APPAREO

Helicopter Instructions for Continued Airworthiness

Appareo Systems Stratus ES/ESG System

MAKE: _____

MODEL: _____

SERIAL NUMBER: _____

REGISTRATION NUMBER: _____

This document must be attached to the Aircraft Instructions for Continued Airworthiness (Maintenance Manual). The information contained herein supplements the basic Instructions for Continued Airworthiness only in those areas listed, when the aircraft is modified by the FAA TSO installation of a Stratus ES/ESG system. For limitations and procedures not contained in this document, consult the basic Airplane Instructions for Continued Airworthiness (Maintenance Manual).

APPAREO SYSTEMS, LLC
FARGO, NORTH DAKOTA 58102

Helicopter Instructions for Continued Airworthiness

Record of Revision

Revision Number	Change Description	Effective Date	Inserted By
1.0	Initial release	10/03/2019	Angela Lorenz
1.1	Updates to cover models in AML	02/04/2020	Vernon Miller

Related Documentation

Document Number	Title
600840-000059	Stratus ES/ESG Helicopter Installation Instructions
600890-000049	Stratus ES/ESG Pilot's Guide
601837-000050	Stratus ES/ESG Helicopter Installation and Wiring Drawings

Warranty

To view the Stratus ES/ESG warranty, log into the Appareo Dealer Portal or visit www.appareo.com/resources.

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Abbreviations and Definitions

Abbreviation	Term	Definition
AC	Advisory Circular	Document provided by the FAA that provides airworthiness recommendations.
ADS-B	Automatic Dependent Surveillance - Broadcast	Technology implemented by the FAA to provide surveillance and improved situational awareness to both pilots and air traffic controllers.
ATCRBS	Air Traffic Control Radar Beacon System	The surveillance system used by Air Traffic Control to augment radar operations.
BIT	Built In Test	A series of tests performed on start up to monitor the function of the equipment.
CFR	Code of Federal Regulations	Codification of the general and permanent rules and regulations published in the Federal Register by the executive departments and agencies of the United States Federal government.
ES	Extended Squitter	A periodic message that provides position, velocity, and time. Part of the marketing name for Stratus ES.
ESG	Extended Squitter and GPS	Part of the marketing name for Stratus ESG.
FAA	Federal Aviation Administration	Agency of the United States Department of Transportation with authority to regulate and oversee all aspects of civil aviation in the United States.
FCC	Federal Communications Commission	Branch of the government responsible for controlling the regulations around electronic equipment.
GPS	Global Positioning System	A system used to identify the longitude, latitude and in some instances the altitude of a given object.
Hz	Hertz	Unit of frequency based upon cycles per second.
ICA	Instructions for Continued Airworthiness	Document specifying actions taken to ensure the airworthiness of a device.
PMA	Parts Manufacturer Approval	Combined design and production approval from the FAA for modification and replacement parts. It allows a manufacturer to produce and sell these parts for installation on type certificated products. The approval procedures for FAA personnel and guidance for PMA applicants is outlined in FAA Order 8110.42.
STC	Supplemental Type Certification	Type Certificate issued when an applicant has received FAA approval to modify an aircraft from its original design.
TSO	Technical Standard Order	Minimum performance standard for specified materials, parts, and appliances used on civil aircraft (FAA definition).

WAAS	Wide Area Augmentation System	System of ground-based antennas whose precisely known locations are used to correct satellite signals and provide greater positional and integrity of service to aircraft in flight.

1. INTRODUCTION

1.1. PURPOSE

This ICA describes the recommended and required maintenance practices to maintain the Appareo Systems Stratus ES and Stratus ESG systems.

Electronic media or hard copy revisions/updates to this document will be made available to all owners if contact information is provided to the manufacturer. Aircraft owners are encouraged to provide up-to-date information to ensure timely access to new information. You can contact the manufacturer at:

> **Appareo Systems, LLC**
> **1830 NDSU Research Circle North**
> **Fargo, ND 58102**

To view the most current version of this document, go to appareo.com/dealer-portal or www.appareo.com/resources.

All structural and general maintenance must be performed in accordance with the aircraft's Standard Practices Manual and FAA AC 43.13-1B.

1.2. CERTIFICATION INFORMATION

1.2.1. TSO and FCC compliance

TSO
Stratus ES/ESG is compliant with the following Technical Standard Orders:

Reference/Issue	Title
FAA TSO-C112e	Technical Standard Order: Air Traffic Control Radar Beacon System/Mode Select (ATCRBS / Mode S) Airborne Equipment
FAA TSO-C145d (Stratus ESG only)	Technical Standard Order: Airborne Navigation Sensors Using The Global Positioning System
FAA TSO-C166b	Technical Standard Order: Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Service – Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)

Table 1: TSO compliance

FCC
Stratus ES/ESG has an FCC ID of 2AETC-1505005.

1.2.2. TSO deviations

TSO	Section	Deviation
TSO-C145d (Stratus ESG only)	Section 3, Subpart D	Environmental qualification testing was performed to DO-160G, not DO-160E.

Table 2: TSO deviations

1.2.3. Non-TSO functions

Below are Stratus ES/ESG's non-TSO functions:

- VFR key (and configuration).

This non-TSO function does not interfere with Stratus ES/ESG's compliance with the requirements of the TSOs listed in Section 1.2.1.

1.2.4. Environmental qualifications

Stratus ES/ESG is tested to DO-160G. The Stratus ES/ESG Environmental Qualification form is found in Appendix A of the Stratus ES/ESG Installation Instructions (600840-000032).

1.2.5. Criticality level

Software level determination is based on the Functional Hazard Assessment (FHA) and Preliminary System Safety Assessment (PSSA). These assessments determined that the most severe failure conditions (see Table 1) are classified as Major. As such, the Software Assurance Level has been determined to be Major.

Major failure conditions would reduce the capability of the aircraft or the ability of the crew to cope with adverse operating conditions to the extent that it would be a significant reduction in safety margins or functional capabilities or a significant increase in crew workload. Software whose anomalous behavior would cause or contribute to a failure of the system function resulting in a Major failure condition for the aircraft is identified as Level C.

Function	Description	Classification
ATCRBS / Mode S Transponder	Malfunction of the ATCRBS / Mode S transponder function without warning	Major
ADS-B Out	Broadcast of incorrect ADS-B messages without warning	Major
GPS/SBAS Receiver (Stratus ESG only)	Loss or malfunction of the GPS/SBAS receiver function	Major
Pressure Altitude Output	Failure of the pressure altitude output function	Major
RF Feed-Through	Malfunction of the RF feed-through function without warning	Major

Table 3: Criticality level

1.3. SYSTEM DESCRIPTION

Stratus ES and Stratus ESG by Appareo are panel-mounted level 2els Class 1 Extended Squitter transponders. They are Class B1S transponders which are ADS-B Out compliant. Stratus ES and Stratus ESG respond to legacy Mode A/C interrogations and Mode S interrogations from both ground radar and airborne collision avoidance systems. To support the ADS-B Out function, Stratus ESG also contains a Class Beta 1 GPS/WAAS receiver. Stratus ES receives GPS information from approved GPS position sources.

Stratus ES/ESG may be referred to as "transponder" unless product differences require them to be identified separately.

1.3.1. NOTE: This ICA does not cover the maintenance or inspection of GPS antenna (Stratus ESG) or the GPS source (Stratus ES). Refer to manufacturer's maintenance documentation as necessary.Operation of Stratus ES/ESG

See the Stratus ES/ESG Pilot's Guide (600890-000049) for a full description of the transponder's function.

1.3.2. Embedded Hardware and Software

The embedded hardware and software information listed below is current as of the time of publication of this document.

Description	Part number	Revision (or later FAA approved)
Embedded Hardware (FPGA)	501010-000109	R05
Software (DSC)	501010-000113	R07

Table 4: Embedded hardware and software

Refer to Section 4.2.3 for software/embedded hardware update procedures.

1.3.3. Stratus ES/ESG parts catalog

The following parts are required for the installation of Stratus ES/ESG.

Line Replaceable Units (LRUs)

Item	Appareo Part Number	Commercial Part Number	Quantity
Backplate	353070-000369	-	1
Stratus ES Transponder or Stratus ESG Transponder	153510-000069 or 153510-000017	-	1
Stratus ES/ESG Rack	353070-000368	-	1
RF TNC Pass Through Adapter	251015-000077	-	1

(Stratus ESG only)			
RF BNC Pass Through Adapter	251015-000078	-	1

Table 5: Required hardware (LRUs)

COTS components

Item	Appareo Part Number	Commercial Part Number	Quantity
#6-32 x 100° Flat Head SS Screw	-	MS24693, AN507R or other approved fastener	6
Metal Hex Stop Nut *	-	MS21042-06	6
Monadnack Clip Nut 6-32*	-	294667	6
Replacement pins	-	M39029/63-368	-
37 Pin DSUB Connector	251015-000074	M24308/2-4F	1
Screw	353060-000007	- (ALT: MS51957-13)	8
Strain Relief Backshell	356070-000006	M85049/48-1-4F	1

Table 6: Required hardware (COTS components)

*These parts are identified as usable components, but are not identified as the only components that can be used. Installer must determine if the part is appropriate for specific installation or if an alternate part is required.

Stratus ES requires input from a GPS position source, and Stratus ESG requires a GPS antenna. Both systems require a transponder antenna and altitude encoder. See Stratus ES/ESG Installation Instructions (600840-000032) for equipment requirements.

1.4. TOOLS

The following tools may be needed for maintenance of Stratus ES/ESG.

Tool	Part Number	Used For
3/32" hex driver	-	Securing locking mechanism through the face plate
External retaining ring pliers	-	RF pass through adapter
Crimp tool	M22520/2-01	DSUB pins
Positioner	M22520/2-08	DSUB pins
Insertion/extraction tool	M81969/39-01	DSUB pins

Table 7: Required tools

1.5. WEIGHT AND BALANCE INFORMATION

The total weight of the Stratus ES/ESG system and related hardware is less than 4 lbs. Compute a Chart "C" in accordance with the table below, noting the proper aircraft station to obtain balance information.

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Component	Weight
Stratus ES/ESG Unit Weight	2.8 lbs. (1.3 kg)
Stratus ES/ESG Total Installed Weight (Transponder, rack, and connectors)	4.2 lbs. (1.9 kg)

Table 8: Stratus ES/ESG weight

1.6. EQUIPMENT DIMENSIONS

Dimensions for Stratus ES/ESG are outlined in the table below. All figures given are representative of maximum equipment dimensions (where applicable).

Characteristic	Specification
Bezel Width	6.38 inches (162 mm)
Bezel Height	1.69 inches (43 mm)
Rack Width	6.32 inches (160.4 mm)
Rack Height	1.65 inches (42 mm)
Depth from back of bezel to end of strain relief on rack (not compensating for wire bend radius)	10.75 inches (273 mm)

Table 9: Equipment dimensions

Figure 1: Dimensions

RADIO CUT OUT
RACK MOUNTED IN FRONT OF PANEL

RADIO CUT OUT
RACK MOUNTED BEHIND PANEL
MAX PANEL THICKNESS .12 [3.0mm]
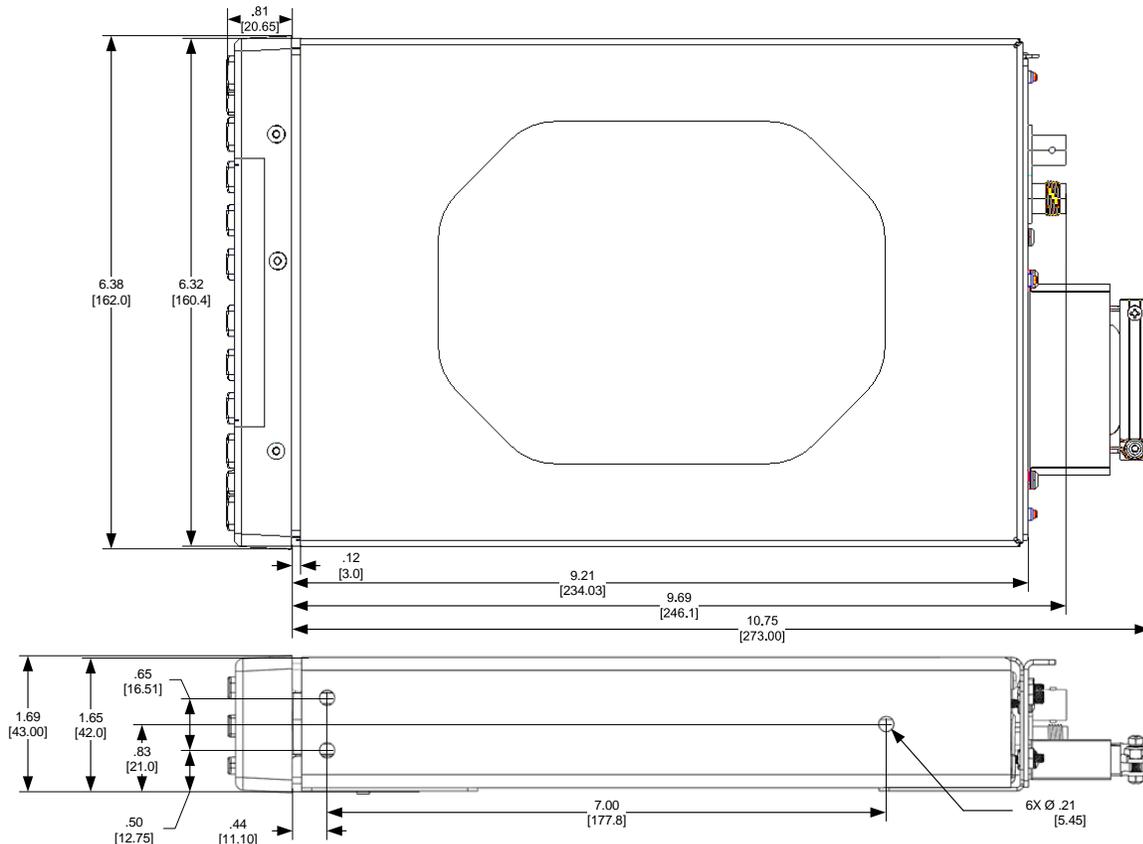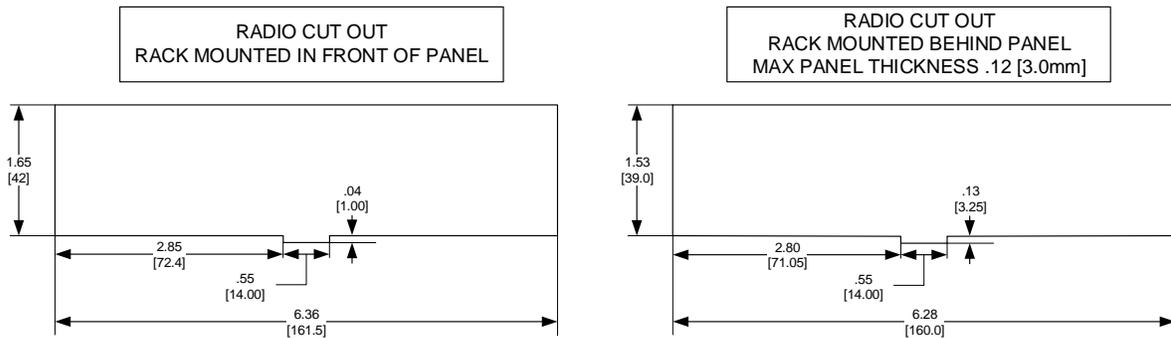
Figure 2: Panel Cut Out

1.7. ELECTRICAL SPECIFICATIONS

Characteristic	Specification
Altitude	Up to 25,000 ft
External Suppression Input	Low ≤ 0.5 V High ≥ 5 V (suppressed)
Mode A Capability	4096 Identification Codes
Mode C Altitude Capability	Parallel altitude encoder: up to 62,700 ft Serial altitude encoder: up to 126,700 ft
Mode S Capability	Parallel altitude encoder: up to 62,700 ft Serial altitude encoder: up to 126,700 ft
Operational Temperature Range	-20°C to +55°C
Receiver Frequency	1030 MHz
Receiver Sensitivity	-74 dBm nominal for 90% replies
Transmitter Frequency	1090 MHz ± 1 MHz
Transmitter Power	310 Watts nominal

Table 10: Electrical specifications

1.8. POWER REQUIREMENTS

Characteristic	Specification
Input Voltage Range	11 to 36 Vdc
Nominal Current Draw	0.28 A at 28 Vdc 0.5 A at 14 Vdc
Power Input	8 W Typical 59.5 W Max

Table 11: Power requirements

2. AIRWORTHINESS LIMITATIONS

This Airworthiness Limitations section is FAA approved and specifies inspections and other maintenance required under §43.16 and §91.403 of the Federal Aviation Regulations unless an alternate program has been FAA approved.

There are no airworthiness limitations associated with this type design change.

3. INSPECTION REQUIREMENTS AND OVERHAUL (ATA CHAPTER 5)

Requirement	Inspection	
	Special Inspection	**Inspection Term**
1. Inspect transponder for damage.	NOTE: 1, 2, 3	12 calendar months
2. Inspect transponder wiring and connectors for security.	NOTE: 1, 2, 3	12 calendar months
3. Inspect transponder connector contacts and attachment hardware for corrosion.	NOTE: 2	12 calendar months
4. Clean transponder.		As necessary
5. In accordance with 14 CFR 91.411 and 91.413, inspect and test transponder for the interface with each static pressure system, altimeter instrument, automatic pressure altitude reporting system, or any other integrated system using the tests and specifications in 14 CFR Part 43, Appendix E and F.		24 calendar months or After any maintenance performed on integrated systems including maintenance performed on transponder where data correspondence error could be introduced

Table 12: Scheduled maintenance

NOTES:
1. This item requires inspection following a hard landing event.
2. This item requires inspection following a lightning strike event.
3. This item requires inspection following a rotor strike event.

3.1. GENERAL INSPECTION INFORMATION

Removal and installation instructions are found in this document. Manufacturer's installation manuals and basic aircraft maintenance manuals should be used for additional reference material. Component maintenance must be completed by an authorized repair facility. Refer to Section 10: Servicing. If for any reason during inspection Stratus ES/ESG fails inspection or is otherwise not working properly, read the instructions contained in this manual before removing any transponder components. If difficulty is encountered, seek assistance by contacting the manufacturer.

4. DIMENSIONS AND ACCESS (ATA CHAPTER 6)

4.1. COMPONENT LOCATIONS

Stratus ES/ESG: Stratus ES/ESG is panel mounted.

GPS position source (Stratus ES): Compatible GPS position sources are panel mounted.

GPS antenna (Stratus ESG): Typical GPS antenna installation locations are on the top of the aircraft or on the empennage with consideration for line of sight with satellites.

Transponder antenna: The transponder antenna should be mounted vertically on the bottom of the aircraft.

Altitude encoder: The altitude encoder should be installed using the manufacturer's instructions and recommendations.

4.2. MAINTENANCE INSTRUCTIONS

The following instructions are in addition to the standard practices used to maintain the aircraft structure, the wiring described in the aircraft manufacturer's maintenance manual, and FAA Advisory Circular 43.13-1B.

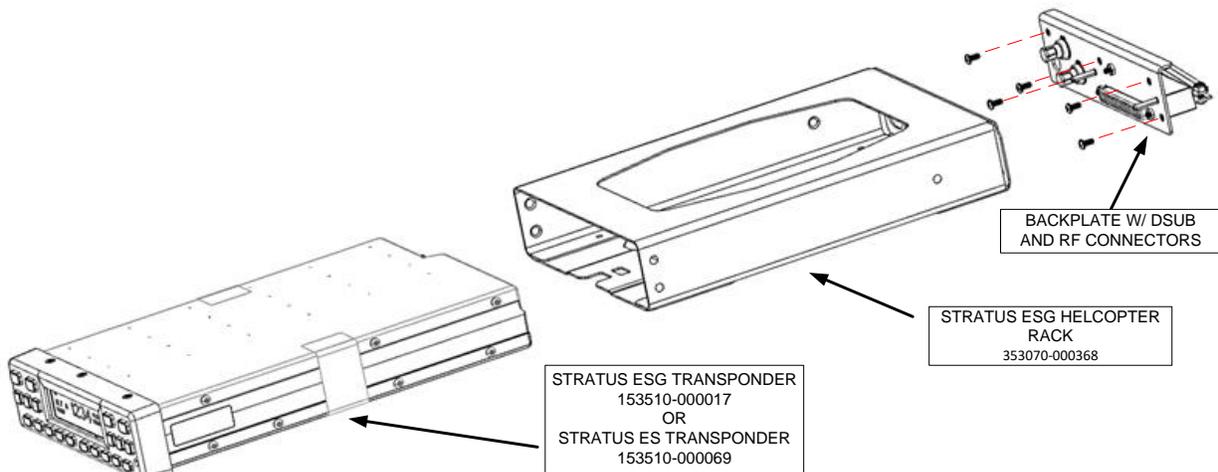### 4.2.1. Stratus ES/ESG System Removal

BACKPLATE W/ DSUB AND RF CONNECTORS

STRATUS ESG HELCOPTER RACK
353070-000368

STRATUS ESG TRANSPONDER
153510-000017
OR
STRATUS ES TRANSPONDER
153510-000069

Figure 3: Stratus ES/ESG installation diagram

ITEM	PN	DESCRIPTION	QTY
1	153510-000017	STRATUS ESG	1
	153510-000069	STRATUS ES	1
2	251015-000077*	RF TNC CONNECTOR	1
3	251015-000078	RF BNC CONNECTOR	1
4	353070-000368	STRATUS ESG RACK HELICOPTER	1
5	353070-000369	BACKPLATE ASSEMBLY, HELICOPTER	1
6	356060-000007*	SCREW	8
7	M24308/2-4F	37 PIN DSUB CONNECTOR	1
8	M85049/48-1-4F	DSUB STRN RLF BCKSHLL	1
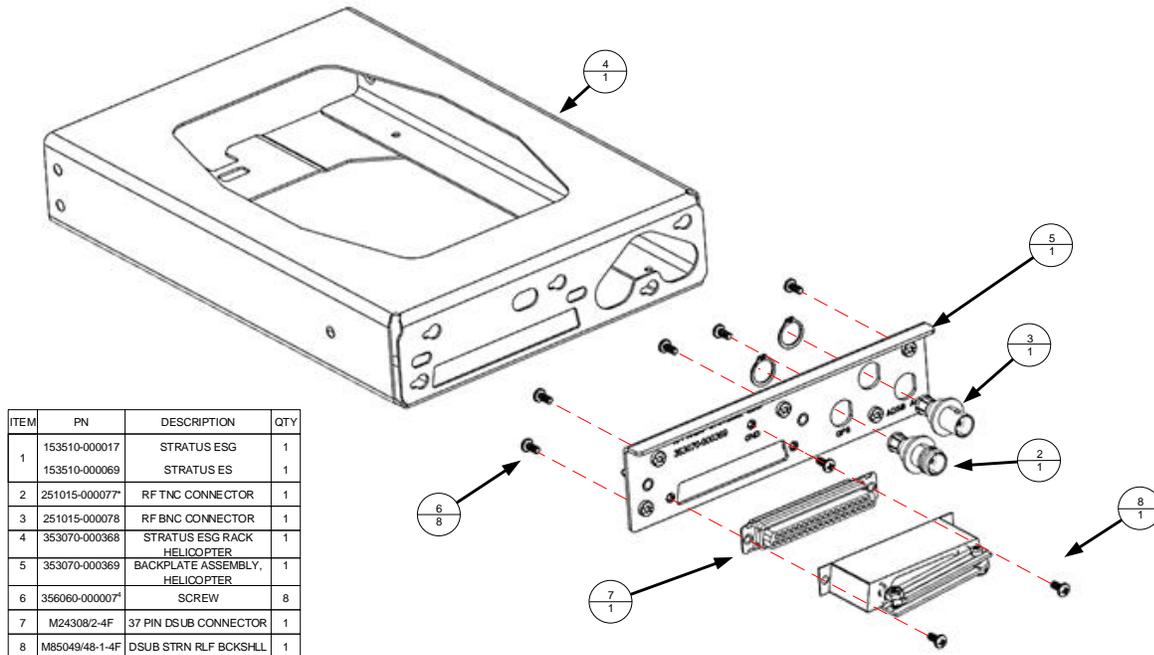
Figure 4: Backplate Assembly
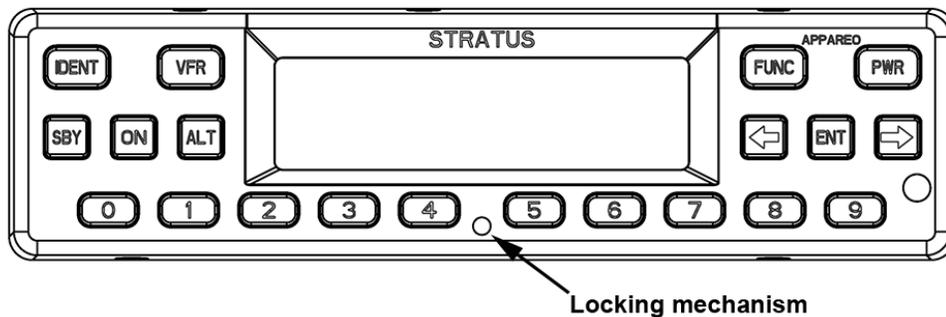
Locking mechanism

Figure 5: Locking mechanism location

To remove the transponder assembly:

Turn the 3/32 hex wrench counter-clockwise on the locking mechanism through the front of the transponder to loosen the lock until the transponder connectors disconnect. Keep loosening the transponder until it stops sliding out of the install rack. Do not loosen any further. Pull out the transponder by hand.

4.2.2. Stratus ES/ESG System Replacement

To replace the transponder assembly:

1. Adjust the locking mechanism on the transponder using a 3/32 hex wrench so that the front lobe is in a vertical position. Insert the unit by hand until it comes to a stop. This occurs when the front lobe contacts the clearance slot of the install rack.

2. Tighten the locking mechanism with the 3/32 hex wrench until it is tight and the connectors have mated. Do not overtighten. If the mechanism will not tighten, verify that the transponder is properly seated in the rack. The unit is fully seated when the unit does not move back when tightening the locking mechanism.

NOTE: Ensure that the transponder is seated as far back as possible against the backplate so that there is a secure connection between the transponder and the connectors.

NOTE: Conduct the applicable functional tests in Section 4.3 after replacing the transponder assembly.

4.2.3. Software Update

The following equipment is required to perform a software update:

- Portable computer with Windows operating system, Windows 7 or later
- Stratus ES/ESG Software Update Tool desktop software (See Step 4)
- Stratus ES/ESG software/embedded hardware update (See Step 4)
- 3 amp power supply
- D-sub wiring harness
- Serial to USB adapter (optional)

To perform a software/embedded hardware update, complete the following steps:

1. Use the following diagram to wire the transponder for a software update.
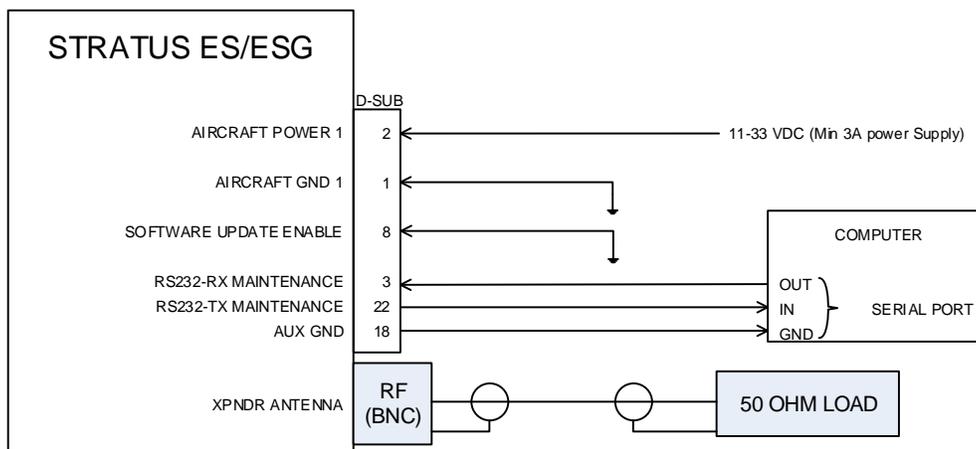
Figure 6: Software update wiring diagram

2. Plug the serial port connector into the computer. A serial to USB adapter may be required. If the adapter requires you to install drivers, install them.

3. Power on the transponder. It will enter into software update mode.

   NOTE: The screen will be black, but the keypad will illuminate.

4. Apply the software/embedded hardware update.

   a. Download the Stratus ES/ESG Update Tool and update file.

      i. **Dealers:** Log in to the Appareo Dealer Portal, then navigate to appareo.com/dealer-portal/service-bulletins.

         Experimental pilots: Navigate to www.appareo.com/resources and click "Service Bulletins."

      ii. Download the Stratus ES/ESG Update Tool (if you have not already done so) and the update file for your transponder model. When prompted, install the software by following the on-screen prompts.

   b. Open the Stratus ES/ESG Update Tool.

   c. Click the box below "Update File" and navigate to the update file that was downloaded in Step 4.a.

   d. Use the "Port" drop-down menu to select the computer port that is connected to Stratus ES/ESG.

   e. Click **Update**. A pop-up box will appear when the update begins and completes.

5. Verify that the software/embedded hardware update has applied correctly.

   a. Remove the grounding pin (pin 8).

   b. Turn off Stratus ES/ESG and enter into configuration mode (while holding the **FUNC** key, press and release the **PWR** key).

   c. Press **FUNC** or the arrow keys to advance to the software versions diagnostic screens and verify that the most recent programmed configuration appears. Refer to the service bulletin alerting you of the software update for the most recent programmed configuration.

4.2.4. Stratus ES/ESG Configuration

See Stratus ES/ESG Installation Instructions (600840-000032) for instructions for how to configure the transponder if a replacement has been installed or the unit is new to this aircraft.

4.3. FUNCTIONAL TESTS

When installed in accordance with these installation instructions, Stratus ES/ESG complies with 14 CFR Part 91.227.

Final installation checks for Stratus ES/ESG are the responsibility of the installer. The installer must ensure that the transponder is installed on an aircraft that coincides with the approval given within the testing performed for the TSOs held by this device (TSO-C112e, TSO-C145d (Stratus ESG only), and TSO-C166b). Refer to Appendix A of the Stratus ES/ESG Installation Instructions (600840-000032).

After installation is complete, verify operation as identified in 14 CFR Part 43, Appendix F. The IFR6000 with OPT3 (manufactured by Cobham AvComm – formerly Aeroflex Test Solutions) or equivalent test set can be used to determine compliance.

Additional information about compliance testing can be found in Chapter 4 of Advisory Circular (AC) 20-165B.

When installed correctly, Stratus ES/ESG complies with 14 CFR Part 91.215 & 91.225. While in airspace specified in 14 CFR Part 91.215, Stratus ES/ESG must be maintained to 14 CFR Part 91.413.

In addition to maintaining compliance to the regulations above, perform the following operational tests after configuration. Depending on the maintenance performed, an EMI test might also be required. See Stratus ES/ESG Installation Instructions (600840-000032) for EMI test procedures.

NOTE: Tests should be executed in an area where the aircraft has an unimpeded view of the sky, such that a proper GPS fix can be established.

4.3.1. Power bus

Turn on the power to the aircraft. Verify that the unit powers on.

4.3.2. Discrete inputs

NOTE: Depending on the installation, the functional tests for the following discrete inputs are optional.

1. Turn off the transponder and enter into configuration mode on the transponder (while holding the **FUNC** key, press and release the **PWR** key).

2. Press **FUNC** or the arrow keys to advance to the external input diagnostics screen. The screen displays the real-time state of the external standby, external IDENT, and squat switch inputs.

3. Activate and deactivate each discrete input and verify that the proper state is reflected on the display.

- External standby: Ground each transponder's external standby pin and verify that the state is "inactive."

- External IDENT: Activate the external switch and verify that the state is "active."

- Squat switch: Activate the squat switch and verify that the correct state is shown.

4.3.3. Analog inputs

1. Enter into configuration mode on the transponder.

2. Press **FUNC** or the arrow keys to advance to the analog input diagnostics screen. The screen displays the real-time values read from the lighting bus and ambient light sensor.

3. Block the ambient lighting sensor input. Verify that the signal percentage drops.

Ambient light sensor
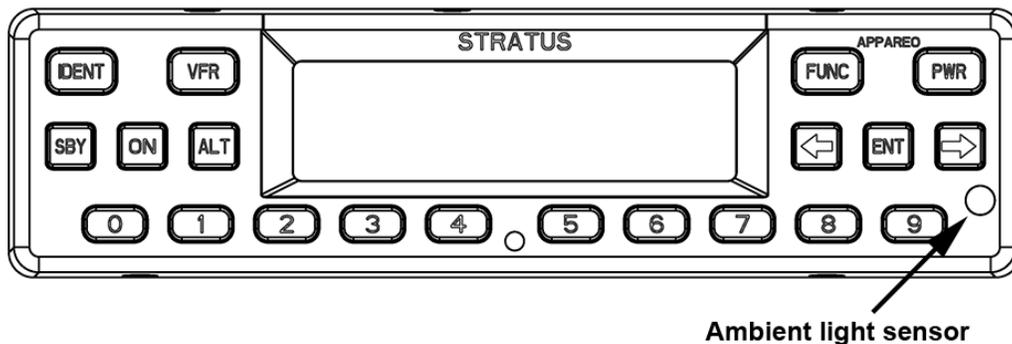
Figure 7: Interface for Stratus ES/ESG functional tests

4. Shine a light on the ambient light sensor. Verify that the signal percentage increases.

5. If you are using the 14V or 28V lighting bus: Adjust the lighting bus input to minimum. Verify that the displayed value is 0%.

6. If you are using the 14V or 28V lighting bus: Adjust the lighting bus input to maximum. Verify that the displayed value is 100%.

4.3.4. GPS position source (Stratus ES)

1. Enter into configuration mode on Stratus ES.

2. Press **FUNC** or the arrow keys to advance to the GPS receiver diagnostic screen.

3. Verify that the NIC value, latitude, and longitude are all non-zero numbers.

4.3.5. GPS antenna (Stratus ESG)

1. Turn off all avionics except Stratus ESG.

2. Enter into configuration mode on Stratus ESG.

3. Press **FUNC** or the arrow keys to advance to the GPS receiver diagnostic screen and wait until the NIC value is a non-zero number.

4. Turn on one avionic at a time. Verify that the NIC value does not drop below 7.

4.3.6. Altitude encoder

1. Enter into configuration mode on the transponder.

2. Press **FUNC** or the arrow keys to advance to the altitude diagnostic screen.

3. Verify that the altitude displayed is correct to your geographic location.

4.3.7. ADS-B Out Verification

The aircraft requires an unimpeded view of the sky for GPS reception; otherwise, a GPS repeater will be required. Using the transponder test set, perform an AC20-165 air test.

1. Power on the transponder.

2. The transponder will enter into GND mode. Press **ALT**.

   NOTE: Coordination with ATC may be required depending on location of facility.

3. Verify the following ADS-B out parameters using the transponder test set:

   - NIC ≥ 7
   - NACp ≥ 8
   - NACv ≥ 1
   - SIL ≥ 3
   - SDA ≥ 2

4.4.   Event indicators

When certain events occur, an indicator will appear on your Stratus ES/ESG display. The table below describes each indicator's meaning.

Indicator	Meaning
⊕	ADS-B transmission contains GPS position information with a radius of containment under 1 nautical mile.
Ⓡ	A response was transmitted from a mode A/C/S interrogation. The indicator will time out if another reply does not occur within one second.
⚠	A built-in-test (BIT) has failed. See Section 10.1.3 of this document and the Stratus ES/ESG Pilot's Guide (600890-000049) for more information about BIT failures.

Table 13: Event indicators

5.   LIFTING AND SHORING (ATA CHAPTER 7)

5.1. LIFTING INFORMATION

5.1.1. Jacking Information

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

5.1.2. Lifting Information

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

5.2. SHORING INFORMATION

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

6. LEVELING AND WEIGHING (ATA CHAPTER 8)

6.1. LEVELING INFORMATION

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

6.2. WEIGHING INFORMATION

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

7. TOWING AND TAXIING (ATA CHAPTER 9)

7.1. TOW INSTRUCTIONS

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

7.2. TAXIING INSTRUCTIONS

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

8. PARKING, MOORING AND STORAGE (ATA CHAPTER 10)

8.1. MOORING INFORMATION

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

8.2. PARKING INFORMATION

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

8.3. STORAGE LIMITATIONS

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

9. PLACARDS AND MARKINGS (ATA CHAPTER 11)

Ensure that the labeling is in accordance with AC 43.13-2B, Chapter 2, Section 207, Sub-Section f., Paragraph (4).

10. SERVICING (ATA CHAPTER 12)

10.1. SERVICING INFORMATION

The Stratus ES/ESG system has a number of internal self-test features. See Section 10.1.2 for a troubleshooting guide.

10.1.1. Component Repair

Equipment determined in need of repair must be returned to a properly rated repair facility that is trained and qualified. Appareo provides repair services and has an authorized repair station.

To utilize Appareo's repair services, contact Appareo support for a Return Merchandise Authorization (RMA) number. Return all defective and suspected defective components to the following address for repair and replacement.

> **Appareo Systems, LLC**
> **Attn:** *[RMA Number]*
> **1830 NDSU Research Circle North**
> **Fargo, ND 58102**

For additional information, contact Appareo Systems at +1-701-356-2200.

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10.1.2. Troubleshooting

Use the table below to troubleshoot possible problems with Stratus ES/ESG. For a full list of BIT failures, see Stratus ES/ESG Installation Instructions (600840-000032).

Problem	Troubleshooting Steps
GPS information is not being received	**Stratus ES:** 1. Enter into configuration mode on Stratus ES. 2. Go to the BIT diagnostic screen. **If the GPS Failure BIT failed (a "1" appears):** There is a problem with the connection to the GPS position source. Verify that the connection between Stratus ES and the GPS position source is secure. **If the GPS Failure BIT did not fail (a "0" appears):** The GPS position source is not achieving GPS lock, but the connection is good and the position source is configured correctly. Refer to the documentation for your GPS position source for troubleshooting. **NOTE:** A BIT failure will not appear until at least 5 minutes after Stratus ES is powered on.
	Stratus ESG: 1. Verify that the aircraft has a clear view of the sky. 2. Verify that the antenna connections and cables are not loose. 3. Verify that the coax cable is connected to the correct port. **NOTE**: Initial GPS fix could take up to 20 minutes.
GPS antenna signal quality is reduced (Stratus ESG only)	1. Turn off all avionics except the GPS/transponder. 2. Enter into configuration mode on Stratus ESG. 3. Go to the CN0 diagnostic screen and wait for the CN0 values to populate. 4. Turn on one avionic at a time. If the CN0 values drop by 2 dB or more, there might be an interference problem. The avionic causing the interference might need to be relocated in the cockpit, antennas might need to be moved farther apart, or filters might need to be added to the avionic.

Transponder is not receiving the squat switch position	1. Check the connections and the pin-out of the transponder to verify that the squat switch port is correctly connected. 2. Verify that the squat switch works independent of the transponder.
The power key does not power on Stratus ES/ESG	1. Verify that the power key is not stuck. 2. Verify that the circuit breaker has not tripped. **If it has tripped:** Reset the circuit breaker switch and try the power key again. **NOTE:** If the circuit breaker opens it may be reset only once. **If it did not trip:** Verify that the electrical connection to the transponder is secure. Verify that the voltage at the input to the unit is between 11 VDC and 36 VDC.
The altitude displayed is incorrect	1. Enter into configuration mode on Stratus ES/ESG and verify that the altitude source is set as the currently used altitude source. If the altitude source is a serial connection, verify that the correct encoding option was selected. 2. Verify that the correct connections are made to the transponder. 3. Use an altitude simulator to verify the cabling. 4. Verify that there is not a problem with the altitude source.
The screen displays a "transmitter failure" error message	This message appears when one of the following issues occurs: improper impedance between antenna and transponder, improper connection on connectors, improper seating of transponder into tray. 1. Verify that the transponder is completely seated in the rack. Ensure back plate has been properly installed to rack. 2. Verify that the transponder antenna is connected to the port labeled XPNDR ANT and that the GPS antenna is connected to the port labeled GPS (Stratus ESG only). 3. Check all connectors to ensure they are properly mated. Check these connectors for opens or shorts. 4. Verify that the maximum loss from the transponder connector to the antenna connector is 2 db. 5. Inspect the transponder antenna to ensure functionality and adherence to requirements identified in the transponder antenna section. 6. Inspect wiring to ensure cabling integrity.

| The screen displays a Built in Test (BIT) failure

The display screen will display a warning message and degraded state indicator ⚠ in the event that any of Stratus ES/ESG's BITs fail. | The Stratus ES/ESG screen might display a warning message with the instructions below. Below is guidance regarding how to assess the failure:

• **PRESS FUNC TO CLEAR:** A non-critical error has been detected. The transponder will run in a degraded state until the error is resolved. Contact Appareo for further assistance.

• **PLEASE RESTART UNIT:** A critical error has been detected. Restarting the unit may fix the error. If the message returns after restarting, contact Appareo for further assistance.

• **PLEASE SHUTDOWN UNIT:** A critical error has been detected. Power off the unit and do not turn it back on. Contact Appareo for further assistance.

• **OVERHEATED:** The transponder has overheated. Transponder function will resume when the transponder cools down.

• **WAITING TO BE UNSTUCK:** A key has been depressed for more than 20 seconds. If a key is stuck, try to unstick the key.

• **WAITING FOR RELEASE:** The external suppression input is constantly in a suppressed state. Contact Appareo for further assistance.

• **ATTEMPTING TO RECOVER:** A squitter rate error has been detected. The transponder may recover itself, but if it does not, restart the unit. If the warning message persists, contact Appareo for further assistance. |

Table 14: Troubleshooting guide

10.1.3.   BIT diagnostic

The BIT diagnostic screen displays any Built In Test failure codes. If the screen displays all zeros, no BIT failure has been detected. Otherwise, a "1" will display.

Each number corresponds with a specific failure, depending on its position in the string of numbers on the screen—failure position 1 being the leftmost space, and failure position 20 being the rightmost space. Reference the table below to determine which BIT has failed. Once all BIT failures have been resolved, press **ENT** to clear all codes.

NOTE: The following BIT failure positions are applicable to software (DSC) version R07. For version R06, the first 2 BITs are not present. For earlier versions, the first 3 BITs are not present.

Failure Position	BIT Failure	Display Message	Corrective Action
1	Transmitter Failure	TRANSMITTER FAILURE CHECK CONNECTION	Verify that the connection between Stratus ES/ESG and the transponder antenna is secure. See Section 7 for more information.
2	Transmitter PLL	TRANSMITTER FAILURE	Contact Appareo
3	GPS Failure (Stratus ES only)	GPS INPUT FAILURE	Verify that the connection between Stratus ES and the GPS position source is secure.
4	Transmitter	TRANSMITTER FAILURE	Contact Appareo
5	Display	none	Contact Appareo
6	GPS Failure (Stratus ESG only)	GPS RECEIVERFAILURE	Contact Appareo
7	Altitude Source	ALTITUDE INPUT FAILURE	Use the altitude diagnostic screen to troubleshoot the altitude encoder connection
8	Internal Temperature	OVERHEATED	Let the transponder cool down.
9	Single Event Upset	none	Contact Appareo
10	Stuck Key	KEY STUCK	Try to unstick the stuck key
11	Stuck External IDENT	EXTERNAL IDENT STUCK	Use the external inputs diagnostic screen to check correctness of external IDENT polarity
12	Suppression	SUPPRESSED	Check correctness of suppression input polarity
13	FPGA Checksum	none	Contact Appareo
14	EEPROM Checksum	MEMORY READ FAILURE	Re-configure Stratus ES/ESG, if necessary. Verify that the GPS Week Number Rollover is set to the correct value.
15	Squitter Rate	SQUITTER FAILURE	Contact Appareo
16	Mode S Address	ICAO ADDRESS CHANGE	Contact Appareo
17	GPS Failure (Stratus ESG only)	GPS RECEIVER FAILURE	Contact Appareo
18	1030 MHz RX VCO Lock	1030 MHZ RECEIVER FAILURE	Contact Appareo
19	DSC RAM	RAM FAILURE	Contact Appareo
20	FPGA RAM	none	Contact Appareo
21	GPS Failure (Stratus ESG only)	GPS RECEIVER FAILURE	Contact Appareo
22	GPS Failure (Stratus ESG only)	GPS RECEIVER FAILURE	Contact Appareo

Table 15: BIT diagnostic codes

10.2. LUBRICATION INFORMATION

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

10.3. EQUIPMENT REQUIRED FOR SERVICING

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

10.4. CONSUMABLE MATERIALS

No change to basic aircraft Instructions for Continued Airworthiness (Maintenance Manuals)

11. WIRING DIAGRAMS

Stratus ES D-SUB PINOUT DESCRIPTIONS						
PIN	DESCRIPTION	I/O		PIN	DESCRIPTION	I/O
1	AIRCRAFT GROUND			20	AIRCRAFT GROUND	
2	AIRCRAFT POWER			21	AIRCRAFT POWER	
3	RS232 EXTERNAL GPS	IN		22	RS232-TX MAINTENANCE	OUT
4	-			23	RS232-TX AUX	OUT
5	RS232-RX ALTITUDE	IN		24	RS232-TX ALTITUDE	OUT
6	RS232-TX GPS 1PPS	OUT		25	EXTERNAL IDENT	IN
7	EXTERNAL STANDBY	IN		26	EXTERNAL SQUAT SWITCH	IN
8	SOFTWARE UPDATE ENABLE	IN		27	ALTITUDE D4	IN
9	ALTITUDE A1	IN		28	ALTITUDE A2	IN
10	ALTITUDE A4	IN		29	ALTITUDE B1	IN
11	ALTITUDE B2	IN		30	ALTITUDE B4	IN
12	ALTITUDE C1	IN		31	ALTITUDE C2	IN
13	ALTITUDE C4	IN		32	EXTERNAL SUPPRESS I/O	I/O
14	EXTERNAL SUPPRESS IN	IN		33	14V LIGHTING BUS HI	IN
15	28V LIGHTING BUS HI	IN		34	-	
16	-			35	-	
17	AUX +5V POWER	OUT		36	AUX +5V POWER	OUT
18	EXTERNAL GPS COMMON (GND)			37	ALTITUDE COMMON (GND)	
19	AUX +5V POWER	OUT				

Stratus ESG D-SUB PINOUT DESCRIPTIONS						
PIN	DESCRIPTION	I/O		PIN	DESCRIPTION	I/O
1	AIRCRAFT GROUND			20	AIRCRAFT GROUND	
2	AIRCRAFT POWER			21	AIRCRAFT POWER	
3	RS232-RX MAINTENANCE	IN		22	RS232-TX MAINTENANCE	OUT
4	-			23	RS232-TX AUX	OUT
5	RS232-RX ALTITUDE	IN		24	RS232-TX ALTITUDE	OUT
6	RS232-TX GPS 1PPS	OUT		25	EXTERNAL IDENT	IN
7	EXTERNAL STANDBY	IN		26	EXTERNAL SQUAT SWITCH	IN
8	SOFTWARE UPDATE ENABLE	IN		27	ALTITUDE D4	IN
9	ALTITUDE A1	IN		28	ALTITUDE A2	IN
10	ALTITUDE A4	IN		29	ALTITUDE B1	IN
11	ALTITUDE B2	IN		30	ALTITUDE B4	IN
12	ALTITUDE C1	IN		31	ALTITUDE C2	IN
13	ALTITUDE C4	IN		32	EXTERNAL SUPPRESS I/O	I/O
14	EXTERNAL SUPPRESS IN	IN		33	14V LIGHTING BUS HI	IN
15	28V LIGHTING BUS HI	IN		34	-	
16	-			35	-	
17	AUX +5V POWER	OUT		36	AUX +5V POWER	OUT
18	AUX GROUND			37	ALTITUDE COMMON (GND)	
19	AUX +5V POWER	OUT				
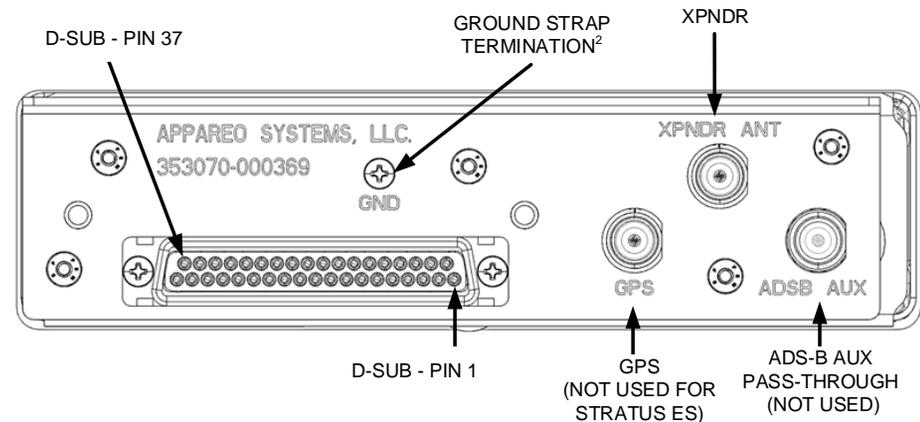
NOTES:
SOME DETAIL IS REMOVED FOR CLARITY
1 MAX CURRENT DRAW COMBINED FOR AUX +5V POWER IS 1.25 AMP. THIS WILL RESULT IN AN INCREASE OF
   0.25 AMP @28VDC AND 0.47 AMP @ 14VDC
2 BOND IMPEDENCE BETWEEN AIRCRAFT GROUND AND UNIT CHASSIS MUST BE LESS THAN 2.5 MILLIOHMS.
   PROVIDED FOR TERMINATION IS A #4-40 THREADED GROUNDING POINT.

Figure 8: Pin-out

APPAREO

Typical Stratus ES Interconnect
(Parallel Altitude Encoder)
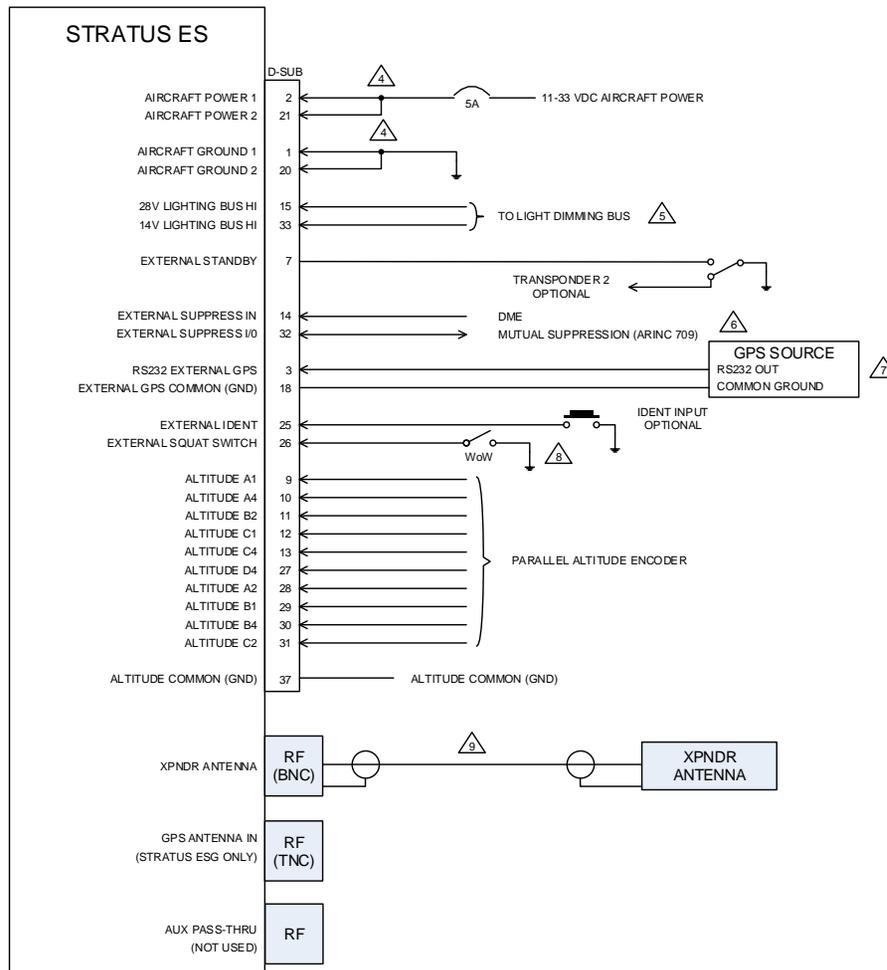
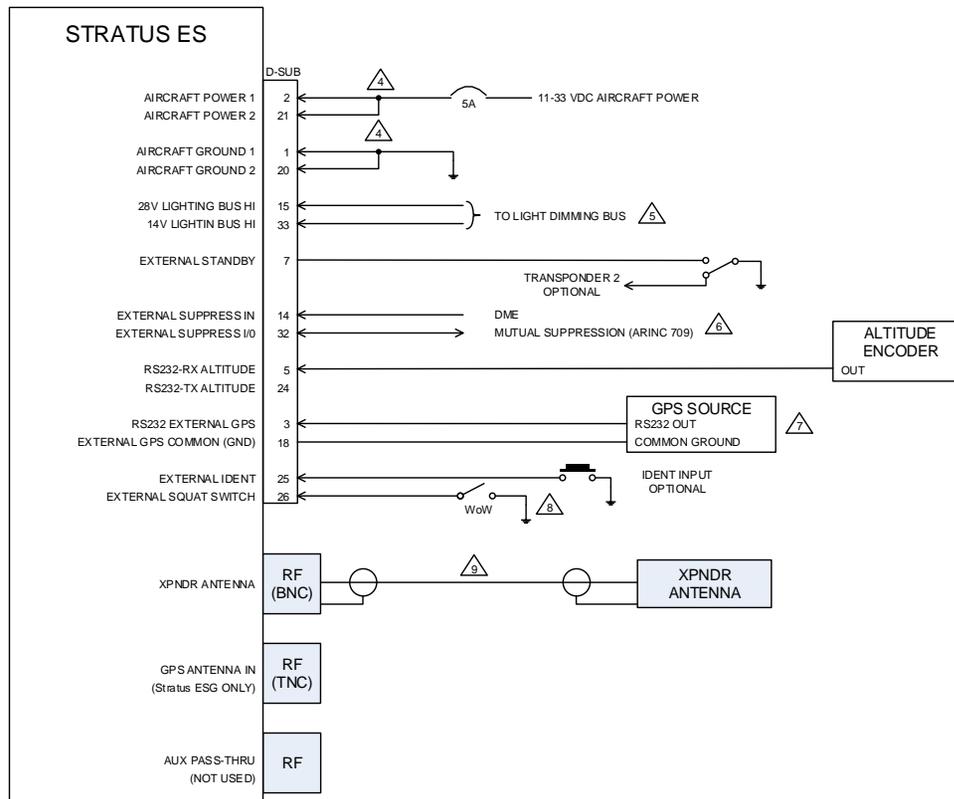**Figure 9: Stratus ES wiring diagram with parallel altitude encoder**

NOTES:

SOME DETAIL IS REMOVED FOR CLARITY

1 UNLESS OTHERWISE SPECIFIED, ALL WIRING TO BE DONE WITH 22 AWG WIRING

2 DRAWING DEPICTS INSTALLATION WITH A PARALLEL ALTITUDE ENCODER. SEE PAGE 26 FOR SERIAL ENCODER WIRING

3 PIN 24 (RS232 TX ALTITUDE) CAN BE USED AS A SERIAL ALTITUDE SOURCE FOR OTHER EQUIPMENT

4 FROM SPLICE TO UNIT, WIRE LENGTH SHOULD NOT EXCEED 6 INCHES

5 CONNECT ONLY 1 INPUT TO LIGHTING BUS

- TO CONTROL BRIGHTNESS WITH THE AMBIENT LIGHT SENSOR, DO NOT CONNECT THESE PINS AND SELECT THE AMBIENT LIGHT SENSOR DURING BACKLIGHT SOURCE CONFIGURATION

6 ONLY ONE SUPPRESSION SOURCE MAY BE CONNECTED AT ONE TIME (OPTIONAL)

7 APPROVED EXTERNAL GPS SOURCES ARE: GARMIN 430W/530W, GARMIN 650/750, & AVIDYNE IFD440/IFD540. SEE INSTALLATION INSTRUCTIONS SECTION 1.11.1 FOR ADDITIONAL DETAILS

8 OPTIONAL INSTALLATION. TYPICALLY CONNECTED TO WEIGHT ON WHEELS SWITCH. REFER TO AIRCRAFT MANUAL TO DETERMINE APPLICABILITY.

9 USING RG400, THE MAXIMUM CABLE LENGTH IS 14 FEET WITH A MAXIMUM OF 2 dB LOSS. IF THE INSTALLATION REQUIRES MORE LENGTH, SELECT OTHER 50 OHM COAX THAT WILL PROVIDE A MAXIMUM 2 dB LOSS.

APPAREO

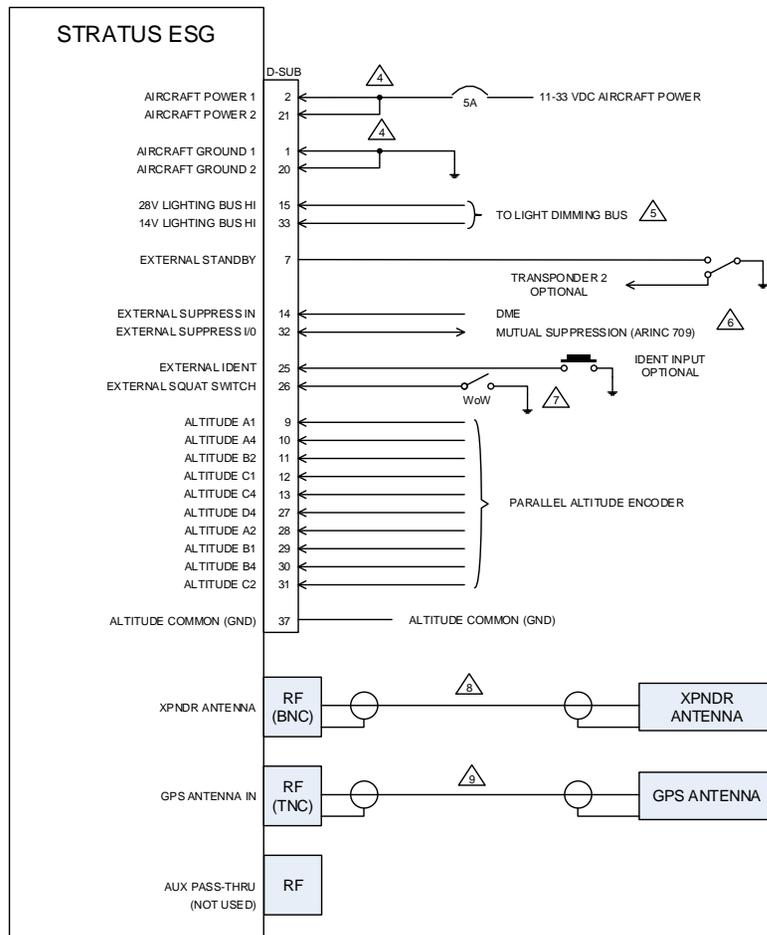# Typical Stratus ES Interconnect
(Serial Altitude Encoder)

NOTES:

SOME DETAIL IS REMOVED FOR CLARITY
1 UNLESS OTHERWISE SPECIFIED, ALL WIRING TO BE DONE WITH 22 AWG WIRING
2 DRAWING DEPICTS INSTALLATION WITH A SERIAL ENCODER. SEE PAGE 25 FOR PARALLEL ENCODER WIRING
3 PIN 24 (RS232 TX ALTITUDE) CAN BE USED AS A SERIAL ALTITUDE SOURCE FOR OTHER EQUIPMENT
4 FROM SPLICE TO UNIT, WIRE LENGTH SHOULD NOT EXCEED 6 INCHES
5 CONNECT ONLY 1 INPUT TO LIGHTING BUS
- TO CONTROL BRIGHTNESS WITH THE AMBIENT LIGHT SENSOR, DO NOT CONNECT THESE PINS AND SELECT THE AMBIENT LIGHT SENSOR DURING BACKLIGHT SOURCE CONFIGURATION
6 ONLY ONE SUPPRESSION SOURCE MAY BE CONNECTED AT ONE TIME (OPTIONAL)
7 APPROVED EXTERNAL GPS SOURCES ARE: GARMIN 430W/530W, GARMIN 650/750, & AVIDYNE IFD440/IFD540. SEE INSTALLATION INSTRUCTIONS SECTION 1.11.1 FOR ADDITIONAL DETAILS
8 OPTIONAL INSTALLATION. TYPICALLY CONNECTED TO WEIGHT ON WHEELS SWITCH. REFER TO AIRCRAFT MANUAL TO DETERMINE APPLICABILITY.
9 USING RG400, THE MAXIMUM CABLE LENGTH IS 14 FEET WITH A MAXIMUM OF 2 dB LOSS. IF THE INSTALLATION REQUIRES MORE LENGTH, SELECT OTHER 50 OHM COAX THAT WILL PROVIDE A MAXIMUM 2 dB LOSS.

Figure 10: Stratus ES wiring diagram with serial altitude encoder

Typical Stratus ESG Interconnect
(Parallel Altitude Encoder)

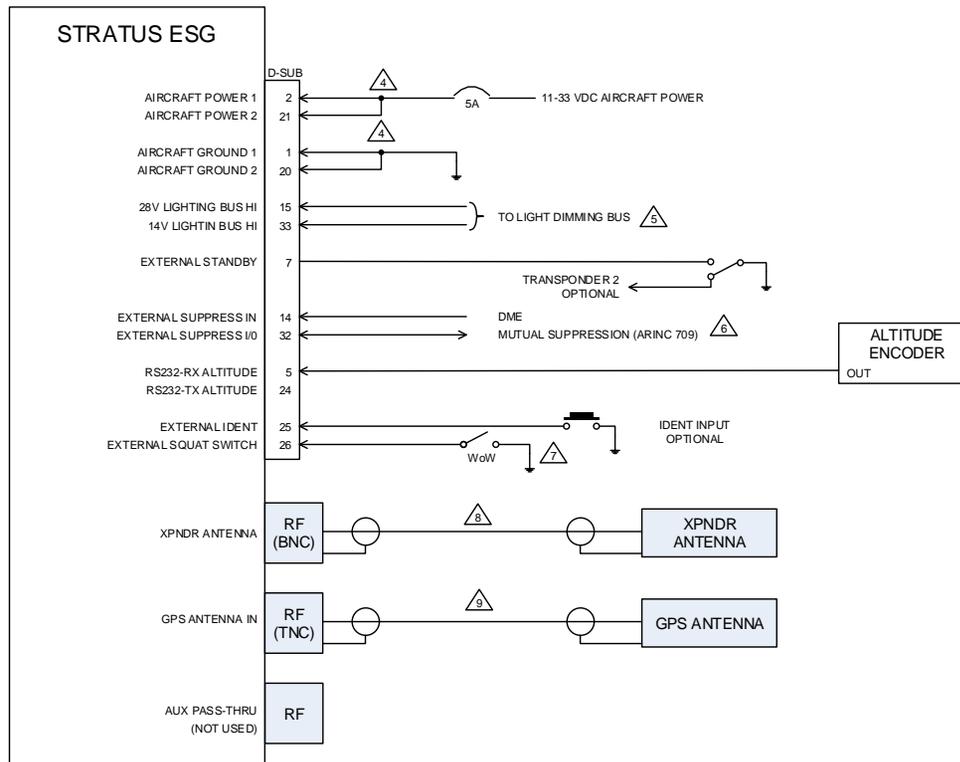**Figure 11: Stratus ESG wiring diagram with parallel altitude encoder**

NOTES:

SOME DETAIL IS REMOVED FOR CLARITY
1 UNLESS OTHERWISE SPECIFIED, ALL WIRING TO BE DONE WITH 22 AWG WIRING
2 DRAWING DEPICTS INSTALLATION WITH A PARALLEL ALTITUDE ENCODER. SEE PAGE 28 FOR SERIAL ENCODER WIRING
3 PIN 24 (RS232 TX ALTITUDE) CAN BE USED AS A SERIAL ALTITUDE SOURCE FOR OTHER EQUIPMENT
4 FROM SPLICE TO UNIT, WIRE LENGTH SHOULD NOT EXCEED 6 INCHES
5 CONNECT ONLY 1 INPUT TO LIGHTING BUS
- TO CONTROL BRIGHTNESS WITH THE AMBIENT LIGHT SENSOR, DO NOT CONNECT THESE PINS AND SELECT THE AMBIENT LIGHT SENSOR DURING BACKLIGHT SOURCE CONFIGURATION
6 ONLY ONE SUPPRESSION SOURCE MAY BE CONNECTED AT ONE TIME (OPTIONAL)
7 OPTIONAL INSTALLATION. TYPICALLY CONNECTED TO WEIGHT ON WHEELS SWITCH. REFER TO AIRCRAFT MANUAL TO DETERMINE APPLICABILITY.
8 USING RG400, THE MAXIMUM CABLE LENGTH IS 14 FEET WITH A MAXIMUM OF 2 dB LOSS. IF THE INSTALLATION REQUIRES MORE LENGTH, SELECT OTHER 50 OHM COAX THAT WILL PROVIDE A MAXIMUM 2 dB LOSS.
9 ALL WIRING SHOULD HAVE A MINIMUM OF 2 dB LOSS AND A MAXIMUM OF 7 dB LOSS. EACH BNC OR TNC CONNECTION IS ESTIMATED TO HAVE A 0.2 dB LOSS

Typical Stratus ESG Interconnect
(Serial Altitude Encoder)

NOTES:

SOME DETAIL IS REMOVED FOR CLARITY
1 UNLESS OTHERWISE SPECIFIED, ALL WIRING TO BE DONE WITH 22 AWG WIRING
2 DRAWING DEPICTS INSTALLATION WITH A SERIAL ENCODER. SEE PAGE 27 FOR PARALLEL ENCODER WIRING
3 PIN 24 (RS232 TX ALTITUDE) CAN BE USED AS A SERIAL ALTITUDE SOURCE FOR OTHER EQUIPMENT
4 FROM SPLICE TO UNIT, WIRE LENGTH SHOULD NOT EXCEED 6 INCHES
5 CONNECT ONLY 1 INPUT TO LIGHTING BUS
- TO CONTROL BRIGHTNESS WITH THE AMBIENT LIGHT SENSOR, DO NOT CONNECT THESE PINS AND SELECT THE AMBIENT LIGHT SENSOR DURING BACKLIGHT SOURCE CONFIGURATION
6 ONLY ONE SUPPRESSION SOURCE MAY BE CONNECTED AT ONE TIME (OPTIONAL)
7 OPTIONAL INSTALLATION. TYPICALLY CONNECTED TO WEIGHT ON WHEELS SWITCH. REFER TO AIRCRAFT MANUAL TO DETERMINE APPLICABILITY.
8 USING RG400, THE MAXIMUM CABLE LENGTH IS 14 FEET WITH A MAXIMUM OF 2 dB LOSS. IF THE INSTALLATION REQUIRES MORE LENGTH, SELECT OTHER 50 OHM COAX THAT WILL PROVIDE A MAXIMUM 2 dB LOSS.
9 ALL WIRING SHOULD HAVE A MINIMUM OF 2 dB LOSS AND A MAXIMUM OF 7 dB LOSS. EACH BNC OR TNC CONNECTION IS ESTIMATED TO HAVE A 0.2 dB LOSS

Figure 12: Stratus ESG wiring diagram with serial altitude encoder

APPAREO

Appendix A: Wire routing and location

NOTE: These diagrams are generic. Each aircraft may be configured differently and may have a different arrangement of avionics and circuit panels.
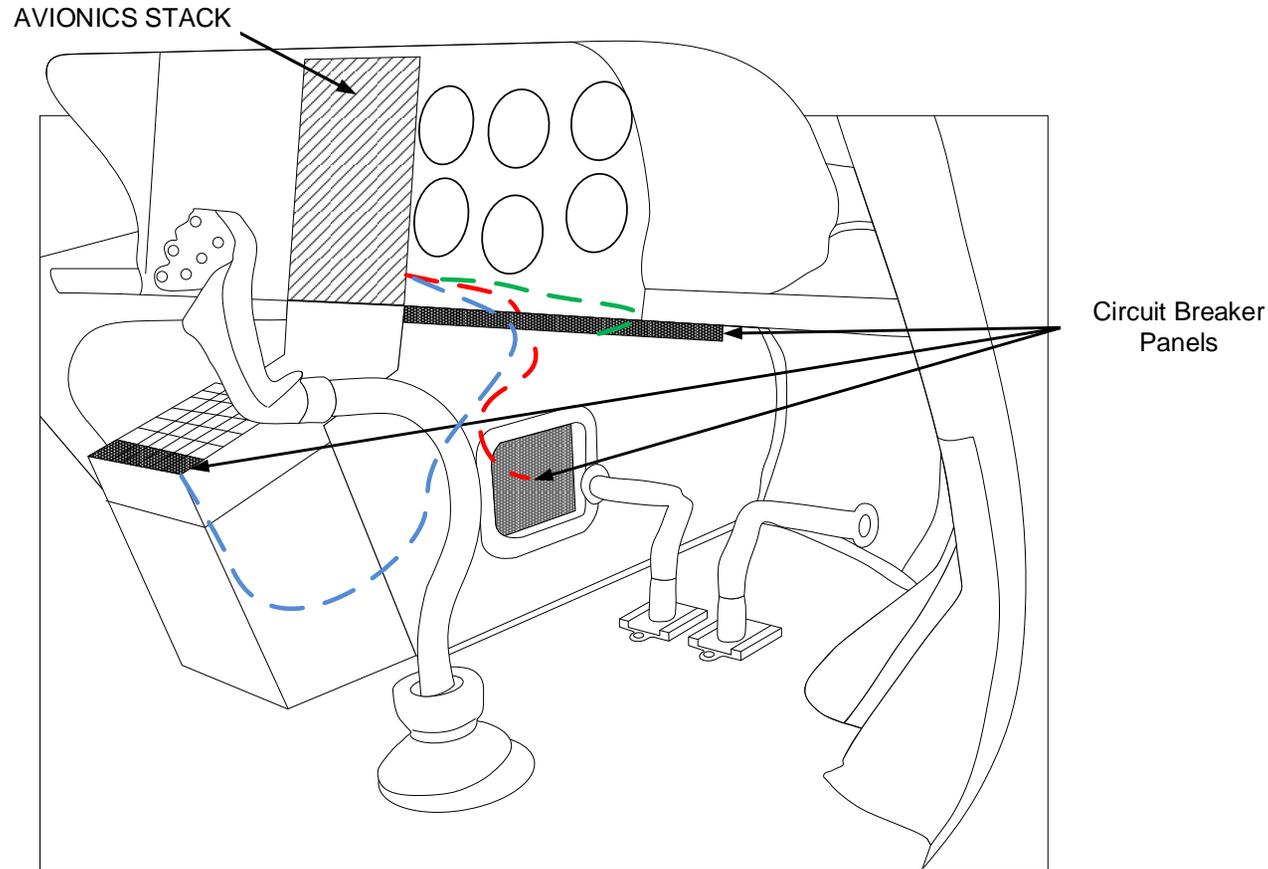
AVIONICS STACK

Circuit Breaker
Panels

Figure 13: AS350, EC120, EC130 Wire Routing

AVIONICS
STACK

CIRCUIT
BREAKER
PANEL
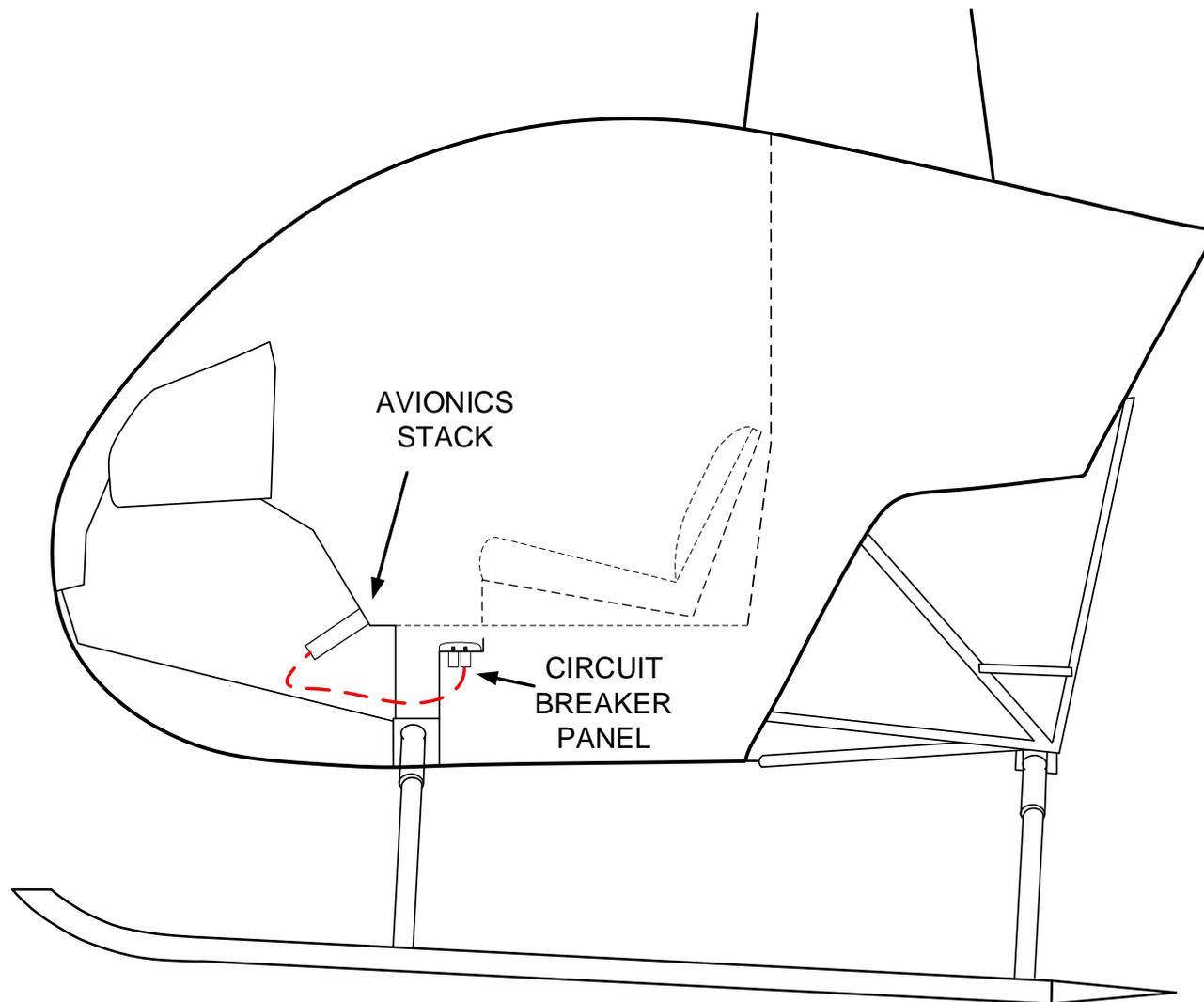
Figure 14: R22 & R44 Wire Routing
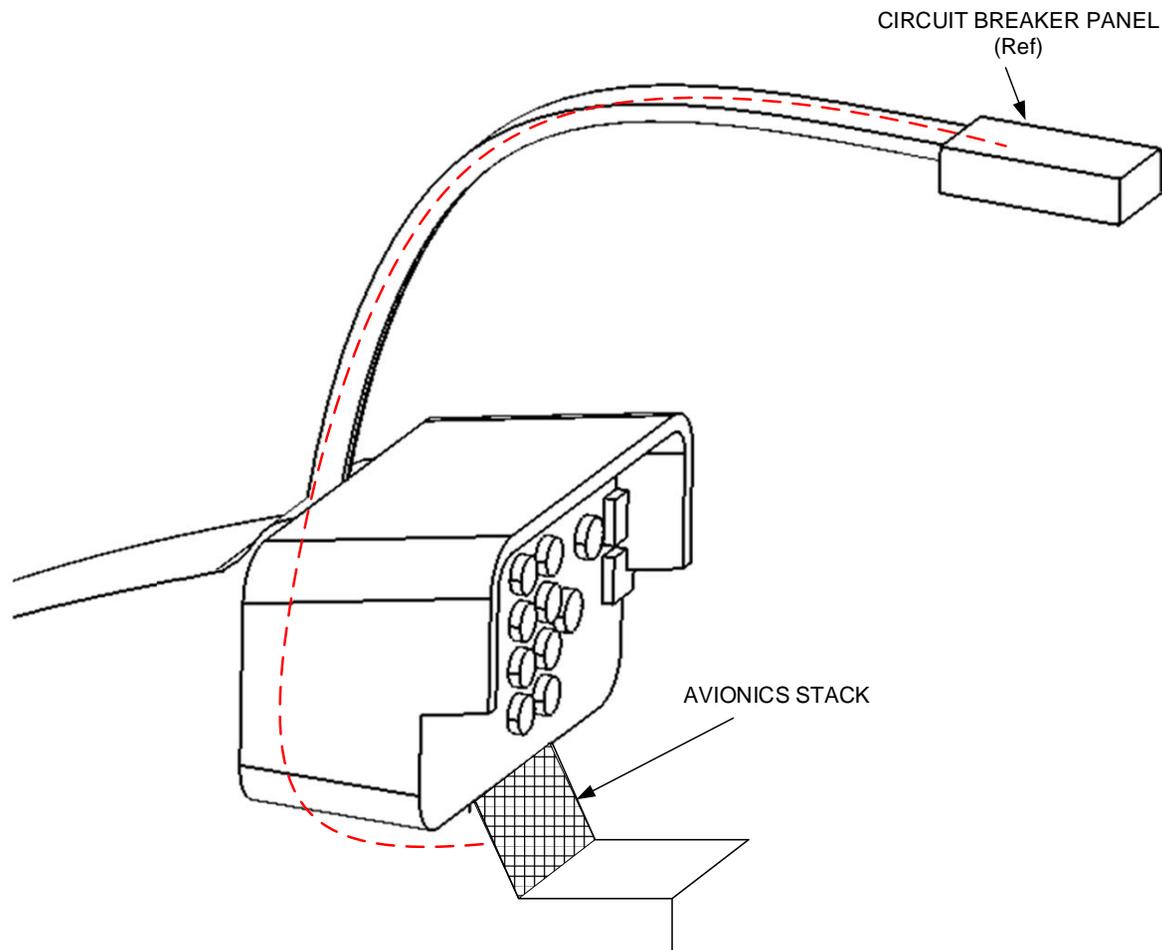
CIRCUIT BREAKER PANEL
(Ref)

AVIONICS STACK

Figure 15: Agusta A109 & A119 and Bell 206, 407 Wire Routing