Garmin G1000

The G1000 is a fully-integrated, all-glass cockpit avionics system designed for general aviation. This advanced technology replaces the conventional six pack instruments and avionics stack with a completely new cockpit layout and installation architecture. Two high definition LCD displays are the centerpiece of this avionics suite. The primary flight display (PFD) on the left is designed to display critical flight information while the multi-function display (MFD) on the right provides system monitoring and situational awareness. An audio panel (GMA) located between both displays allows the pilot to select the audio source.

Displays

The g1000 uses two identical high resolution displays on either side of the panel.
The left display is referred to as the Primary Flight Display (PFD)

- Displays primary flight instruments
  The right display is referred to as the Multifunction Display (MFD)
- Displays engine instrumentation, system parameters, and moving map overlayed with weather.
  Heat is dissipated from these displays by one small fan for each display.
  The heat is then directed away from the displays by the fan in the glare shield.
  These are both connected by the high speed data bus

Display Failure

If a display fails the system will automatically revert to reversionary mode.
The pilot can also manually enter the system into reversionary mode by pressing the display back up button.
In reversionary mode the high speed data bus is cut off and the working display will only have access to the systems on that displays GIA.
The GDC, GRS, GEA, and GTX LRUS follow a backup path to the remaining GIA for the data to be processed for that display.

The PFD

The PFD is connected to GIA 1
GIA 1 contains

- Processor
- VHF 1
- NAV 1

- G / S 1
- GPS 1

The MFD

The MFD is connected to GIA 2
GIA 2 contains

- Processor
- VHF 2
- NAV 2
- G / S 2
- GPS 2

Line Replaceable Units (LRU)

Beyond the displays is the hidden hardware called line replaceable units

- modules of the g1000 installed on a rack assembly
- can be removed or replaced easily
- helps to eliminate downtime for maintenance
- additional slots are also available as new technology is available

Garmin Integrated Avionics (GIA)

The heart of the g1000 is the GIA's
There are two GIAs in the system for redundancy
Each GIA has an independent micro processor that analyses the data coming from the Air data computer, Attitude heading reference system, engine airframe, and transponder LRU's.
The two GIA's run independently from each other so the information can be crosschecked and prevent corrupted data from being sent out.

Both GIA's are integrated with communication and navigation radios.

- GIA 1
  - COM 1
  - NAV 1
  - GPS 1
  - Flight Director
  - ELT
- GIA 2
  - COM 2

- NAV 2
- GPS 2
- Data Link

Two combined Antennas are installed on top of the cabin. The left antenna is COM 2/ GPS 2, and the right antenna is COM 1/ NAV 1.
The first GPS that becomes active during initialization becomes the primary GPS for navigation.
For conventional navigation two dipole antenna are placed on top of the vertical stabilizer for VOR and glide slope reception.

GIA Failure

In the event of a GIA failure the remaining GIA take over all computing and display functions through the high speed data bus without any pilot input.
COM and NAV functions from the failed GIA would be rendered unusable and red flagged.

Dual GIA Failure

In the event that both the GIA's fail, all COM and NAV functions would be lost. The pilot would not have the ability to navigate or communicate with instruments.
The Engine Airframe (GEA), and the Transponder (GTX) do not have a backup path around the GIA's. The pilot would receive no information pertaining to the engine systems, or transponder.
The Air Data Computer and the Attitude Heading Reference System LRU's would be the only ones feeding the displays. This would still display attitude, heading, airspeed, altimeter info, vertical speed, OAT, and TAS.

Garmin Data Computer (GDC)

The garmin air data computer processes and computes data from the pitot static system using a pitot tube, static port, and an outside air temperature probe.

- The GDC is located in the AFT baggage compartment
  Information derived from the GDC are, IAS, TAS, altitude, and vertical speed.
  The pressure altitude derived from the GDC is also used to operate the transponder in altitude mode.

GDC Failure

If the GDC fails, the airspeed, altitude, vertical speed, true airspeed and outside air temperature will be flagged as INOP on the PFD.

Garmin Reference System (GRS)

The garmin Reference system is a solid state gyro system. It has no internal moving parts. It is coupled with a magnetometer and provides accurate attitude, turn rate, and heading information.
The GRS uses highly accurate inertial sensors called Micro Electronic Mechanical Sensors (MEMS). Theses sensors detect rate change around the longitudinal, lateral, and yaw axes. Each sensor is made of tiny elements that vibrate at a specific frequency. When a change in acceleration occurs the frequency changes slightly which induces a voltage that can be measured as a change in pitch, bank, or yaw.

GRS Failure

In the event of a GRS Failure, attitude, turn rate and heading representations are lost and flagged INOP.

Garmin Magnetometer (GMU)

The GMU is a solid state magnetometer with no moving parts. This can accurately. sense the earths magnetic field in the vertical and horizontal plane. Data is then transmitted to the GRS to process heading information. The GMU is installed in the left wing away from any magnetic disturbance.

GMU Failure

If the GMU fails, magnetic heading is lost and flagged INOP.
The GRS will continue to operate without heading inputs from the GMU.

Garmin Engine Airframe (GEA)

The GEA processes incoming data from sensors linked to the engine, electrical, and fuel systems. This system allows for extreme precision.
These systems are constantly monitored and will alert the pilot if they are approaching or exceeding a limitation.
The GEA is the only LRU installed behind the MFD.
If the GEA fails all engine, electrical, and fuel system monitoring is lost and flagged INOP.

Garmin Transponder (GTX)

The GTX is a digital transponder that provides

- MODE A (no altitude)
- MODE C (altitude reporting)
- MODE S (altitude reporting with datalink capability)
  The unit is installed in the avionics bay with its associated antenna under neath the fuselage.

If the GTX fails all transponder functions are lost. It is important to note that the GDC needs to interface with the transponder to provide altitude reporting. If the GDC fails the transponder will automatically degrade to MODE A with no altitude reporting and may preclude operation in some airspace per FAR 91

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Mounting Positions

Mounted in the avionics bay underneath the aft baggage compartment:

- Garmin Data Computer (GDC)
- Garmin Integrated Avionics (GIA)
- Garmin Transponder (GTX)
  Mounted behind the MFD
- Garmin Engine Airframe (GEA)
  Mounted in the left wing
- Garmin Magnetometer (GMU)