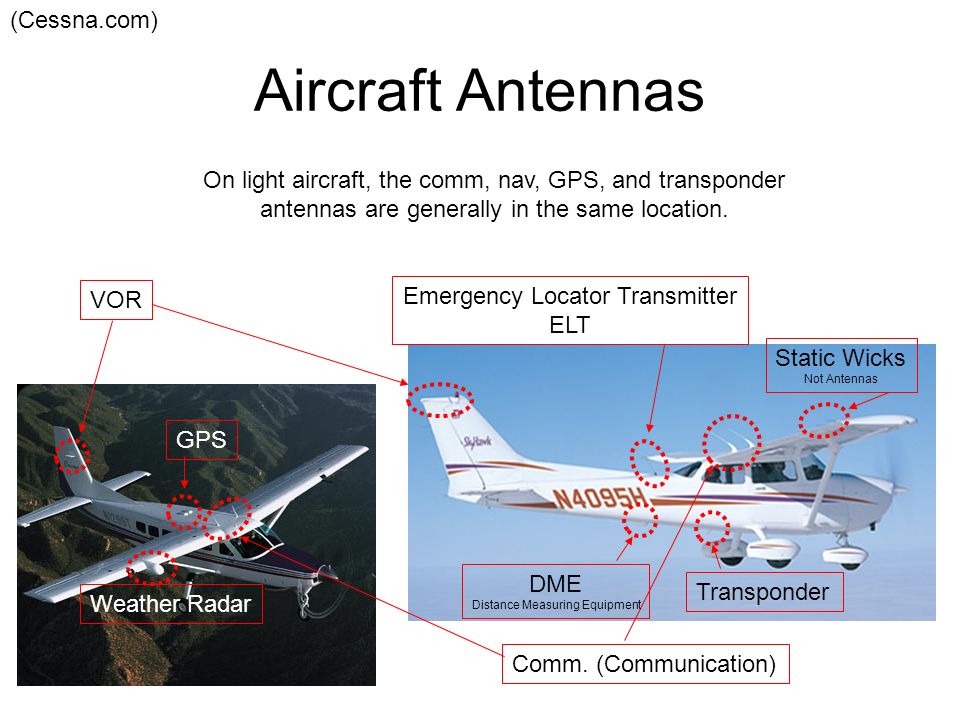


Figure 23 D



Figure 24 E

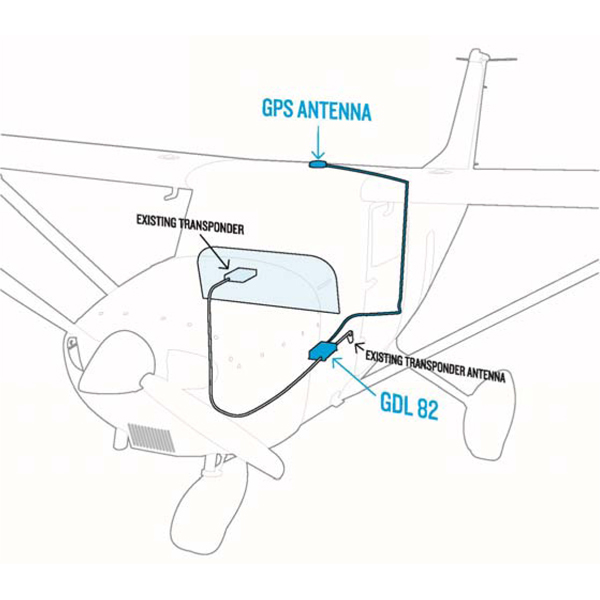
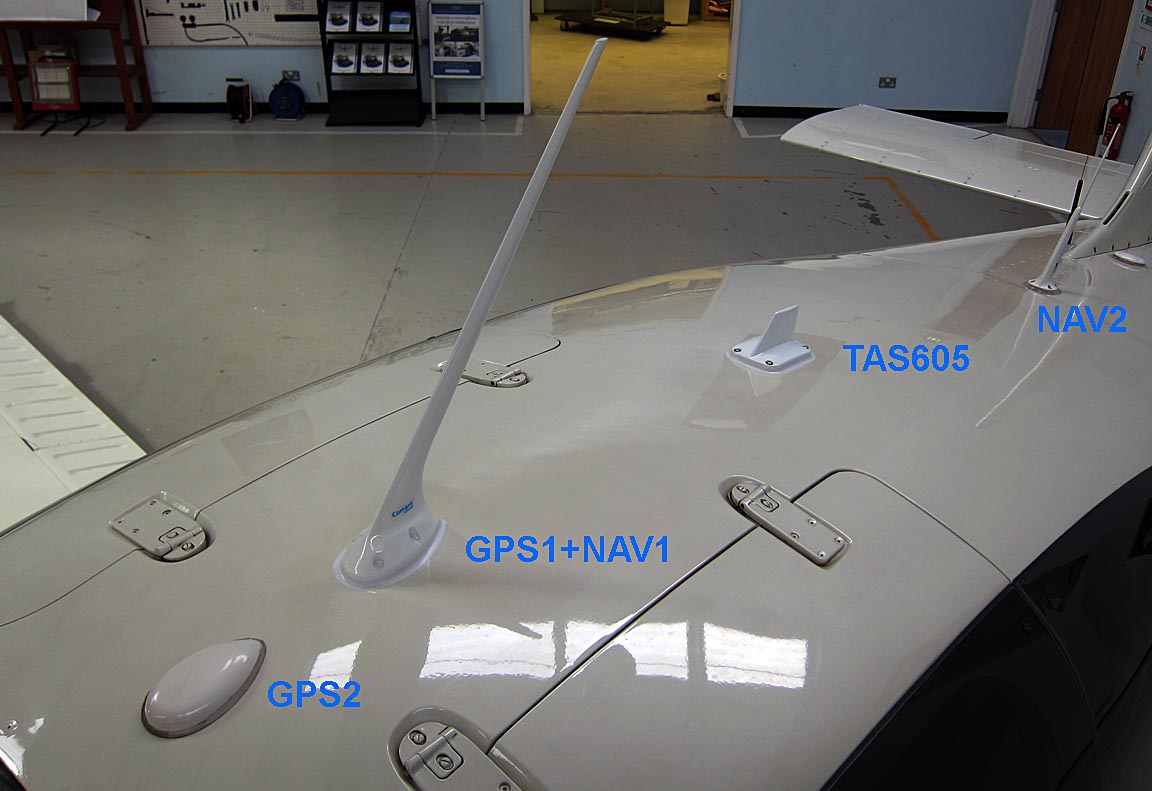


Figure 25 F



**Figure 26 G**

# Circuit Diagram

## **Will be drawn again with sensors in professional manner.**

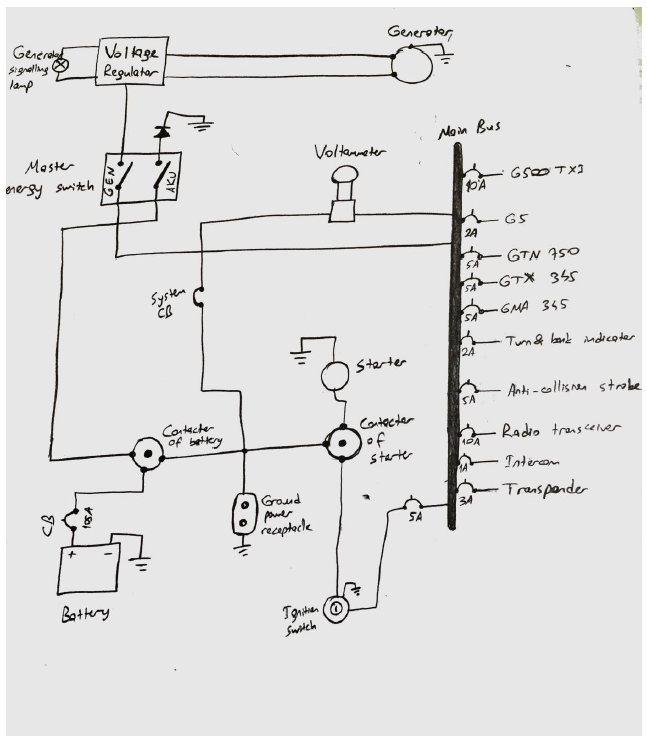
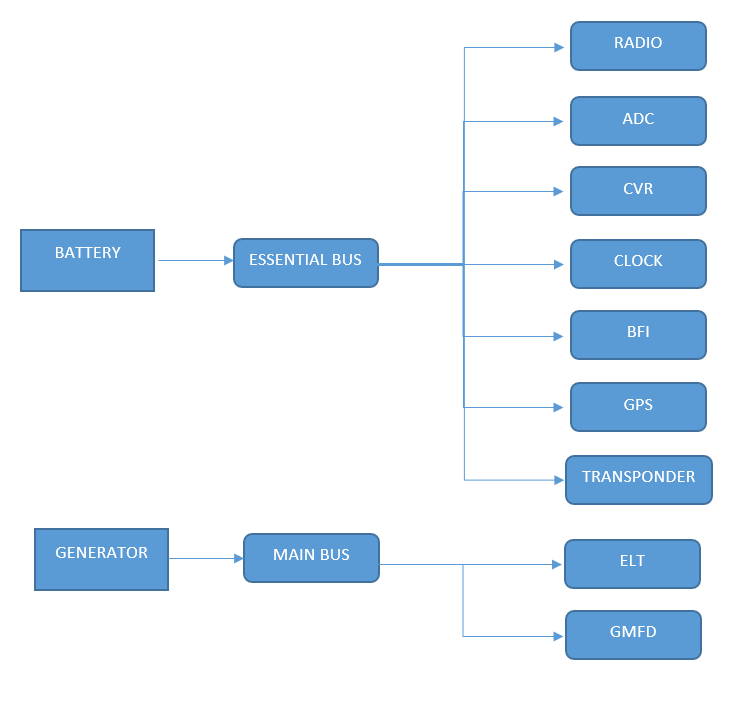


Figure 27 Circuit Diagram

# Preliminary Electrical Architecture

On Figure 32, you can observe the preliminary electrical architecture. Two busses – main and essential- are used on the architecture, typical for such aircraft. The generator relies on the engine to provide power while battery is used to provide a steady and safe source of energy in the case of a discrepancy.

* **GMFD** stands for the control panels.
* **CVR** is the black box.
* The rest is given below.



**Figure 28 : Preliminary Electrical Architecture**