2018

VLA Report 2018_11

PDR REVIEW REPORT

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İçindekiler Tablosu

1. Avionics and BFI

1.1. 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

1.2. 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)	

1.2.1. 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

PFD	MFD	EIS [2]
GDU 700( )/1060	GDU 700P/1060 [3]	GDU 700( )/1060 [3]
• Attitude • Airspeed • Altitude • Vertical Speed • Turn Coordinator • HSI • HSI Map [4] • Clock • Lateral and Vertical Deviation Indicators • Datalink Weather Display [1] • Radar Altimeter [1] • Autopilot Annunciations [1] • Flight Director [1] • Synthetic Vision [1] • Flight Path Marker [1] • System Advisories • Safety Monitors [1] • GPS NAV Status • Display Backup [1] [4] • Terrain Avoidance [1]	• Navigation Map • Traffic [1] • Terrain • Charts • Flight Plan • Weather [1] • Waypoint Information • Music Services [1] • Terrain Avoidance [1] • Engine Data [1] • System Advisories • Video [1]	• Fuel Qty (Main, Aux) • RPM/Tach • Propeller Sync Display • Manifold Pressure • Oil Pressure • Oil Temperature • Fuel Flow • Fuel Pressure • Fuel Calculations • Cylinder Operating Temperatures (CHT, EGT) • TIT • Lean Assist Mode • Carburetor Air Temperature • Intercooler Temperatures (IAT, CDT, Difference) • Amps/Volts • User Selectable Fields • User Adjustable Advisories

[1] Function availability dependent upon aircraft interfaces or enablement.
[2] Displayed engine operating parameters dependent upon configuration.
[3] GDU 700( ) MFD/EIS provides the same MFD and EIS functionality listed with the exception of weather radar and multi-engine.
[4] Not available for GDU 700L.

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.

LRU	14 Volt Current Draw		28 Volt Current Draw	
	Typical	Maximum	Typical	Maximum
GDU 700( )	3.0 A	6.0 A	1.5 A	3.0 A
GDU 1060	5.0 A	8.0 A	2.5 A	4.0 A
GRS 79/GMU 44	480 mA	958 mA	240 mA	479 mA
GRS 77/GMU 44	600 mA	1.0 A	300 mA	1.0 A
GSU 75( )/GMU 44/GTP 59	760 mA	958 mA	380 mA	479 mA
GDC 72/GTP 59	420 mA	958 mA	210 mA	479 mA
GDC 74( )/GTP 59	410 mA	480 mA	200 mA	235 mA
GAD 43	410 mA	720 mA	210 mA	350 mA
GAD 43e	790 mA	1.22 A	390 mA	590 mA
GCU 485	120 mA	357 mA	64 mA	179 mA
GEA 110	0.30 A	0.60 A	0.15 A	0.30 A

Figure 4 Electrical Load of Subsystems of G500 TXI

1.2.2. Garmin GTN750

Figure 5 Garmin GTN750

1.2.3. Garmin GMA345

Figure 6 Garmin GMA 345

1.2.4. Garmin GTX345

Figure 7 Garmin GTX 335/345

1.2.5. Garmin G5

Figure 8 Garmin G5

1.3. 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.

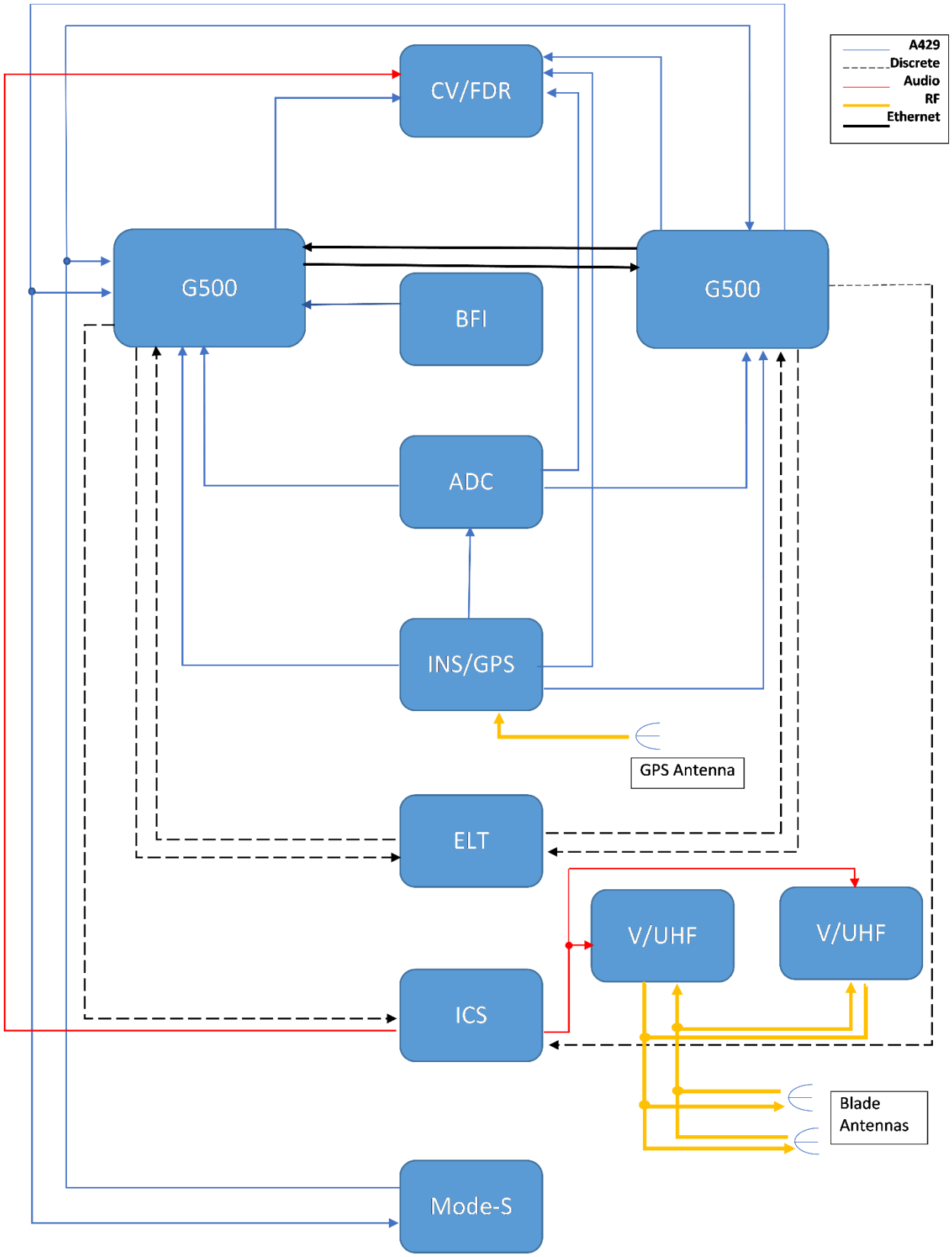


Figure 9 : The proposed avinoic architecture. Notice the legend.

1.4. 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/

2. Cockpit Design

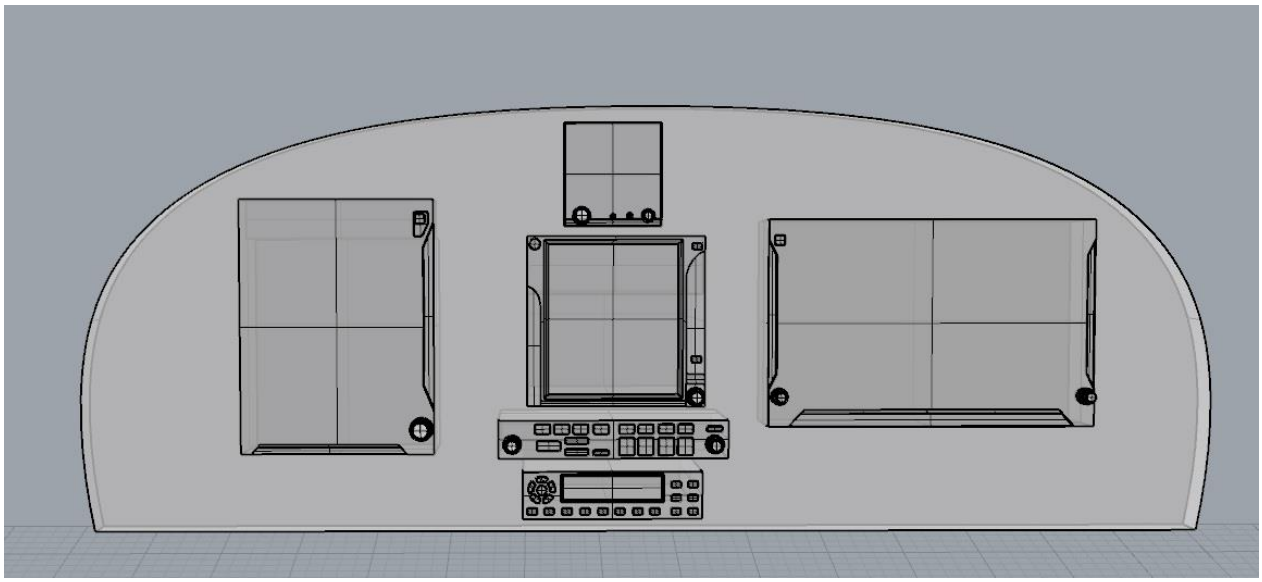


Figure 10 Proposed Cockpit Design

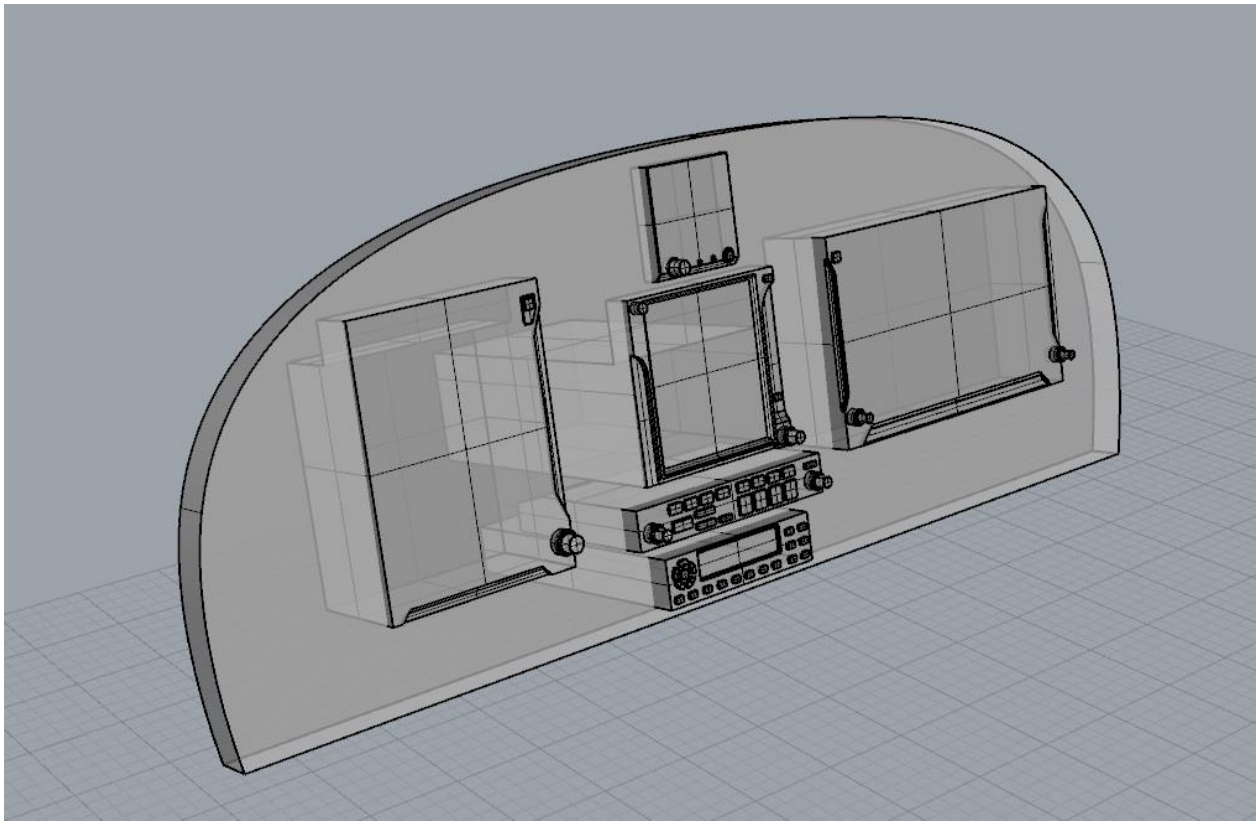


Figure 11 Proposed Cockpit Design

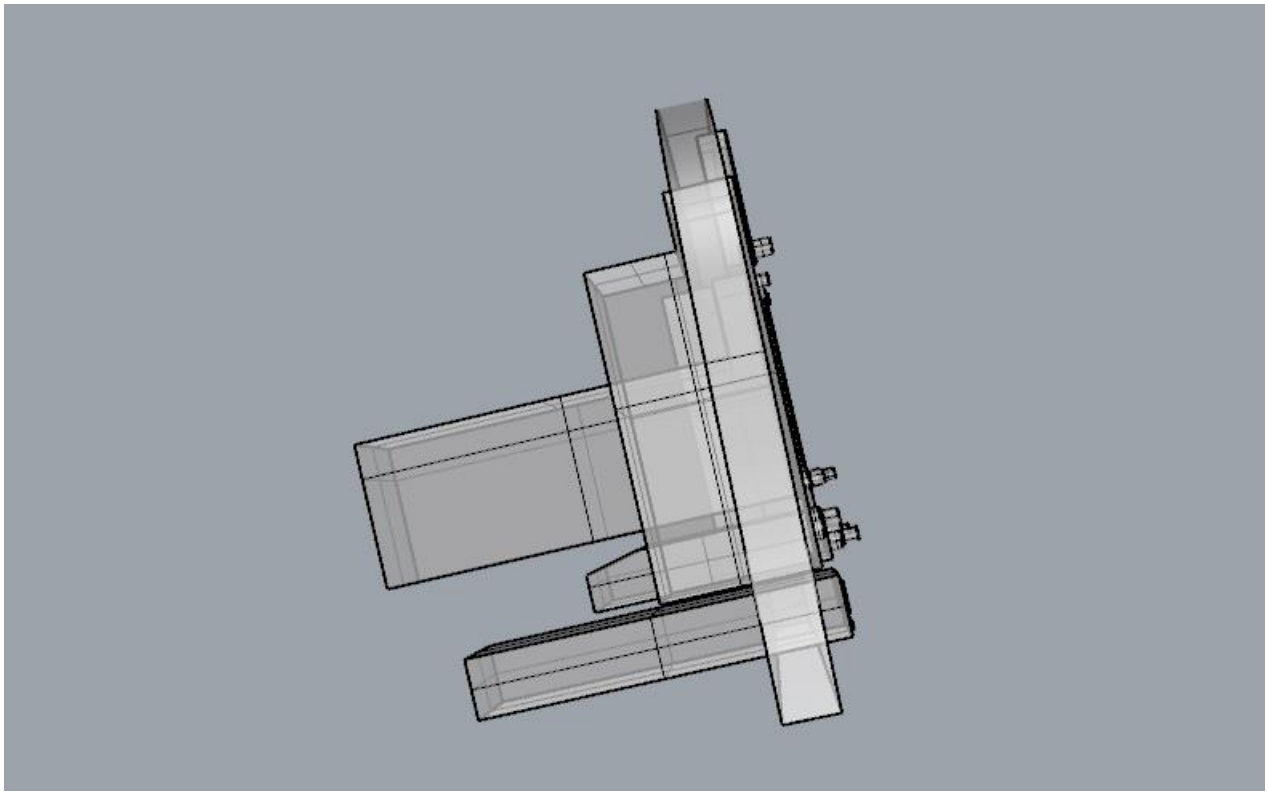


Figure 12 Proposed Cockpit Design

3. Motor Interface

3.1. 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

3.2. EIS Components

3.2.1. 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

3.2.2. Carburetor Temperature Probe

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

Figure 15 Carburetor Temperature Probe

3.2.3. Oil Temperature Probe

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

Figure 16 Oil Temperature Probe

3.2.4. 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)

3.2.5. 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

3.2.6. 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.

3.3. Rotax 912 Connection

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

4. 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.

4.1. GPS Antenna Installation on AQUILA AT01 (A21)

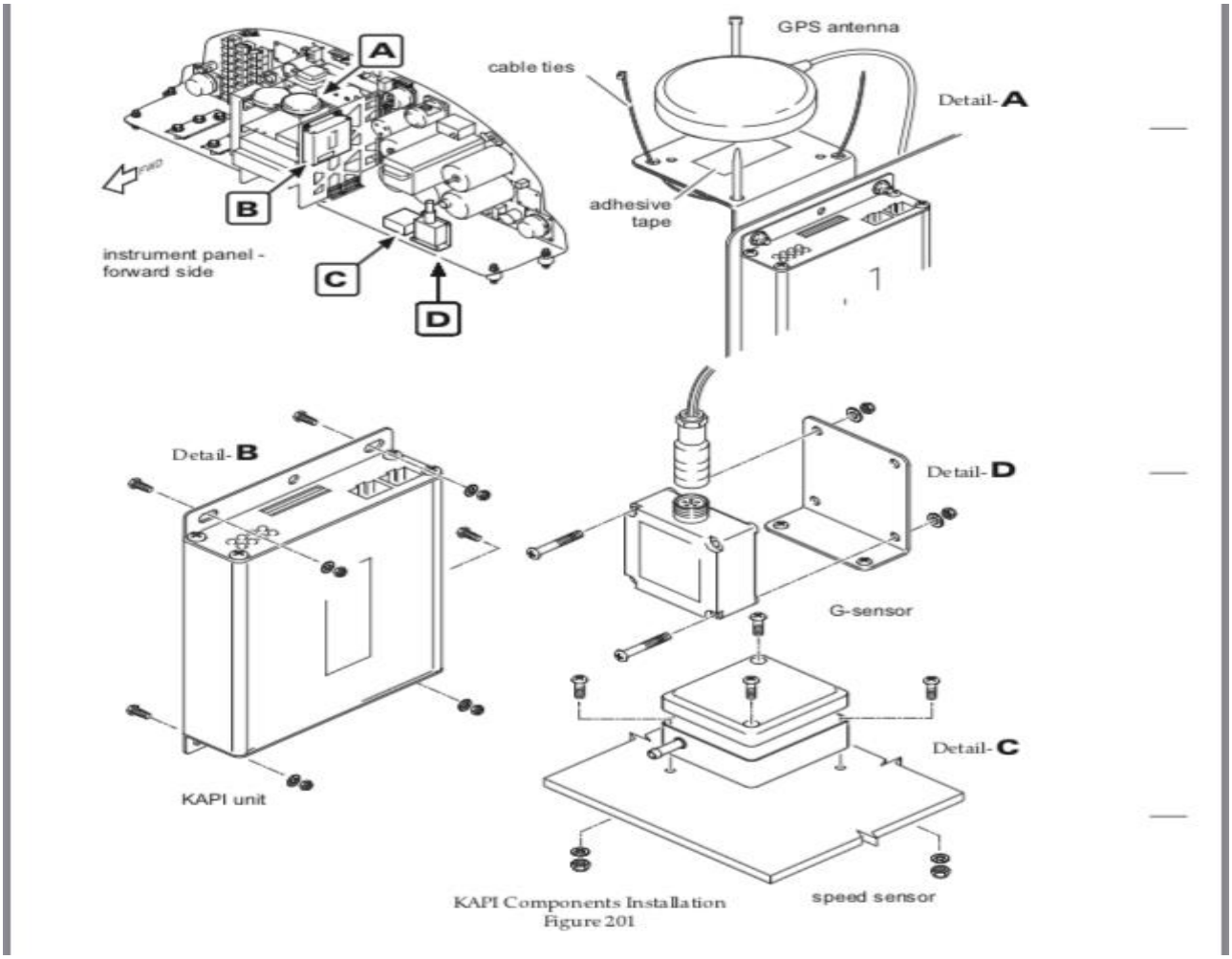


Figure 20 A

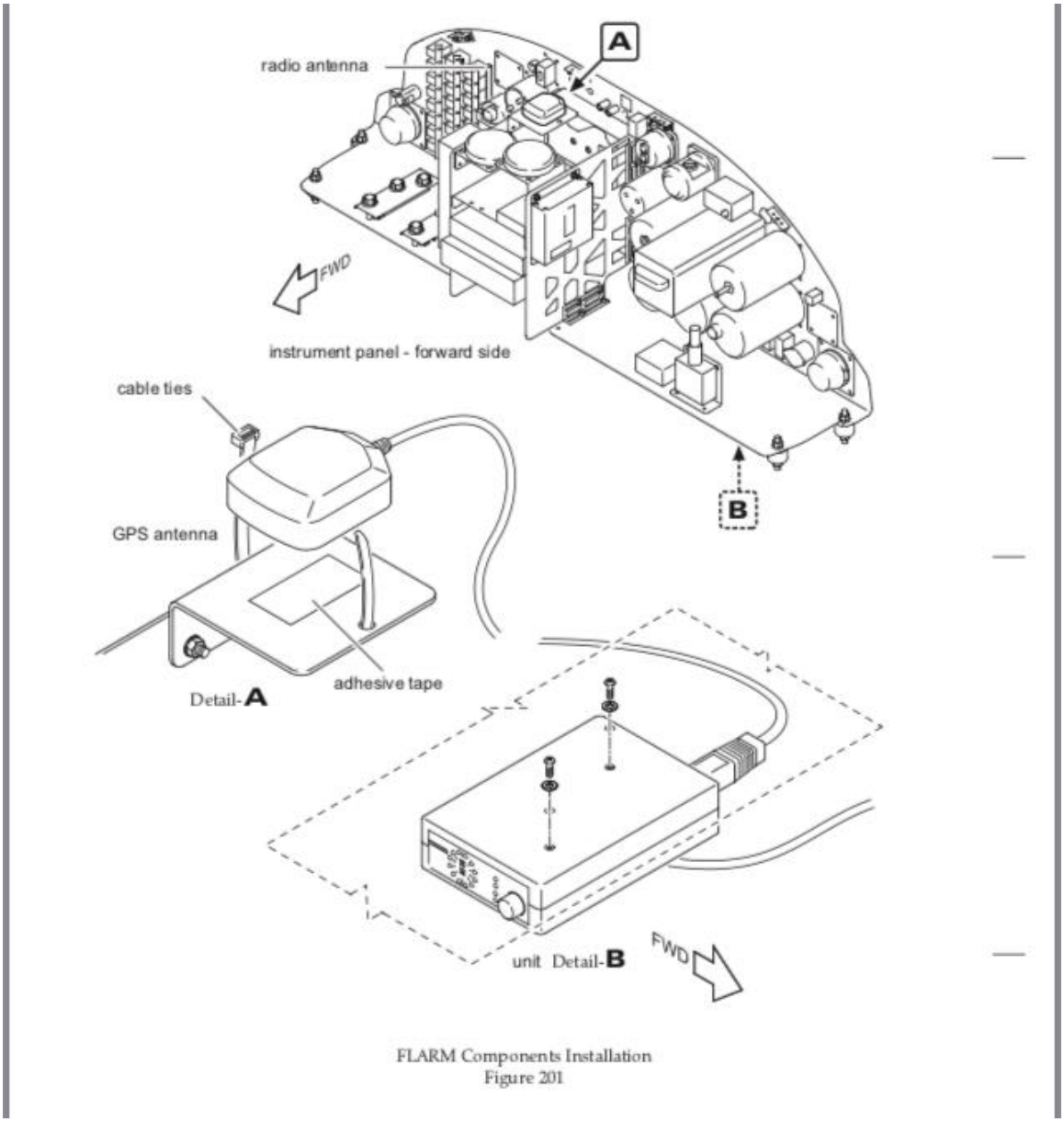
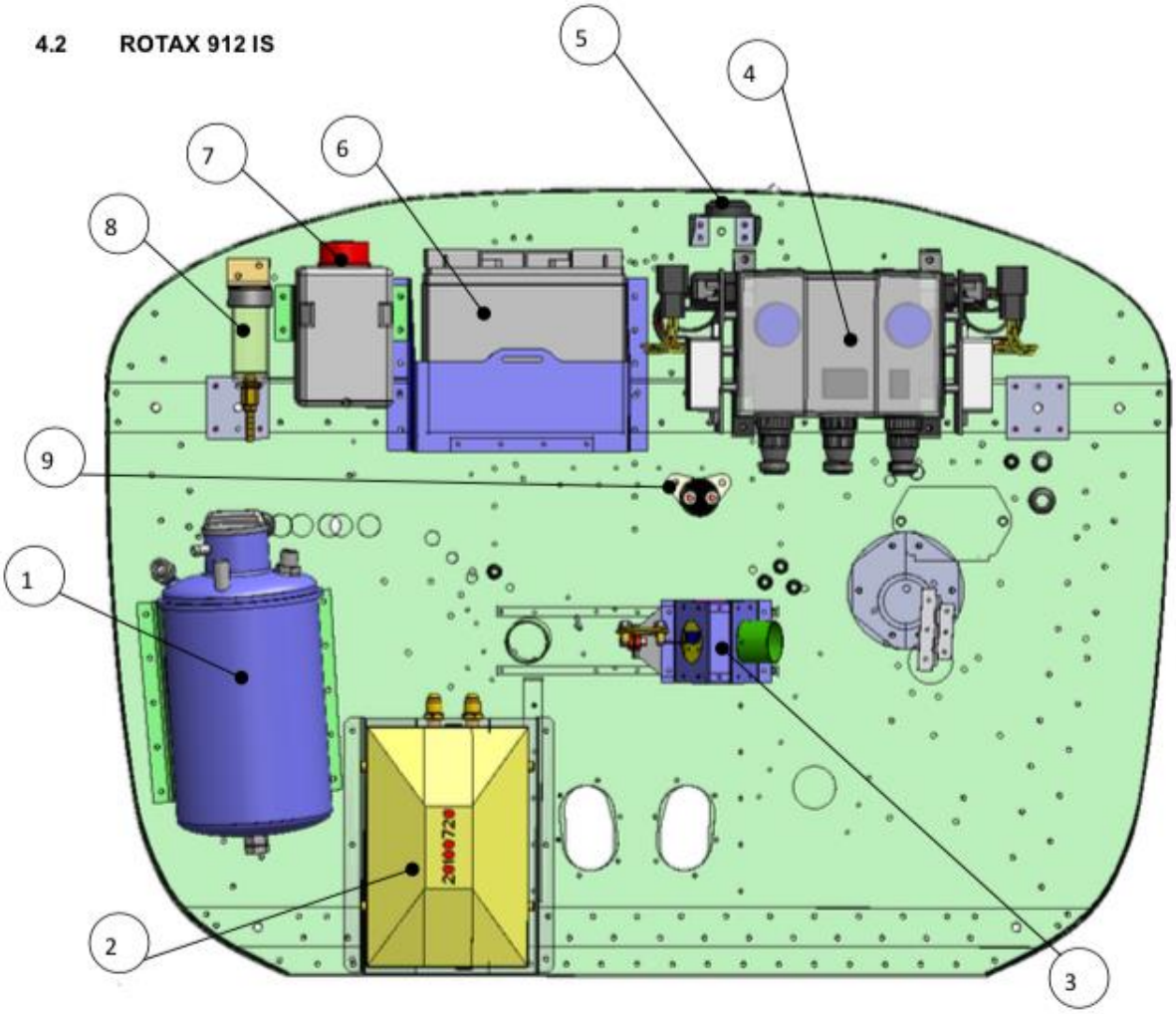


Figure 21 B

- 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).

4.2. GPS Antenna Installation on SLING 2



1	Oil reservoir	7	Coolant overflow bottle
2	Fuel pump assembly	8	Brake fluid reservoir
3	Cabin air inlet / splitter box	9	Starter relay
4	Fuse box		
5	GPS antenna		
6	Main battery		

Figure 22 C

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

4.3. General Light Aircraft Sensors

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

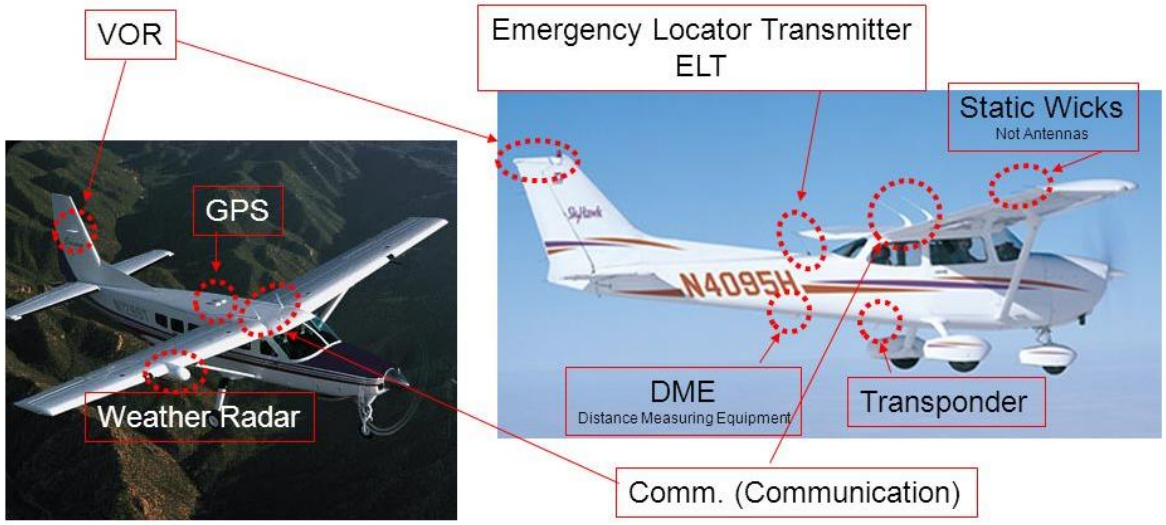


Figure 23 D

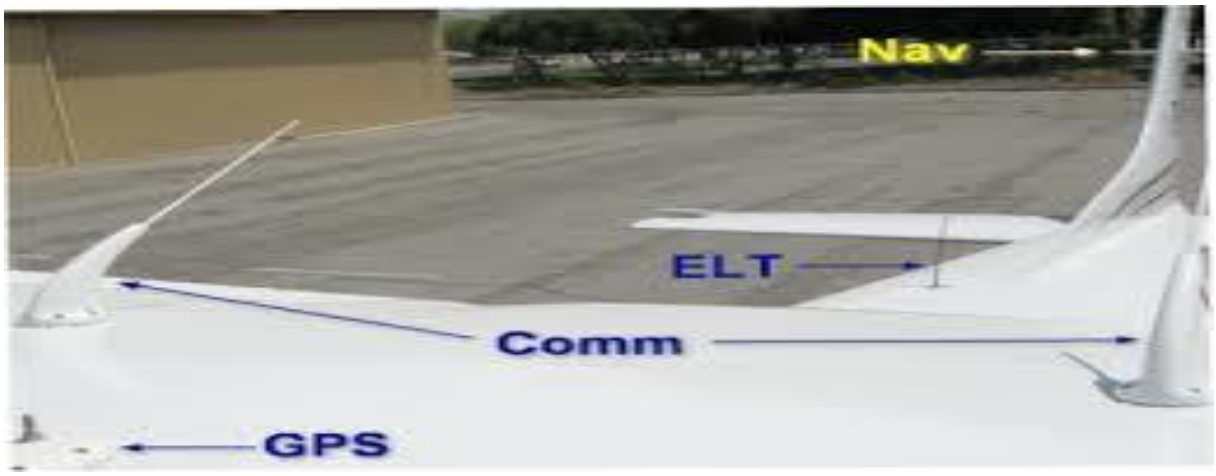


Figure 24 E

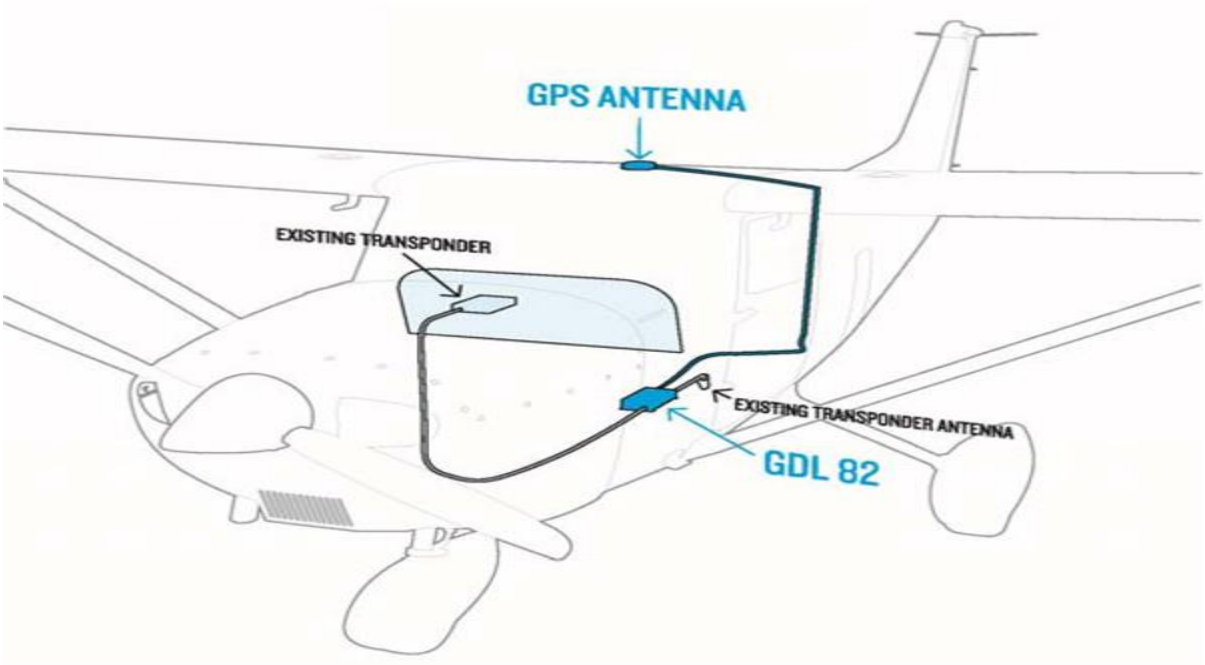


Figure 25 F

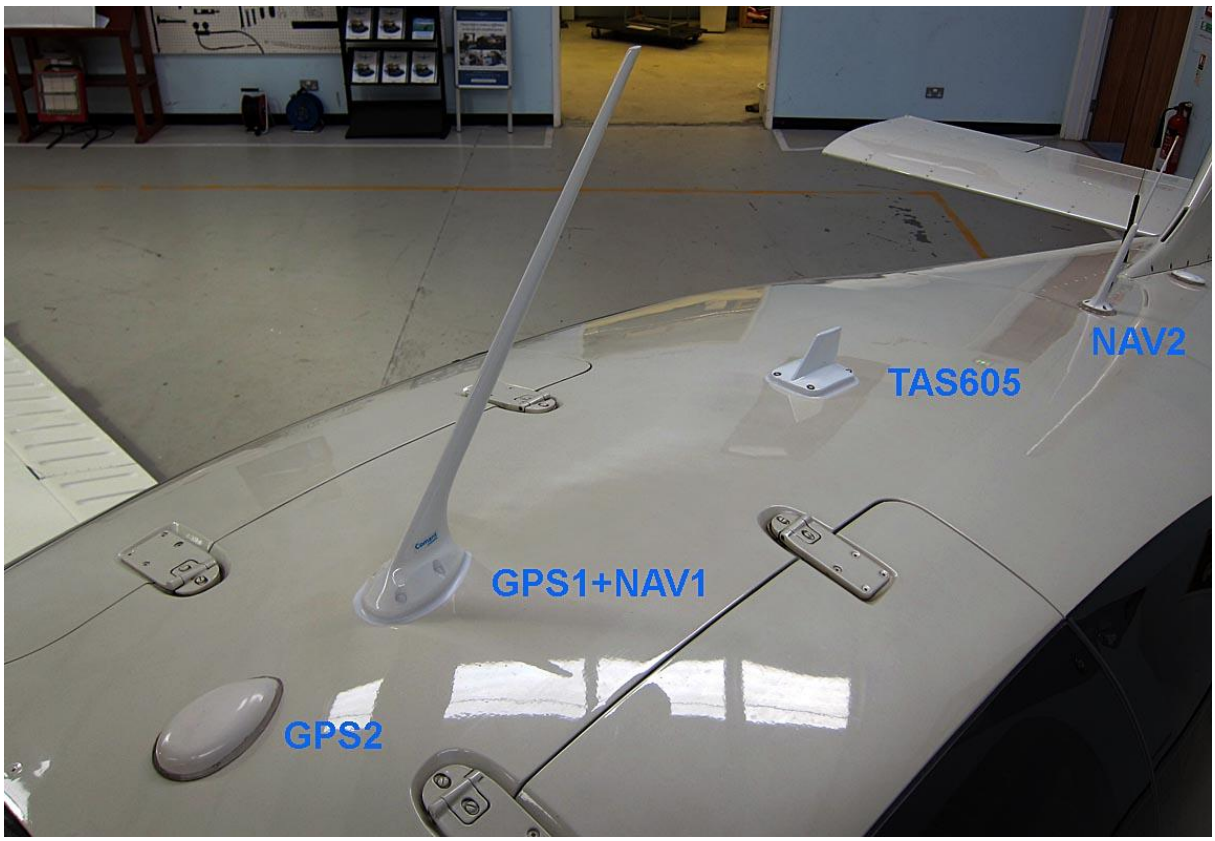


Figure 26 G

5. Circuit Diagram

5.1. Will be drawn again with sensors in professional manner.

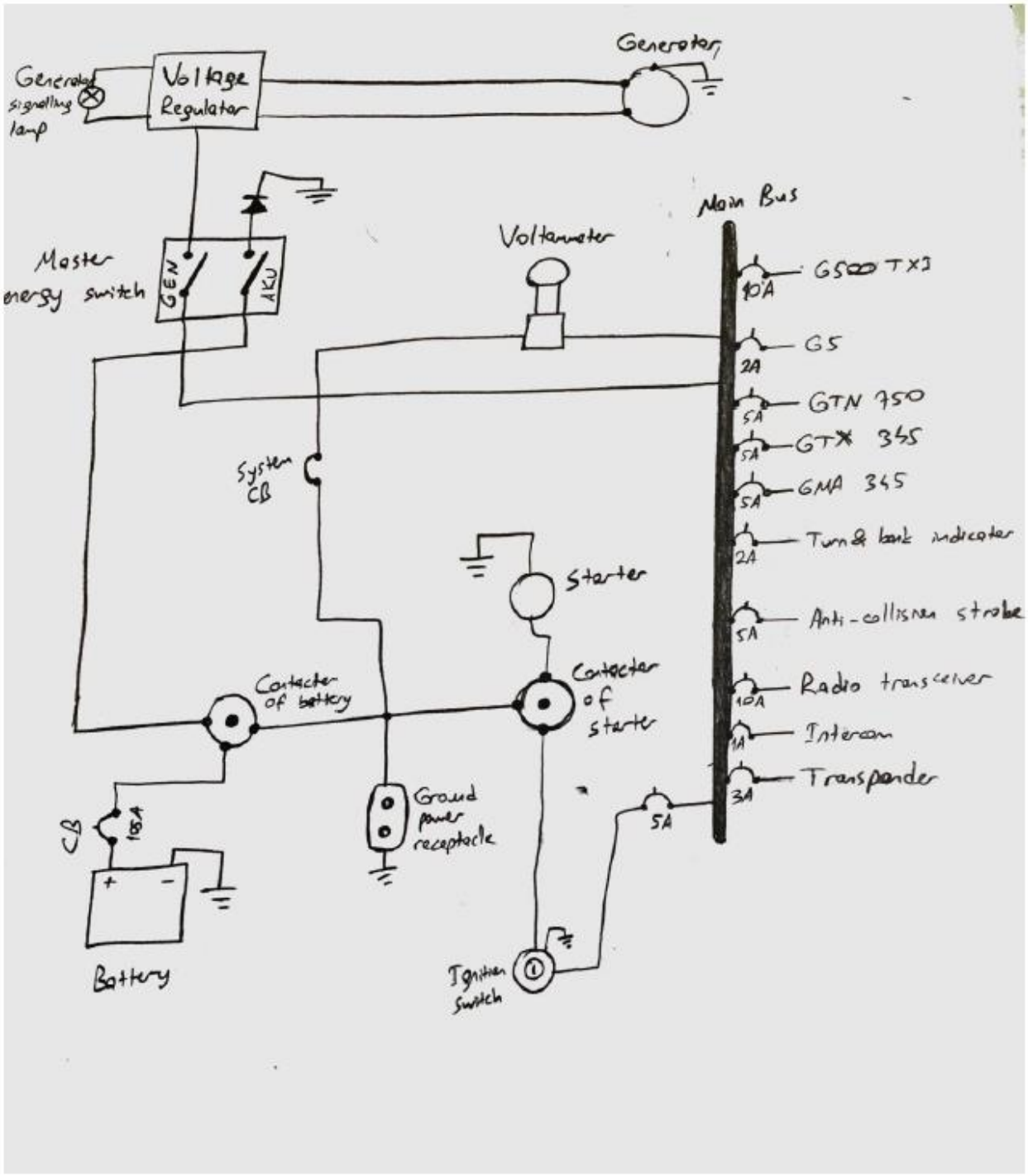


Figure 27 Circuit Diagram

6. 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.

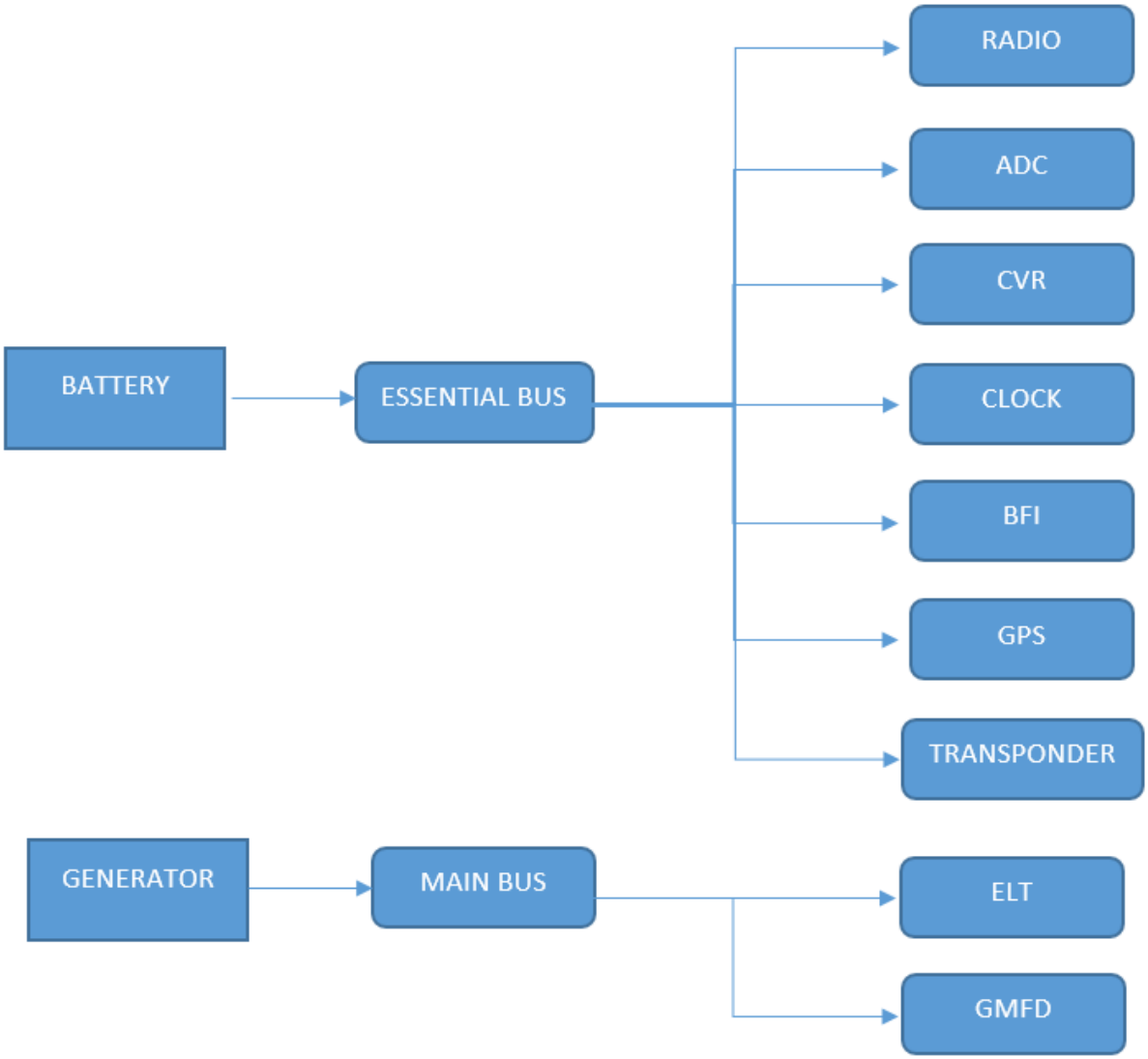


Figure 28 : Preliminary Electrical Architecture