AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B)

ADS-B sends data to and from equipped aircraft in two formats. One format is called Universal Access Transceiver (UAT). It provides weather from Flight Information Service-Broadcast (FIS-B) and traffic from Traffic Information Service-Broadcast (TIS-B). UAT is considered the "general aviation" solution and is valid in all U.S. airspace except Class A. UAT operates at 978 MHz, similar to a transponder signal.

The other format is called 1090ES for 1090 MHz Extended Squitter. 1090ES provides traffic information and is valid in all airspace worldwide.

FIS-B weather and TIS-B traffic were added to the ADS-B system in the U.S. to provide incentive to incorporate ADS-B into the general aviation fleet.

ADS-B is related to, but different from, the Traffic Collision Avoidance System (TCAS).

UAT In/Out equipped aircraft can communicate their identity and position to each other without the aid of a ground station. That allows us to see another aircraft's trajectory on a moving map in near real-time. Similarly, TCAS equipped aircraft can process 1090ES signals. In other words, 1090ES-equipped aircraft are seen directly on TCAS. But a 1090ES-equipped aircraft without TCAS requires a ground station to receive traffic information. And a UAT equipped aircraft without TCAS will only see 1090ES aircraft via a ground station.

UAT-UAT: Both aircraft see each other without ground stations
UAT-1090ES: Needs a ground station to link the aircraft
1090ES-1090ES: Needs a ground station
1090ES-TCAS: TCAS can see 1090ES

This aircraft transmits and receives ADS-B through the transponder antenna using both UAT and 1090ES. The GTX 345 transponder processes the signals it receives from ground stations and from other UAT-equipped aircraft within transponder range. The transponder sends ADS-B information to the GTN 750xi (GTN) and PFD by a wired connection, and to Foreflight by a Bluetooth connection.

ALTERNATE ENGINE AIR

The pilot can select a source of alternate engine air in case the air filter is blocked by ice, water, or other foreign objects. The bypass consists of a sliding metal plate in the bottom of the filtered air box below the engine. The plate normally blocks an opening in the air box. When the ALT ENG AIR control is pulled, the plate swings away allowing unfiltered air from the cowl area to enter the engine.

The bypass can not be reset in flight. It is normally tested annually during routine maintenance. If the control is used, it should be left in the full out position until the cowl can be removed and the valve reset and sealed. The control is secured by a break-away device to prevent inadvertent actuation.

AUDIO SYSTEM

The audio system's central component is the audio panel. See the manufacturer's instructions for details of the audio panel operation.

PS Engineering PMA8000BT Audio Panel

Audio is available from a number of sources. Currently, the following components provide audio to the headphones and cabin speaker:

Com1:	GTN 750xi
Com2:	SL30
Nav1:	GTN 750xi
Nav2	SL30
Marker	Not used
ADF	Not used
AUX	GTX345 for traffic warnings
PFD	Provides unmutable flight and system warnings
Headsets	As required
Intercom	Available to all headsets

Each seat is provided with jacks for aviation headphones. Two different types of jacks are available to accommodate various types of headphone connectors. Only one headphone should be connected at any seat. If a headset is not in use, it should be disconnected to prevent introduction of unwanted cabin noise.

In the event of an audio panel electrical failure, audio signals are put through directly from the source to the headsets. The tone of the audio signals change noticeably. No ICS is available.

BLUETOOTH

Bluetooth connections available from several devices:

- Zulu headsets for audio and telephone
- Audio panel to distribute auxiliary audio and telephone
- GTX345 transponder for ADS-B information
- GMU460 PFD for flight plans, traffic and weather
- iPad for ADS-B and flight planning when connected to the transponder and the PFD.

CARGO SECURING EQUIPMENT

Six tie-down fittings are provided for securing cargo. Four are in the corners of the baggage compartment. Two are in the passenger foot wells. Each tie-down is rated to secure a maximum of 38 lbs. To secure the maximum baggage compartment load, each tie down must be loaded equally.

The foot well tie downs have cords and hooks attached for conveniently securing small personal items.

A mesh barrier is installed behind the rear seats. The barrier is intended to separate bulky, lightweight items such as jackets, small packages, and soft items from the passenger area. The barrier is not a substitute for proper securing of heavy cargo. The barrier can be removed when carrying very large items. However, care should be taken to adequately secure large items using the cargo tie downs and the rear seat belts as necessary.

A convenient pocket for the tow bar is installed in the aft wall of the baggage compartment.

ELECTRICAL SYSTEM

The electrical system consists of electrical storage, generation, indicating, and distribution components. The system uses standard 12 volt, direct current, negative ground components. Two batteries featuring lithium iron phosphate ($LiFePO_4$) chemistry

Storage

The electrical system uses three lithium-ion batteries for storage. The main battery is an EarthX ETX900 featuring lithium iron phosphate ($LiFePO_4$) chemistry. It is mounted with a similarly sized ETX680 auxiliary (aux) battery in the standard location behind the baggage bulkhead. The main and auxiliary batteries provide power for starting and reserve power in case of alternator failure. In addition, the aux battery normally provides a secondary power source to the avionics during engine start. Secondary power compensates for normal voltage sag of the main battery during engine start. Since the avionics stay online without rebooting and resetting, the need to reload flight plans and other data is eliminated.

A third lithium-ion battery is integrated into the case of the backup EFIS. Each battery has an internal battery management system (BMS) that controls charging and discharging, and monitors battery condition. The EFIS battery is completely self contained and requires no actions from the user. It provides up to four hours of backup protection.

Generation

Power is generated by a single belt driven alternator manufactured by Plane Power. The alternator is capable of producing at least 60 amps of current. It has an internal voltage regulator. It is controlled by the BATTERY switch and FIELD circuit breaker.

If the electrical system experiences an over-voltage, a crowbar circuit within the alternator regulator will open the alternator field by grounding and subsequently opening the field circuit breaker. In this manner the alternator will be removed from the electrical system.

WARNING

Use care working around a stationary, powered alternator as it can cause severe burns.

When the engine is not running, full field current is applied to the alternator. The result is heating of the alternator, which can become very hot. In addition, a significant amount of power from the battery is wasted. If the main battery or ground power is used, a good practice is to pull the FIELD circuit breaker to disable current flow to the field.

Indicating

An amber light near the center of the instrument panel illuminates when the alternator is not providing normal output voltage. If the light is illuminated while the engine is running, the cause should be investigated. The light is dimmable for night operations.

The engine monitoring system provides audio and visual warnings when voltage or amperage is outside the normal range.

Volt and amp meters are also provided within the engine monitoring system. VOLTS1 and VOLTS2 indicate the voltage on the main and aux buses respectively. AMPS1 indicates the amperage being supplied to the main bus by the alternator. AMPS2 indicates the amperage being supplied to the aux bus by the aux battery.

Two battery status lights are located near their respective battery switches. Each light indicates when the BMS senses an abnormal condition within the battery. See NORMAL PROCEDURES for an explanation of the various battery status indications.

Distribution

The electrical distribution system consists of conductors, buses, relays, fuses, circuit breakers, and switches. It is designed to provide ample power for starting and for general use in the case of an alternator failure.

The main bus and aux bus are normally connected by a bus tie relay. When the starter button is engaged, the systems are automatically separated to provide secondary power as described above. Special wiring allows the aux battery to be used for starting in some cases. See NORMAL PROCEDURES for starting with the aux battery.

DANGER
This aircraft contains LITHIUM-ION batteries. Substantial damage can occur to the electrical system if an EPU that is not compatible with the batteries is connected incorrectly. Follow the instructions in NORMAL PROCEDURES when connecting an EPU.

An External Power Unit (EPU) socket is wired through a relay to the main bus. The EPU relay is controlled by a switch located below the main and aux battery switches, under the instrument panel on the left side of the cockpit. Move the EPU switch up to connect an EPU. The EPU is has over-voltage protection. If the EPU circuit senses voltage in excess of about 15 volts, the EPU switch will move to the "tripped" position and disconnect the EPU. This is useful in the event that a 24 volt power source is inadvertently connected to the aircraft. See NORMAL PROCEDURES for use of the EPU connection.

See the most recent version of the drawing titled *N921AC DC Distribution* for details related to electrical distribution. The drawing is located on a USB thumb drive in the AOM binder.

ENGINE IGNITION SYSTEM

The engine in this airplane has been modified by the replacement of the traditional magnetos with electronic ignition. The system is produced by E-MAG. It consists of two independent ignition units, each being capable of maintaining safe engine performance.

Each system is powered by a self-contained permanent magnet alternator (PMA). The PMA is driven by the rotating mechanism that traditionally operates the magnetos. In addition to each PMA, each ignition unit is powered from the aircraft aux bus. Power for safe operation of either ignition system is provided by each unit's PMA, and the aux battery, main battery, or alternator.

Switching is accomplished by turning the IGNITION switches to OFF, TEST, or FLY. In the OFF position, the units are grounded and prevented from creating any spark. TEST powers each unit from its PMA only, disconnecting bus power. FLY connects the aux bus and allows the unit to automatically select PMA or aux bus power.

The ignitions are mounted in the same manner as the magnetos. Automotive type ignition cables fire standard automotive spark plugs. Timing is checked but not normally adjusted. Checks are performed in accordance with the procedures provided by eMag.

FLAP POSITIONING SYSTEM

This aircraft uses an aftermarket flap positioning system manufactured by Show Planes (Medford, OR). Flap position is indicated on the PFD.

To extend the flaps, push the flap switch down for a one-second count. The flaps will begin to extend, then stop after lowering approximately one inch. Once the flaps have reached the first position, the flap switch can be activated again to lower the flaps to the half-travel position. A third push lowers the flaps completely. The flaps must come to a stop before they can be lowered to the next position. Pushing the flap switch down after the flaps are in the lowest position has no effect, and is not detrimental to the system.

To raise the flaps, raise the switch to the full up position. The flaps will retract and the flap motor will stop when the flaps are fully retracted.

FUEL SYSTEM

The airframe fuel system consists of two vented tanks, fuel level senders, associated tubing and lines, a fuel selector valve, an electric fuel pump/filter assembly, engine driven fuel pump, and fuel pressure sender. The airframe fuel system ends at the engine fuel injection servo.

The RSA fuel injection system is described in the Engine Operating Handbook.

Tanks

The fuel tanks are bladderless aluminum tanks comprising the inboard wing leading edges. Each tank holds thirty gallons of fuel. The tanks are not permanently attached and can be removed for repair. Each rivet and seam is sealed with aviation grade fuel tank sealant (PRC or ProSeal).

The tanks are vented by a ¼" aluminum tube that is routed internally from near the filler opening to the root of the tank. There it exits and extends downward below the wing. The vent tube protrudes through the wing interconnect fairing approximately 14 inches aft of the leading edge. A check valve is installed in each vent line between the wing root and fuselage. If the tank vent openings become blocked by ice or debris, the tank will still vent through the check valve.

Fuel Level Senders

Each tank contains one float-type fuel level sender. A variable resistor is attached to each float so that as the fuel level changes, the resistance from the sender changes. The engine monitor converts the resistance measurement to fuel quantity. Each float rises until it touches the top of the tank near the inboard rib. At that point, approximately ten gallons of fuel can be added to the tank. As a result, the indicators show "20+" until the fuel level has fallen enough to allow the senders to move.

Plumbing

Each tank outlet is fed by a coarse fuel screen. The screen is removable from outside of the tank at the inboard edge. Fuel is routed from the tanks to the engine via 3/8" aluminum tubing and aircraft grade aluminum fittings, and by flexible rubber hoses forward of the firewall. The flexible hoses are steel braided and fire proofed to reflect heat and provide fire protection. All fuel fittings forward of the firewall are steel or stainless steel for increased fire protection.

Pumps

An electric fuel pump and filter assembly is located in the tunnel between the front foot wells. The fuel pump provides approximately 30 psi at flow rates in excess of 45 gallons per hour which is more than adequate to supply the engine. The filter assembly is field serviceable and should be disassemble periodically to check for contamination.

The engine driven fuel pump is cam driven by a pushrod. It is a diaphragm style pump that provides approximately 25 psi at full RPM. If the diaphragm fails, fuel will still pass through the pump.

Since the engine pump provides slightly less pressure than the electric pump, a pressure rise can be observed on the fuel pressure gauge when the electric pump is turned on.

Pressure Sender

A fuel pressure sender is located on the firewall downstream of the engine driven fuel pump. It is isolated from the engine by a flexible hose. A flow reducer protects against spraying fuel in the event of hose or sender failure.

LIGHTING

Interior Lighting

The cabin has four interior lamps. A single overhead white courtesy light is controlled by a switch on the aft side of the overhead console. Footwell lighting is installed for the front and rear occupants. A light under the glareshield provides instrument panel flood lighting for switch labels, maps, kneeboards, etc.

All interior lighting is protected by the DIM circuit breaker.

All instruments are internally lighted with the exception of the mechanical airspeed indicator, altimeter, and clock.

Exterior Lighting

Exterior lighting consists of strobe, navigation, landing, and taxi lights.

The strobe flash pattern is configurable by cycling through several pre-programmed patterns via a push-button switch behind the rear bulkhead.

A landing light is located in the left wing tip. A taxi light is located in the right wing tip.

The landing and taxi lights can be configured to flash individually or alternately.

When FLASH is off, the landing and taxi lights turn on and off normally. If FLASH is on, LAND or TAXI lights that are switched off will flash. LAND or TAXI lights that are switched on will remain on without flashing. If both lights are flashing, they alternate from side to side for maximum visibility.

NAVIGATION

This airplane is equipped with an IFR certified, WAAS enabled GPS incorporated into the GTN. The GTN also incorporates a traditional aviation navigation receiver (NAV), labeled VLOC1 on the PFD. A second NAV is incorporated into the SL30. The second NAV is labeled VLOC2 on the PFD.

The PFD displays GPS, VLOC1 and VLOC2 depending on how it is configured.

A G5 secondary flight display (SFD) shows NAV information from the GTN. GPS and VLOC1 are shown on the SFD by toggling the CDI source on the GTN. VLOC2 is not available on the G5.

The PFD includes a stand-alone GPS capable of providing some navigation capability. See the G3X manual for a full description.

OXYGEN SYSTEM

Supplemental oxygen is stored in a standard aviation “E” size oxygen tank between the front seats. Oxygen quantity is indicated by a gauge located in the forward part of the console. The tank can store up to 24 cubic feet at full pressure.

Four ports are positioned in each corner of the console for use by each occupant. The console is removable by removing two wires from piano hinges. The wires are removed and inserted from the rear of the console.

A filler hose is stored in the forward console compartment. It can be used to fill the oxygen tank without removing it from the aircraft.

PITOT/STATIC SYSTEM

The pitot/static system is conventional. Two static ports are installed in the tailcone area on each side of the fuselage. Internal plumbing connects the static ports to the instrument plumbing.

A pitot tube on the lower left wing surface collects pitot pressure for airspeed measurements. The pitot tube is electrically heated to prevent ice build-up. The heat in the pitot tube is heated. Pitot heat function is indicated by a warning message on the PFD.

Whenever the pitot or static system is opened, it must be tested to ensure correct operation before the next flight.

The instrument static air source can be changed from the external static ports to an internal static source in case of blockage due to ice, water, or foreign material. A toggle valve on the instrument panel selects the NORMAL or ALTERNATE static source. The alternate source is referenced to the cabin. Depending on the settings of the various ventilation sources, the cabin static pressure may be somewhat different than the outside static pressure. When switching between normal and alternate, any instruments referenced to static pressure may rapidly change a few percent. This is most noticeable, but harmless, when the autopilot changes altitude to remain at the selected static pressure.

TRIM SYSTEM

Elevator, rudder, and aileron control forces can be neutralized with the trim system. The elevator and aileron systems are electrically adjusted from each control stick. Rudder trim is controlled by a panel-mounted rocker switch. A master TRIM switch/circuit breaker on the panel powers all trim axes.

The trim system is powered by the main or aux bus. The appropriate bus is automatically selected.

Trim position is indicated on the PFD. Trim speed is adjusted with the PFD in configuration mode.

Trim in all three axes is automatically sensed and adjusted when the autopilot is on. Manually changing any trim position will disengage the autopilot.

VENTILATION

Fresh air is supplied to the cabin by two large eyeball vents at the left and right lower corners of the instrument panel, and by pointable vents in each passenger seat area. The rear vents are activated by pushing the round knob forward.

Front and rear cabin heat is provided by a single control labeled PULL HEAT on the right side of the instrument panel. Cabin heat is obtained from a standard exhaust pipe muff, then routed through the center tunnel to outlets near the firewall and passenger footwells. Pulling the knob opens a diverter valve to allow the desired amount of hot air into the cabin.

A second knob labeled PULL DEFOG diverts air from a second heat muff to an opening below the instrument panel. Warm air is then directed through the glareshield exhaust fan onto the windshield.

WARNING

Extended or excessive use of DEFOG can cause damage to the windscreen. The system will provide a large volume of very hot air to the windscreen in case of emergency. Care should be taken to only use as much DEFOG flow as necessary. Be sure the DEFOG control is fully forward when not in use.

Ventilation is provided to the area behind the instrument panel by small openings in the top of each forward cabin air inlet. The openings route outside air to the instrument area. The tubes are designed to separate rain water and provide only dry air. Hot air is exhausted by a fan in the glare shield. This opening should not be blocked in flight by papers or other objects.

BLANK

END OF SECTION