Piper Aircraft

M500

Product Launch and Enhancements

2015

M500 G1000 Enhancements

High Level Scope:

- GDU Software Version 14.0 (Standard)

- GMA-350 Digital Audio Panel (Standard)

- Aspen EFD1000 Standby Instrument (Standard)

- Technomark EL Placards (Standard)

- GRC 10/GRT 10: Wireless XM Radio Remote Control (Option)

- True Blue Power Dual USB Charging Ports (Standard)

- GTS 825 Traffic Advisory System (Option)

- GSR-56 Iridium transceiver (Option)

- ADF 3500: Becker remote mounted ADF (Option)

- GFC 700 Enhancements Features (Standard)

- Enviro Digital Cabin Pressurization Control System (Standard)

M500 G1000 Enhancements
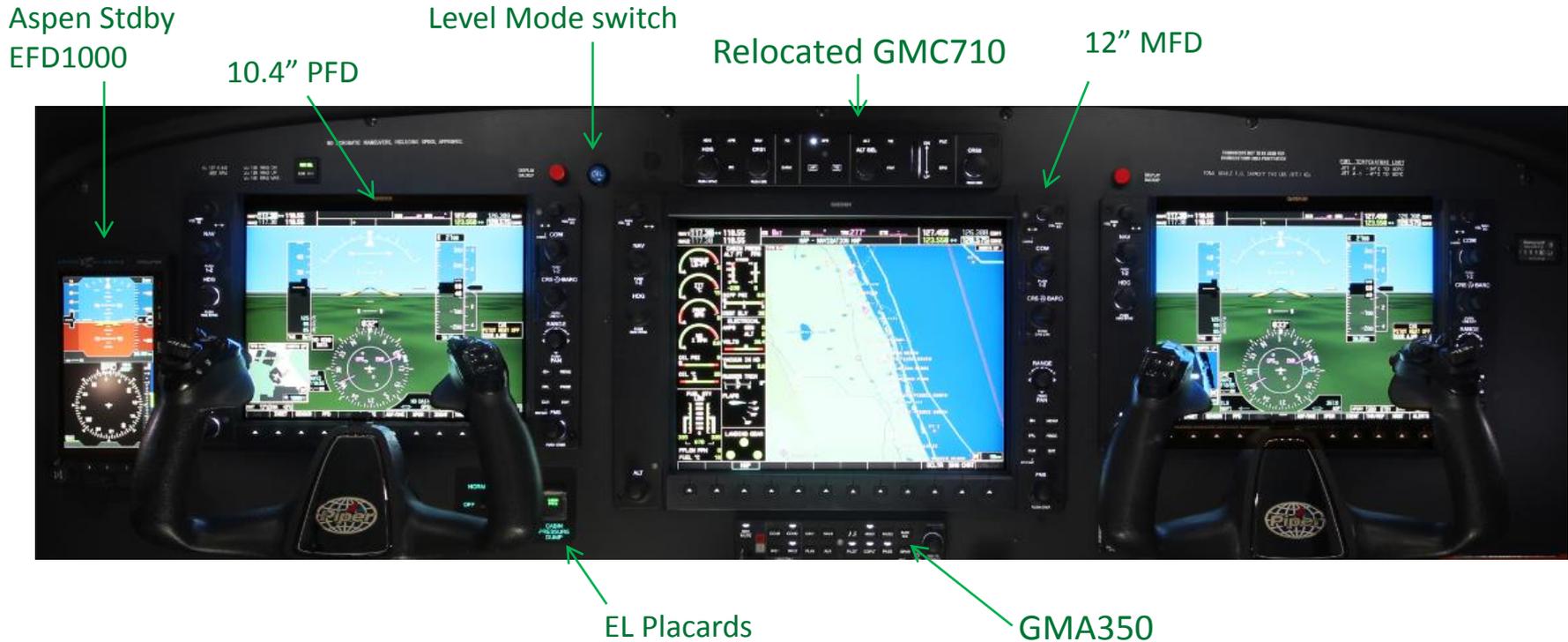
- **Software** *(Standard)*
  - **Phase 3 Software Highlights**
    - GDU Software version 14.0
    - Bottlang Charts
    - Flight Plan Overlay on Weather Radar page
    - Flight Plan Upload via GSR 56
    - Position reporting support for GSR 56
    - Revert to GPS track when heading not available
    - Sync active Navigation Database
    - Display Weather Radar information on Moving Map
    - Smart Airspace Decluttering
    - Display of Piper PA46 Ownership Icons
    - ADS-B IN Phase 1 Applications (AIRB, SURF, VSA, CSA)
    - GSR 56 telephone directory support
    - Includes highly configurable EIS
    - Gear Position – incorporated into G1000
    - Gear and Stall Warning – incorporated into G100
    - Master Caution/Master Warning (eliminates Eaton push button switches)
  - **Enviro CPCS**
    - Replaces mechanical Cabin Pressurization System

M500 Instrument Panel

Aspen Stdby EFD1000

Level Mode switch

Relocated GMC710

12" MFD

10.4" PFD

EL Placards

GMA350

Other instrument panel highlights

- ADF removed from Instrument Panel. Integrated with G1000.
- Gear position, Master warning, Master caution, Cabin alt mute, Gear warning mute switches removed. Integrated with G1000.
- CPCS controller removed. Integrated with G1000.
- Wet compass removed.

M500 G1000 Enhancements

- **GMA-350 Digital Audio Panel**   *(Standard)*
  - Supports 3D audio
  - Future Automatic Speech Recognition (ASR) support
  - Ambient noise reduction via internal mic, settings to be determined

M500 G1000 Enhancements

- **EFD1000 Aspen Electronic Standby Instrument**   *(Standard)*
  - 6 inch high resolution display
  - Automated power switching
  - Reduced cost and weight
  - Replaces:
    - Stby attitude indicator
    - Stby airspeed indicator (ASI)
    - Stby Altimeter
    - Whiskey (Wet) Compass

M500 G1000 Enhancements

(Standard)

- **Technomark Electroluminescent (EL) Placards**
  - Replace Astronics EL Circuit Breaker Placards with Technomark EL Placards (cost reduction).
  - Replace the following lower Instrument Panel transfers/decals with Technomark EL Placards:
    - "Tie Bus" transfer 104349-044
    - "Park Brake Pull On" transfer 104349-042
    - "Bleed Air Pull Off" transfer 104349-041
    - "Landing Gear" decal 84967-343
    - "Emergency Gear Extension" transfer 84967-015
    - "Flaps" decal 84967-315
    - "Defrost Pull/on" transfer 104349-009

M500 G1000 Enhancements

- **True Blue Power Dual USB Charging Port.** *(Standard)*
  - Output Power 2.1 amps per port
  - Input Voltage 10 – 32 VDC
  - Output Voltage 5 VDC $\pm$ 0.25 per port
  - Charge one /two products simultaneously with a USB interface
  - Short-circuit, over-current and over-temperature protection
  - 4 Dual USB Charging Ports per Aircraft
    - 2 cockpit - one each located on Pilot and Co-Pilot side panels.
    - 2 cabin - RH window panel - located on fwd and aft audio/switch panels.

- **110VAC Power Outlets** *(Option)*
  - Between aft facing cabin seats

M500 G1000 Enhancements

- **GRC 10/GRT 10: Wireless XM Radio Remote Control**   *(Option)*
  - Bundled with GDL 69A option XM WX Satellite Radio/Weather

M500 G1000 Enhancements

- **GTS-825 Traffic Advisory System** *(Option)*
    - ADS-B In Traffic System provides a comprehensive traffic picture
    - Coupled with GTX 33ES provides ADS-B IN and OUT
    - Tracks up to 75 targets up to a 40 nm interrogation range
    - Spoken ATC-like aural alerts help keep your eyes outside scanning for targets
    - Dual GA-58 directional antennas

M500 G1000 Enhancements

- ## GSR-56 Iridium transceiver *(Option)*

  - Sat Phone, Voice and Text Messaging
  - SMS text messages via MFD
  - Voice calls via crew and cabin headsets
  - Worldwide Weather through Garmin Flight Data Services
  - Priority scheme to be defined during design phase
  - Aft equipment shelf installation
  - Sensor Systems S67-1575-109 Antenna

M500 G1000 Enhancements

- **ADF 3500: Becker remote mounted ADF**   *(Option)*
  - Replaces KR-87 ADF
  - Integrates fully with G1000
  - Consists of:
    - RA 3502 Receiver
    - AC 3504-1 RMI Converter
    - AN 3500 Antenna

Avionics/Electrical – Overview

- – GRC 10/GRT 10: Wireless XM Radio Remote Control

- – GTS 825 Traffic Advisory System
  - ADS-B In Traffic System provides a comprehensive traffic picture
  - Coupled with GTX 33ES provides ADS-B IN and OUT

- – ADF 3500: Becker remote mounted ADF
  - Integrates fully with G1000

- – GSR-56 Iridium transceiver
  - Sat Phone, Voice and Text Messaging
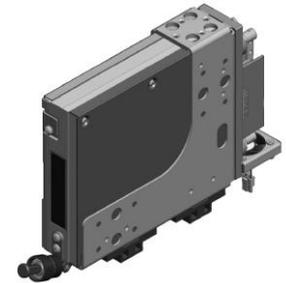
Enhanced AFCS

Enhanced AFCS

- Underspeed Protection (USP)
- Coupled Go Around
- Expanded Engage Envelope
- Level Mode
- Electronic Stability and Protection (ESP)

M500 G1000 Enhancements

(Standard)

- **GFC 700 Enhanced Features**
  - **Level mode**
    - **Manual mode selection (NPF-0011 section 4.1.4)**
      - Included with basic AP installation
      - LVL Push button switch, located adjacent to AP controller
      - Selection of LVL control results in AP engagement in roll and pitch modes with level roll and zero pitch command.
      - Selection of LVL control when AP already engaged to be discussed further during preliminary design phase
    - **Automatic mode activation (NPF-0011 section 4.2.1)**
      - Included with ESP installation (option)
      - Trigger based on current Garmin implementation
        » % time ESP engaged over a given time interval
      - Trigger values to be agreed upon during flight test evaluation
      - Level mode PBA to be lit when automatically activated
    - **Subsequent selection of any AP mode or disengagement of AP terminates Level mode**

ELECTRONIC STABILITY PROTECTION

Electronic Stability Protection

- Helps prevent the onset of:
  - Stall/Spins
  - Steep Spirals
  - Loss-of-control conditions
- Functions independently of the auto pilot system
  - Operates in the background
- Only takes effect when the pilot is hand-flying the aircraft with the auto pilot disengaged.
- Activates whenever the airplane exceeds one or more flight parameters.
- Helps correct excessive pitch attitude, roll attitude, or airspeed.

Electronic Stability Protection

Modes
- Pitch
- Roll
- High airspeed

No Pilot Help

Increasing Force

Strong Righting Force
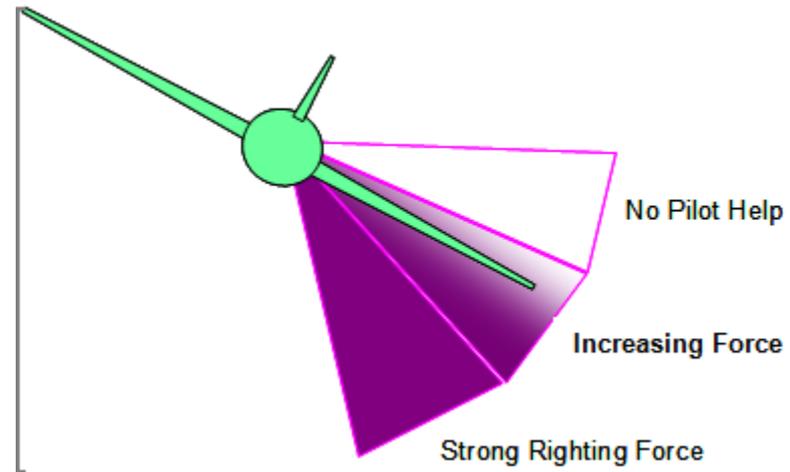
- Designed to provide a correcting force that maintains pilot feel.

- As the bank angle is increased, a region of an increasing force as a function of bank angle is entered.

- The envelope protection system adds bank stability in this region. As the bank angle is increased further, a constant force is applied to right the airplane.

Electronic Stability Protection

- ESP utilizes the same sensors, processors, and actuators as the GFC 700 autopilot but operates separately from the GFC 700.

- Manual Electric Trim (MET) and automatic trim are both disabled when ESP is active.

- Yaw damper and ESP operate independently (separately or simultaneously).

- ESP can be easily overpowered by the pilot and can be temporarily disabled using the AP disconnect or CWS switches.

- The force levels of ESP are designed such that the pilot can easily maintain the airplane attitude within the protected region if desired, but also strong enough to provide a deterrent.

Electronic Stability Protection

ESP will engage at a predetermined bank or pitch angle:

- Roll:
  - 45 degrees

- Pitch:
  - 17 degrees nose up
  - 15 degrees nose down

AUTOPILOT AUTO-ENGAGE

Autopilot Auto-engage

- The GFC700 will automatically engage in LVL mode if ESP has been engaged for a significant interval. This interval is aircraft specific via certification gains and is defined as a threshold of percentage of time X over a time interval Y.

- So if ESP has been engaged for greater than X% of the time over the last Y seconds, the AP will automatically engage in LVL mode (note that this does not require the aircraft to otherwise have a means of manually selecting LVL mode).

- When the AP engages, an aural message "Engaging Autopilot" will annunciate.

LEVEL MODE

Level Mode

- The level function is an autopilot mode which utilizes existing lateral and vertical autopilot algorithms and gains to return the aircraft to a wings level attitude with zero vertical speed.

- Upon engagement the level mode will automatically engage the flight director and autopilot and begin to control the aircraft to straight and level flight.

  - Note that this functionality is different than all other autopilot modes which only engage the flight director when the mode is selected and require a separate engagement of the autopilot via the AP button on the mode controller or GDU.

- The LVL mode annunciation is displayed on PFD(s) AFCS Status Box as both the roll and pitch modes while the mode is active.

Level Mode

- Activating the level mode cancels all armed and active modes.

- All other AP modes are available while the level mode is active by pressing the associated mode button on the mode controller.

  - Note that the level mode is both a vertical and lateral mode. Selecting either a separate vertical or lateral mode while the level function is active will result in transitioning to the selected mode while maintain the level mode for the vertical or lateral mode which has not explicitly been selected. For example, selecting heading mode while the level function is active will result in heading mode for the lateral mode and level mode as the vertical mode. Similarly, selecting altitude mode will result in altitude hold for the vertical mode and level mode for the lateral mode.

- When the LVL button is pressed, the result is always that the AP is engaged in LVL mode. Pressing the LVL button while in LVL mode has no effect. Pressing the LVL button with the AP on or off will result in the AP on and LVL mode.

UNDERSPEED PROTECTION

Underspeed Protection

- Underspeed Protection (USP) is a flight director function that reacts to underspeed conditions in a way that allows the autopilot to remain engaged but prevents the airplane from stalling.
    - Some flight director modes are non-altitude critical modes where there is no defined flight path or obstacle clearance is not important.
    - Other flight director modes are altitude critical where compliance with the programmed flight path may be very important.

- The non-altitude critical modes are defined as the flight director modes of VS, VNAV, PIT, and LVL. USP in these modes is triggered by airspeed and is just a transition from following the selected reference to following a minimum airspeed.
    - This provides for smooth transition to USP and also can provide a larger stall protection margin.
    - In these non-altitude critical modes, the system provides a more smooth transition and less aggressive flight path tracking.

Underspeed Protection

- FLC and IAS may be considered as non-altitude critical modes since they are airspeed command modes. There is no dedicated USP for FLC and IAS, as these modes have a minimum commandable airspeed which provides the same functionality as USP.

- The altitude critical modes are defined as the flight director modes of ALT, VS, GP, TO and GA. There is also a portion of the FLC algorithm that comes into effect that prevents the airplane from descending away from the selected altitude. When the altitude hold submode of FLC is active, then FLC is also considered an altitude critical mode. USP in the altitude critical modes is triggered by stall warning. This allows the airplane to slow as much as possible in these modes based on flap position, bank angle, and weight but still protect against a stall. In these modes when stall protection is triggered, the airplane responds more abruptly and aggressively attempts to minimize flight path deviation while preventing a stall.

Underspeed Protection

Altitude Mode Type	Flight Director Mode	USP Active	USP Trigger Input
Non-critical altitude mode	VS, VNAV, PIT, LVL	Yes	Airspeed
	FLC, IAS	No	N/A
Critical altitude mode	ALT, VS, GP, TO, GA, FLC in altitude hold mode	Yes	Airspeed, Stall warning (AOA or discrete)

- For both cases, the autopilot will remain engaged and protect from an impending stall by lowering the nose as required. Note that in the altitude critical case, if a large deviation is allowed to develop before adding power, and then significant power is applied, the airplane will pitch up at a limited g loading initially (to avoid a g induced stall) and the airplane will accelerate away from stall speed. Then as the airplane accelerates to a speed where higher g loadings can be tolerated, will pitch up more aggressively to a high pitch attitude as it trades airspeed for altitude in an attempt to aggressively regain the reference flight path. See Table 1 for details of the USP trigger inputs.

- A "USP ACTIVE" warning message will be displayed when the USP feature is activated.

COUPLED GO-AROUND

Coupled Go-around

With the stall protections developed as part of the Underspeed Protection (USP) system, coupled go arounds are possible such that the autopilot does not disengage. With this feature, the AP will remain engaged and fly the missed approach. If power is not added, the USP system will maintain a speed just above stall warning, adjusting the airplane's pitch attitude as required.

EXPANDED ENGAGEMENT ENVELOPE

Expanded Engagement Envelope

- Expanded engagement envelope is an autopilot function that, when enabled, allows autopilot engagement up to the limits prescribed by TSO-C9c for automatic pilots (+/- 75° in roll and +/- 50° in pitch).

M500 Standard Equipment

Standard Equipment List	
• G1000 Avionics Suite with Synthetic Vision	• Garmin FliteCharts
• GIA 63W NAV/COM/GPS	• SafeTaxi
• GFC 700 Autopilot with GMC 710 Autopilot controller	• Dual GDC 74A Air Data Computers
• *Enhanced AFCS*	• GWX 68 Weather Radar
• GCU 476 key pad	• Electroluminescent Placards (IP + CB)
• **GMA-350 Audio Panel**	• **Transponder#1 GTX 33 ES**
• **EFD-1000 Aspen Standby System**	• **Dual USB Charging Ports**
• **Upgraded G1000 Software**	

Items in **Bold** are new to the M500.

M500 Optional Equipment

Optional Equipment List	
• **GTS-825 Traffic Advisory System**	• TAWS-B
• **GSR-56 Iridium Transceiver**	• DME BendixKing KN63
• **ADF-3500 Remote Mounted ADF**	• GTX 33ES Second Transponder
• **115 V AC Power Outlets**	• Diversity Digital Transponder
• GDL 69A XM WX Satellite Radio/Weather (**includes GRC / GRT 10 wireless XM Radio Remote)**	• TAWS-B
• WX-500 Stormscope	

Items in Bold are new to the M500.

GTS-825 combined with standard GTX-33ES makes the Meridian M500 ADS-B IN and OUT compliant

Contact Details:

Jackie Carlon
Director of Marketing and Corporate Communications
Piper Aircraft, Inc.
2926 Piper Drive
Vero Beach, FL 32960
Ph.: 772-299-2859
E-mail: jackie.carlon@piper.com