Slocum G2 Glider Maintenance Manual

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Contents

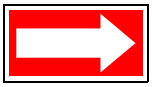
Preface

This manual provides the information required to transport, set up, and maintain the Slocum Glider G2 System. This manual is used in conjunction with the *Slocum Glider G2 Operators Manual*. It is divided into the following sections:

- **Section 1—Warnings and Precautions** covers precautions to be taken while maintaining the G2 system. These include general safety warnings, hazardous material handling, and equipment handling.
- **Section 2—Field Maintenance Procedures** contains step-by-step procedures to be followed in maintaining the G2 system.
- **Section 3—Ballasting** describes how to adjust the mass of the glider so that the glider is neutrally buoyant and properly trimmed at the surface of the operation site water.
- **Section 4—Parts List and Equipment Returns** contains a comprehensive list of the parts and part numbers for the G2 system, along with instructions on how to return equipment for repairs and refurbishment.
- **Appendix—Abbreviations and Acronyms** provides a list of abbreviations and acronyms related to glider maintenance and operations.

Notes and Warnings

Where applicable, special notes and warnings are presented as follows:



NOTE A referral to another part of this manual or to another reference; a recommendation to check that certain criteria are met before proceeding further in a step or sequence; or general information applicable to the setup and operation of the Teledyne Webb Research Slocum G2 Glider.

CAUTION A reminder to follow certain precautions in order to prevent damage to equipment or injury to personnel.

WARNING A reminder that dangerous or damaging consequences could result if certain recommended procedures are not followed.

Format Notes

Glider sensors and commands will be denoted in the Courier font throughout this document, as shown in the example below:

Typing `Report ++ m_roll` will report measured roll (`m_roll`) every four seconds.

When displayed on a PC, some areas will be hyperlinked to information available on the Internet, such as:

http://www.webbresearch.com/

and protected documents by permission:

http://www.glider.webbresearch.com/

Many of the links and the code mentioned in this manual require access by prior arrangement. Please contact glidersupport@webbresearch.com to inquire about access to these protected documents.

Customer Service

We welcome your comments and suggestions for improving our products, documentation, and service for the glider system. Therefore, please contact Glider Support should you have any comments or suggestions about this manual or the Teledyne glider system, or if you require service or support.

Please contact us at:

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www.webbresearch.com

1 Warnings and Precautions

General Safety Warnings

Electrical Shock

WARNING Always shut off the system power before beginning work on equipment.
Do not come into contact with electrical connectors.
Do not be misled by low voltage. Low potentials can also be dangerous.
Do not work alone on electrical equipment. Be sure another person is nearby who can give first aid.

Heavy Objects

WARNING Some objects covered in this manual are heavy and need two people to lift them.
Muscle strain can occur while loading or unloading the glider and cart.

Heavy Parts

WARNING A glider in a crate may pose a crushing hazard.

Pinch Points

WARNING When gliders are assembled and disassembled, certain parts may cause a pinch hazard. Be aware of moving parts that may cause a pinch hazard while locking or unlocking the glider and cart and while disassembling and assembling the glider.

Hazardous Material Warnings and Safety Precautions

Warnings about using and coming into contact with hazardous materials are included throughout this manual. These warnings are designated as shown in the format below. The types of hazardous material warnings that are included in this manual are described below.

WARNING Chemical warnings indicate that the material will cause burns or irritation to human skin or tissue.
Vapor warnings indicate that vapors from a material can be dangerous to life or health.
Fire warnings indicate that a material may ignite and cause burns.
Eye protection warnings indicate that a material will injure the eyes.
When working with these materials, wear the appropriate personal protective equipment (PPE). For more details, see the specific product(s) you are working with in the table below.

Personnel working with the G2 system may come into contact with the following hazardous materials. Safety precautions and warnings for these hazardous materials are described in the table below.

Product Name	Safety Precautions and Warnings
Alkaline Batteries	If the glider contains alkaline batteries, there is a small but finite possibility that batteries of alkaline cells will release a combustible gas mixture, especially if the batteries are exposed to water or sea water and/or shorted. This gas release generally is not evident when batteries are exposed to the atmosphere, as the gases are dispersed and diluted to a safe level. When the batteries are confined in a sealed instrument, the gases can accumulate and an explosion is possible. Teledyne Webb Research has added a catalyst inside of the glider to recombine hydrogen and oxygen into water, and the glider has been designed to relieve excessive internal pressure buildup by having the hull sections separate under internal pressure. Teledyne Webb Research knows of no way to completely eliminate this hazard. The user is warned, and must accept and deal with this risk in order to use this instrument safely as so provided. Personnel with knowledge and training to deal with this risk should seal or operate the instrument.
AquaShield	• Avoid contact with skin, eyes, and clothing. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • Do not breathe vapors or spray mist. Ensure adequate ventilation. • AquaShield 36 X8 may be harmful if swallowed. • Keep people away from and upwind of the spill and/or leak. • Use personal protective equipment. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvent is used for cleaning.

Product Name	Safety Precautions and Warnings
CSC Lithium Battery	• Remove jewelry before handling lithium batteries. • Avoid contact with skin, eyes, and clothing. Wear the appropriate PPE—eye protection and chemical resistant gloves—while handling lithium batteries. • Do not breathe vapors or spray mist. Ensure adequate ventilation. • Sulfuric acid can form if lithium batteries come in contact with water. • Keep people away from and upwind of the spill and/or leak. • If ingested, drink copious amounts of water (or milk, if available). Do not induce vomiting. • Never give anything by mouth to an unconscious person. Immediately seek medical attention. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when working with batteries. For more information about handling and working safely with lithium batteries, see the following documents: • Electrochem's product data sheet for lithium sulfuryl chloride cell batteries at http://www.electrochemsolutions.com/pdf/high-rate/csc93/3B0030Datasheet.pdf. • Electrochem's material safety data sheet (MSDS) for lithium sulfuryl chloride cells and batteries at http://www.electrochemsolutions.com/pdf/CSC_PMX_MSDS.pdf. • *Primary Lithium Battery Safety and Handling Guidelines* at http://www.electrochemsolutions.com/pdf/Safety_and_Handling_Guide.pdf.
Dielectric Grease	• Avoid contact with skin and eyes. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • Do not breathe vapors or spray mist. Ingestion may cause slight stomach irritation and discomfort. Ensure adequate ventilation. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvents are used for cleaning.
Drakeol 9 Light Mineral Oil (LT MIN OIL)	• Avoid contact with skin and eyes. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • Do not breathe vapors or spray mist. Ingestion may cause lung inflammation and damage. Ensure adequate ventilation. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvents are used for cleaning.

Product Name	Safety Precautions and Warnings
Loctite 2440	• Avoid contact with skin and eyes. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • Do not breathe vapors. Loctite 2440 may cause respiratory tract irritation. Ensure adequate ventilation. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvent is used for cleaning.
Loctite 262	• Avoid contact with skin and eyes. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • Do not breathe vapors. Loctite 262 may cause respiratory tract irritation. Ensure adequate ventilation. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvent is used for cleaning.
Loctite 567 Pipe Sealant	• Avoid contact with skin and eyes. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • Do not breathe vapors. Loctite 567 may cause respiratory tract irritation. Ensure adequate ventilation. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvent is used for cleaning.
NatraSorb S	• Avoid contact with skin and eyes. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • Ingestion is unlikely, but if ingested, blockage may occur. Get medical attention.
Parker O-Lube	• Avoid contact with skin and eyes. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • If ingested, immediately drink two glasses of water, induce vomiting, and seek medical attention. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvent is used for cleaning.
Parker Super-O-Lube	• Avoid contact with skin and eyes. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvent is used for cleaning.

Product Name	Safety Precautions and Warnings
Royal Purple Motor Oil	• Avoid contact with skin and eyes. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • Do not breathe vapors. Ensure adequate ventilation. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvent is used for cleaning.
Sea-Bird Anti-Foulant Device (AF24173)	• Avoid contact with skin and eyes. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using this product. • Do not breathe vapors. AF24173 may cause respiratory tract irritation. Ensure adequate ventilation. • Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvent is used for cleaning.

Equipment Handling Warnings, Safety Precautions, and Care Tips

General

- Only trained and authorized personnel should handle the Slocum glider.
- Ensure that the glider is powered down properly before removing the green plug.
- Rinse the glider with fresh water after exposure to salt water.
- Do not apply greater than 15 volts with a power supply.
- When Teledyne Impulse connections are mated, care to the alignment of pins and proper seating of the connector should be taken.
- Carbon fiber hulls should be handled carefully. The O-ring sealing surfaces should be inspected for scratches and defects that could lead to a leak.
- Minor scratches to paint and anodizing should be touched up with automotive paint or nail polish.
- O-rings should be inspected for cleanliness, nicks, and slices. O-ring surfaces should also be inspected for scratches, dents, and cleanliness. Parker Fibrous O-Lube 884-4 (Petroleum Naphthenic Oil and Barium Soap) is recommended. Wear the appropriate PPE—eye protection and chemical resistant gloves—while using these products.
- Rinse the pressure transducer thoroughly with fresh water after each saltwater deployment.
- The internal electronics of this equipment are sensitive to electrostatic discharge (ESD) and proper precautions must be adhered to when handling any electrical components of the system.
- Never power a shallow glider without a vacuum.
- Never run a simulation on a glider other than `on_bench`.
- Never deploy a glider in simulation.
- Never deploy a glider in `boot pico`.
- Never exit to pico during a deployment.
- Never deploy a glider in lab_mode.
- Never perform the top of a yo below 30 meters (with 100- or 200-meter pumps).
- Never secure the glider to the glider cart while the cart is not secure or over the railing or in the water.
- Do secure the glider properly in crate with all three straps for shipping.
- Significant damage to equipment can occur if it is not properly secured. This is true at all times, in the lab, during transportation and while being deployed. The glider cart should be used during maintenance. When parts are removed from the cart, caution must be taken to secure the cylindrical pieces as they can roll off of surfaces.
- Do use fresh desiccants for each deployment.
- Do monitor internal vacuum before launch (less vacuum indicates a leak; positive pressure may indicate dangerous gas accumulation). The vacuum will fluctuate with temperature.

- Do simulate missions before launch.
- Do test Iridium and Argos telemetry before launch.
- To care for dummy and green plugs, use OLube lubrication or silicone spray and keep contact pins clean.
- The ejection weight can come out with moderate force (do not stand behind and activate).

Storage Conditions

For optimum battery life, the storage temperature range is +10 to +25 degrees C. When activated, the glider should be equilibrated at a temperature between -2 and +54 degrees C.

Lifting the Glider

- Lifting the glider is a two-man operation. When in the laboratory, it is generally easier to lift the glider while it is strapped to the cart.
- One person should lift the glider at the forward end and another at the aft end. Please note that the glider is heavier at the forward end.
- Be sure to follow proper lifting procedures:
  - Plan before you lift—You and your lifting partner need to know what you are doing and where you are going to prevent any awkward movements. Also make sure your path is clear.
  - Lift the glider close to your body—You have more strength when you lift close to your body than when you lift at arm's reach. Make sure you have a firm grip on the glider, and keep it balanced close to your body.
  - Keep your feet shoulder width apart to improve your support and balance. Take short steps while moving the glider.
  - Bend with your knees, and keep your back straight.
  - Tighten your stomach muscles while you are lifting the glider. Tight abdominal muscles hold your back in a good lifting position and prevent excessive force on the spine.
  - Lift the glider with your legs. Your leg muscles are much stronger than your back muscles. Also lower the glider with your legs when you are finished moving it. While you are lifting, keep your eyes focused upward so that your back remains straight.
  - Wear a belt or back support to maintain a better lifting posture.

Science Sensor Handling

- Each manufacturer's recommendation for service and care should be followed. Some sensors, especially those protruding, may need special handling during deployment, recovery and shipping to prevent damage.
- Individual sensors may have special needs. See manufacturer's recommendations.

O-ring Maintenance

Following is an excerpt from the *Parker O-Ring Handbook*. This handbook is available for download at:

http://www.parker.com/literature/ORD%205700%20Parker_O-Ring_Handbook.pdf

Cleanliness

Cleanliness is vitally important to ensure proper sealing action and long O-ring life. Every precaution must be taken to ensure that all component parts are clean at time of assembly. Foreign particles—dust, dirt, metal chips, grit, etc.—in the gland may cause leakage and can damage the O-ring, reducing its life.

Assembly

Assembly must be done with great care so that the O-ring is properly placed in the groove and is not damaged as the gland assembly is closed. Some of the more important design features to ensure this are:

1. The inside diameter stretch, as installed in the groove, should not be more than 5%. Excessive stretch will shorten the life of most O-ring materials.
2. The inside diameter expansion needed to reach the groove during assembly ordinarily does not exceed 25-50% and should not exceed 50% of the ultimate elongation of the chosen compound. However, for small diameter O-rings, it may be necessary to exceed this rule of thumb. If so, sufficient time should be allowed for the O-ring to return to its normal diameter before closing the gland assembly.
3. The O-ring should not be twisted. Twisting during installation will most readily occur with O-rings having a large ratio of inside diameter to cross-section diameter.

Surface Finishes

All mating surfaces for the O-ring must also be regularly inspected and cared for to maintain the finish and ensure a proper seal.

2 Field Level Maintenance

Glider

Tools:	Glider Maintenance Accessory Kit
Materials and parts:	Glider (200 or 1000 meters)
Personnel required:	2 electronics technicians

Disassembling the Glider

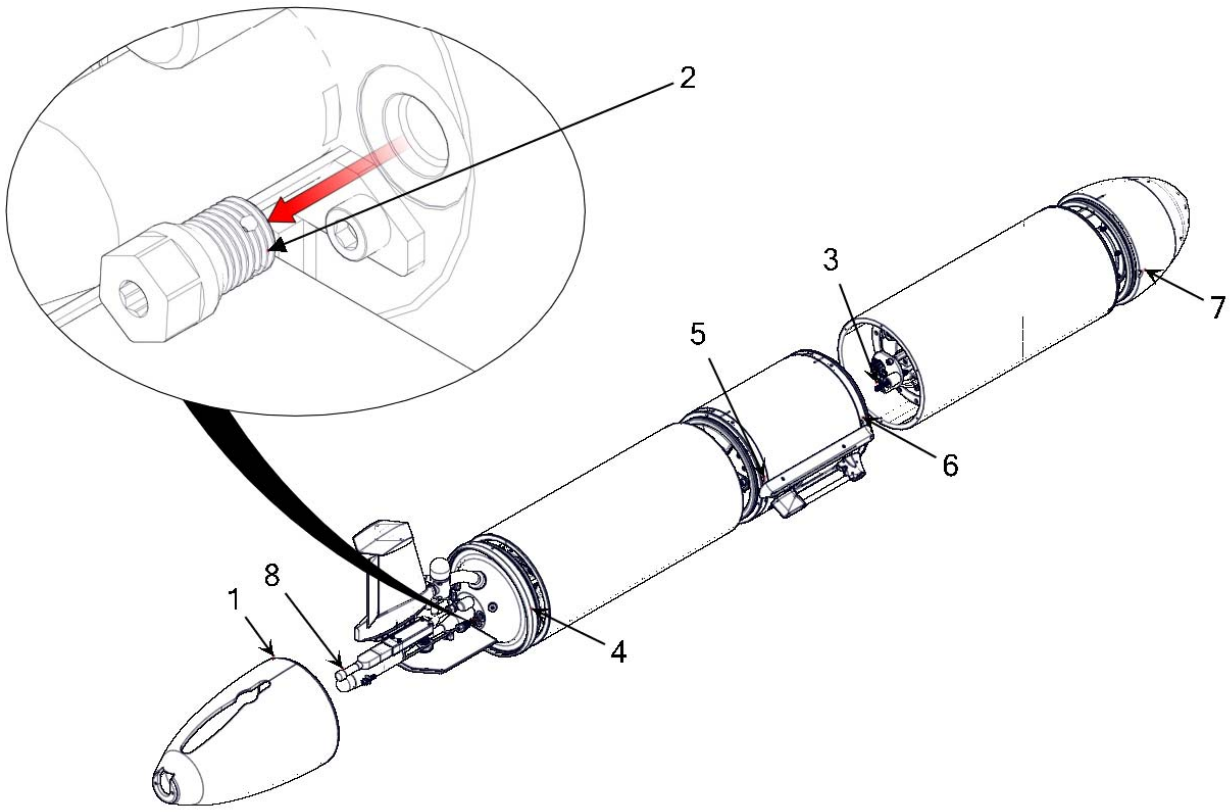
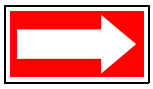


Figure 2-1 G2 Glider.

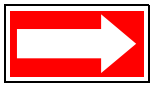
WARNING The user needs to command the glider to “exit” from a terminal and be instructed by the glider that it is OK to remove the power before the green plug or power supply can be removed. If not handled properly, the file system may become corrupt and the glider rendered inoperable. Before exiting, the operator should instruct the glider to deflate the air bladder.

WARNING Lifting the glider is a two-man lift. Failure to comply may result in injuries to personnel or damage to equipment.

1. When properly shut down, ensure that the power to the glider is off by removing the green go plug and replacing with the red stop plug.
2. Remove the aft cover (Figure 2-1, Item 1). For more details, refer to "Removing the Aft Cover" on page 2-55.
3. Remove the military standard (MS) plug (Figure 2-1, Item 2).
4. Insert a 3/16 hex driver into the access port and engage the tie rod.
5. Unscrew until the tie rod is disengaged from the tie rod plate (Figure 2-1, Item 3).



NOTE Take care not to damage the seal area or the threads with the side of the driver.



NOTE Each hull section can be separated by several inches to access the inside of the vehicle. If greater access is needed, the wiring from and to the payload bay or payload section must be disconnected.

6. Use the hull separation tool to separate the science/payload bay from the forward (Figure 1, Item 6) and aft (Figure 2-1, Item 5) hull sections.
7. Grip the digital tail fin (digifin) to separate the aft hull section from the aft end cap assembly (Figure 2-1, Item 4).

8. Use the hull separation tool to separate the forward section from the forward assembly (Figure 2-1, Item 7) For more details, see "Forward Assembly" on page 2-9.

Assembling the Glider

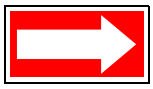
WARNING Lifting the glider is a two-man lift. Failure to comply may result in injuries to personnel or damage to equipment.

1. Ensure that power is not applied to the vehicle and that the red stop plug is installed.

WARNING If assembling the glider for the final time before deployment, a careful visual inspection should be performed on all internal components.

WARNING When the glider is sealed for the final time before a deployment, a full functional test of the glider system should be performed. Contact Glider Support for a copy of the test procedure.

2. Place the three hull sections on the cart in the appropriate fore and aft position, keeping the top centerline marks up and in line.
3. At the forward end of the payload, reconnect the battery connector, serial connector, and battery enable, if applicable, along with the CPC connector.



NOTE Take care when engaging connectors, because the pins are delicate.

4. Slide the payload bay and the forward hull together, taking care not to pinch any wires and to ensure free movement of the battery connector wire, as it must move with pitch adjustments.
5. Position the aft hull so that the center line marks are matched with the payload bay, leaving an approximate three-inch gap between the aft section and payload bay.

NOTE The hull sections must be aligned parallel and at the same height to allow them to fit together. It is recommended that this work is done on the glider cart.

6. Ensure that all of the connectors on the aft chassis are connected and seated properly.
7. Slide the aft end cap and chassis into the aft hull.
8. Take care that the tie rod runs through the tie rod guide tube in the payload bay. This aligns the rod and protects payload components.
9. At the aft end of the payload bay, reconnect the aft battery connector, the serial connectors, and battery enable, if applicable.
10. Slide the payload bay and forward hull sections together until the tie rod engages with the tie rod plate (Figure 2-1, Item 3) in the forward hull section.

NOTE Ensure that the O-rings are seated properly and that no wires are being pinched. Do not damage the O-rings, seal area, or threads with the side of the driver.

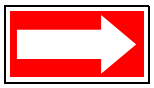
WARNING O-ring care and inspection are critical to successful missions and integral in preventing leaks (see O-ring care section).

11. Use the 3/16" hex T-handled torque wrench to tighten the tie rod to 15 in/lbs.
12. The hull sections should be tight and square to the end caps. The rings and hull sections with the centerline marks should be in alignment.

    If the hull sections are not tight, left the aft end by the digital tail fin (digifin) to wiggle the hull sections, and allow for further tie rod tightening.
13. If required, refit the wing rails with socket head cap screws (SHCSs) with a 5/32" hex driver.

NOTE In addition to desiccants, you can optionally backfill the glider with nitrogen. Contact glidersupport@webbresearch.com for more information.

14. Use a vacuum pump with an evacuation tool and place the 7/16" MS plug (Figure 2-1, Item 2) on the hex driver.
15. Seal the evacuation tool over the aft end cap evacuation port.
16. Evacuate the glider to six inches of mercury for 200-meter glider and seven inches of mercury for a 1000-meter glider, and screw in the MS plug (Figure 2-1, Item 2) using the 15" lb torque handle.



NOTE MS plugs should be inspected for wear and replaced if worn.

WARNING Peek parts are delicate. Proper tools must be used for peek parts and proper torque applied; otherwise, these parts will snap. In general, peek parts (such as the MS vent plug shown in Figure 2-1) can be recognized by their light brown color and plastic appearance.

17. After the glider is sealed, confirm and adjust the vacuum. For more details, see "Checking and Setting the Vacuum on the Glider" on page 2-7.

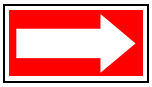
Checking and Setting the Vacuum on the Glider

Before applying power to the glider, verify that the glider is closed and has a proper vacuum. If the glider is not closed and does not have a proper vacuum, then follow these steps:

1. Assemble the glider as described in "Assembling the Glider" on page 2-4.
2. Remove the aft cover as described in "Removing the Aft Cover" on page 2-55.
3. With the vacuum tool and the long T-handle, put a vacuum on the glider. The target is 6" Hg (7 for 1000 m), but it is best to pull a vacuum higher than this as you can bleed some air in when the glider is powered on.
4. Once there is a proper vacuum and the MS vent plug is in place, apply the power. The glider then powers on and goes through its normal startup routine. To gain control of the glider, type `ctrl-c` to display the GliderDOS prompt shown below.

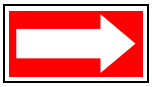
   ```
   SEQUENCE: About to run initial.mi on try 0. You have 120
   seconds to type a control-C to terminate the sequence. The
   control-P character immediately starts the mission. All other
   characters are ignored.
   ```

5. From the GliderDOS prompt, type `callback 30`. This hangs up the Iridium phone for 30 minutes. You can enter any value for callback from 1 to 30. Alternatively, you can type `use - iridium` to take the Iridium out of service until your testing is complete.
6. Type `lab_mode on`. This places the glider in lab mode and prevents the glider from running its default mission.



NOTE Never launch a glider in `lab_mode`.

7. (optional) Type `ballast`. This deflates the air bladder, and sets the pitch motor and ballast pump to 0.



NOTE Never launch a glider in `ballast`.

8. Type `report ++ m_vacuum`. This displays the vacuum inside the glider every time the sensor updates. If the vacuum is already at 6" (7" for 1000-meter) Hg, you are done (+/- .2). If not, you need to adjust the vacuum by allowing air in to decrease the value or pulling more air out to increase the value.
9. Once the vacuum is within 0.2" Hg, type `report clearall`. This stops reporting the vacuum value.

10. If not in place already, install the aft cowling on the glider (see "Aft Cover" on page 2-54). If you are connected via an external power supply, power down by typing `exit` before installing the cowling.
11. Install the stop plug (red) as described in "Stop Plug (Red) and Go Plug (Green)" on page 2-52.

Forward Assembly

Tools:	Hull separation tool
Materials and parts:	Forward assembly (200 or 1000 meters)
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

Removing the Forward Assembly

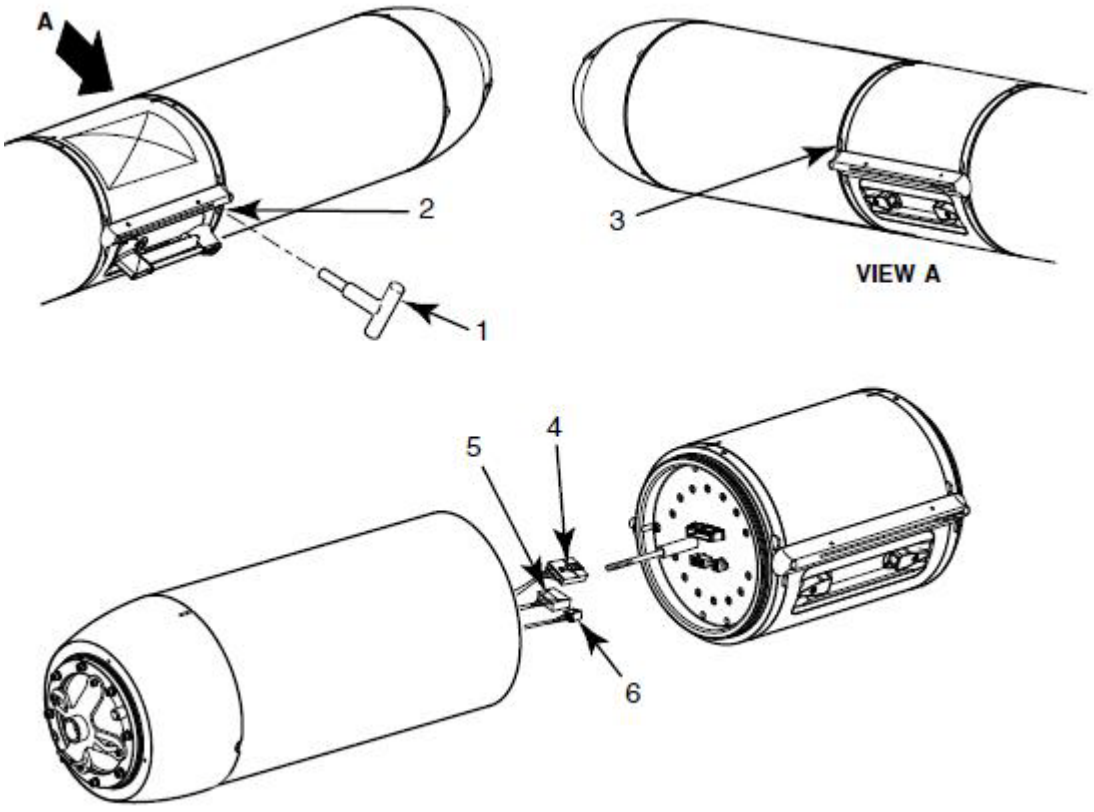


Figure 2-2 Forward assembly (200/1000M).

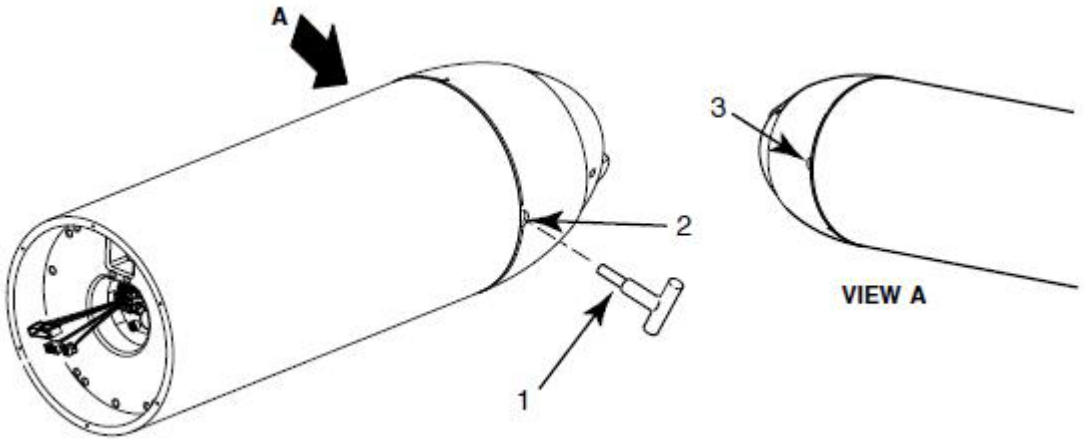


Figure 2-3 Forward assembly (200/1000M).

1. Using the hull separation tool (Figure 2-2, Item 1) at locations 2 and 3 in Figure 2-2, disengage the forward hull section from the payload bay.
2. Disconnect the connectors (Figure 2-2, Items 4-6) from the payload bay.
3. Using the hull separation tool (Figure 2-3, Item 1) at locations 2 and 3 in Figure 2-3, disengage the forward hull section from the forward assembly.

WARNING The forward and aft batteries are heavy and must be supported by the hulls in their respecitive bays at all times. If dissaembly requires removing hulls or the assembly to which the battery is affixed, the batteries should be removed from the vehicle first, or conversly disconnected and left inside in the hulls while the assembly is removed and worked on.

Installing the Forward Assembly

1. Align the forward hull section with the forward assembly.
2. Connect the connectors (Figure 2-2, Items 4-6) from the forward assembly to the payload bay.
3. Align the forward assembly with the payload bay.
4. Reference "Assembling the Glider" on page 2-4 for the final installation.

Tie Rod Assembly

Tools:	Phillips screwdriver
Materials and parts:	Tie rod assembly
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1, "Removing the Aft Cover" on page 2-55, and "Removing the Aft End Cap Assembly" on page 2-57.

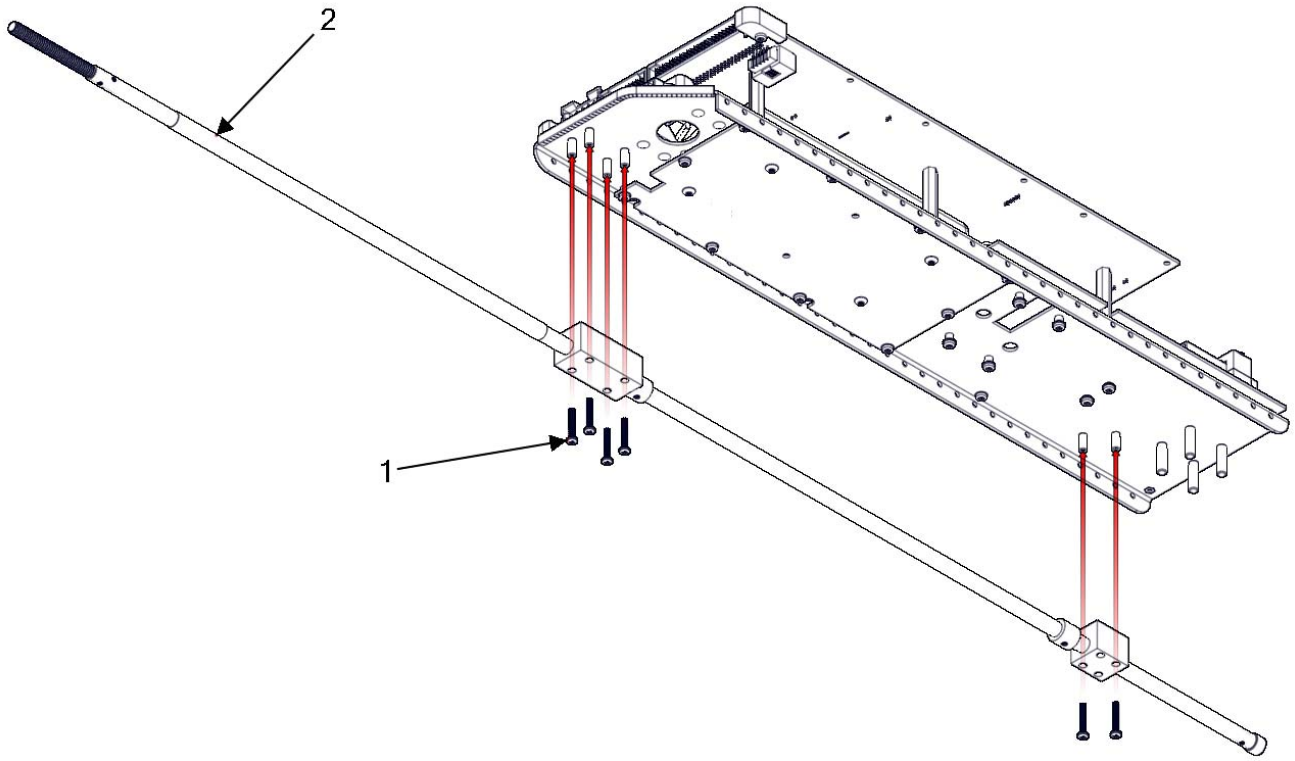


Figure 2-4 Tie rod assembly.

Removing the Tie Rod Assembly

1. Remove the six screws (Figure 2-4, Item 1) that attach the tie rod (Figure 2-4, Item 2) to the bottom of the aft electronics tray.
2. Remove the tie rod (Figure 2-4, Item 2).

Installing the Tie Rod Assembly

1. Position the tie rod assembly (Figure 2-4, Item 2) on the standoffs on the bottom of the aft electronics tray.
2. Install the six screws (Figure 2-4, Item 1) that attach the tie rod (Figure 2-4, Item 2) to the bottom of the aft electronics tray.

Tie Rod Plate

Tools:	Phillips screwdriver
Materials and parts:	Tie rod plate
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

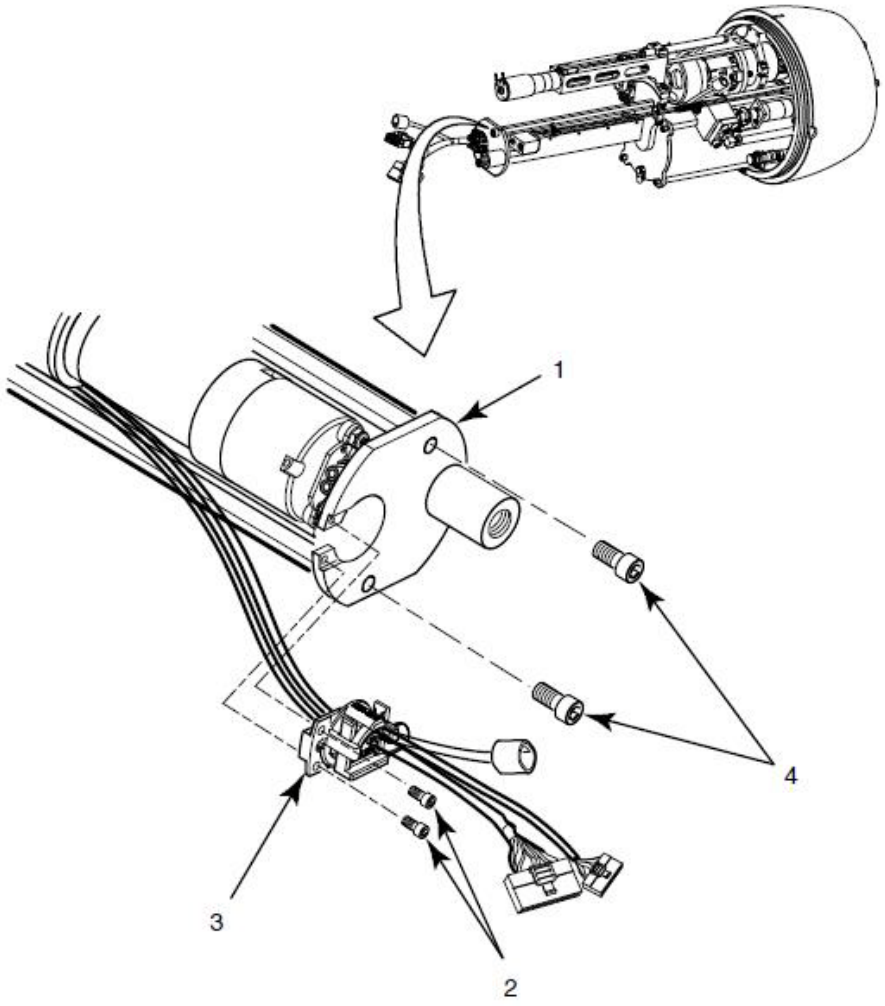


Figure 2-5 Tie rod plate.

Removing the Tie Rod Plate

1. Remove the two screws (Figure 2-5, Item 2) that attach the ratcheting strain relief bushing (Figure 2-5, Item 3) to the tie rod plate (Figure 2-5, Item 1).
2. Remove the two tie rod plate screws (Figure 2-5, Item 4).

Installing the Tie Rod Plate

1. Attach the tie rod plate with the two screws (Figure 2-5, Item 4).
2. Install the two screws (Figure 2-5, Item 2) that attach the ratcheting strain relief bushing (Figure 2-5, Item 3) to the tie rod plate (Figure 2-5, Item 1).

Ballast Bottles

Tools:	Phillips screwdriver
Materials and parts:	Ballast bottle, 60 ML
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

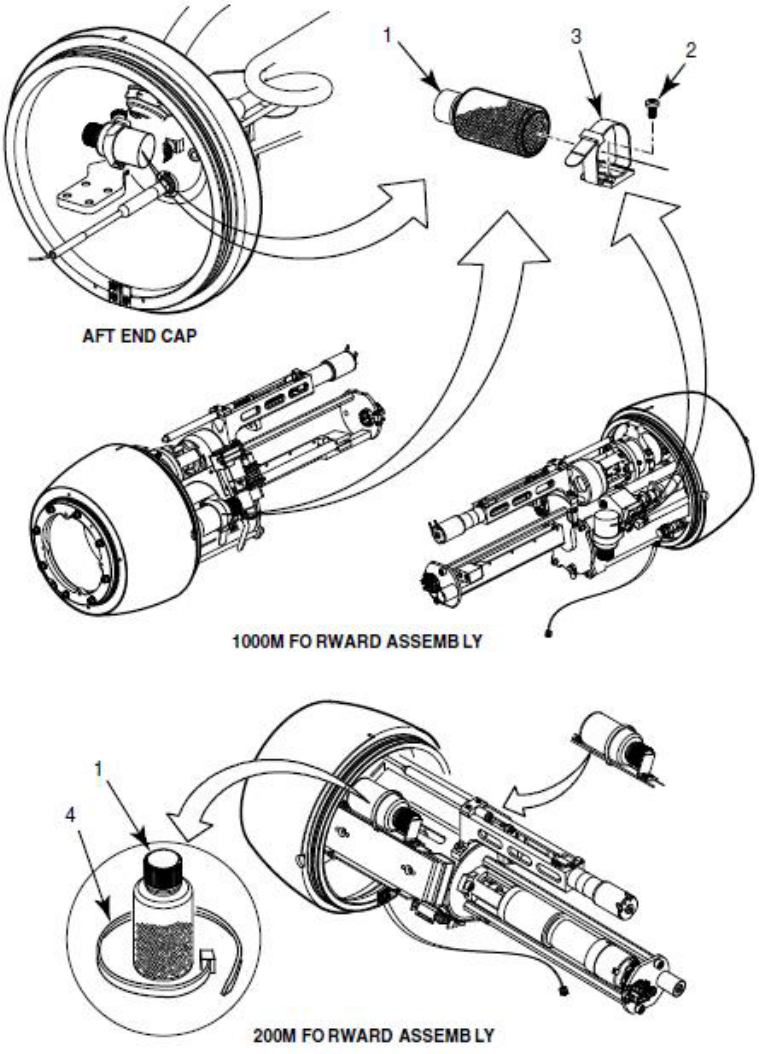


Figure 2-6 Ballast bottles, 60 ML.

NOTE Moving and adjusting the ballast bottles will affect the glider's ballasting and H-moment. This should be done with care to maintain proper ballasting.

WARNING An improperly ballasted glider may not fly well and can cause mission or vehicle failure.

Removing the Ballast Bottles

1. As necessary, remove the screw (Figure 2-6, Item 2) that secures the ballast bottle bracket (Figure 2-6, Item 3).
2. Loosen the ballast bottle bracket (Figure 2-6, Item 3) or the zip tie (Figure 2-6, Item 4).
3. Remove the ballast bottle (Figure 2-6, Item 1).

Installing the Ballast Bottles

1. Install the ballast bottle (Figure 2-6, Item 1).
2. Tighten the ballast bottle bracket (Figure 2-6, Item 3) or the zip tie (Figure 2-6, Item 4).
3. As necessary, install the screw (Figure 2-6, Item 2) that secures the ballast bottle bracket (Figure 2-6, Item 3).

Battery Pack

Tools:	Hex head T-handle
Materials and parts:	Glider battery pack
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

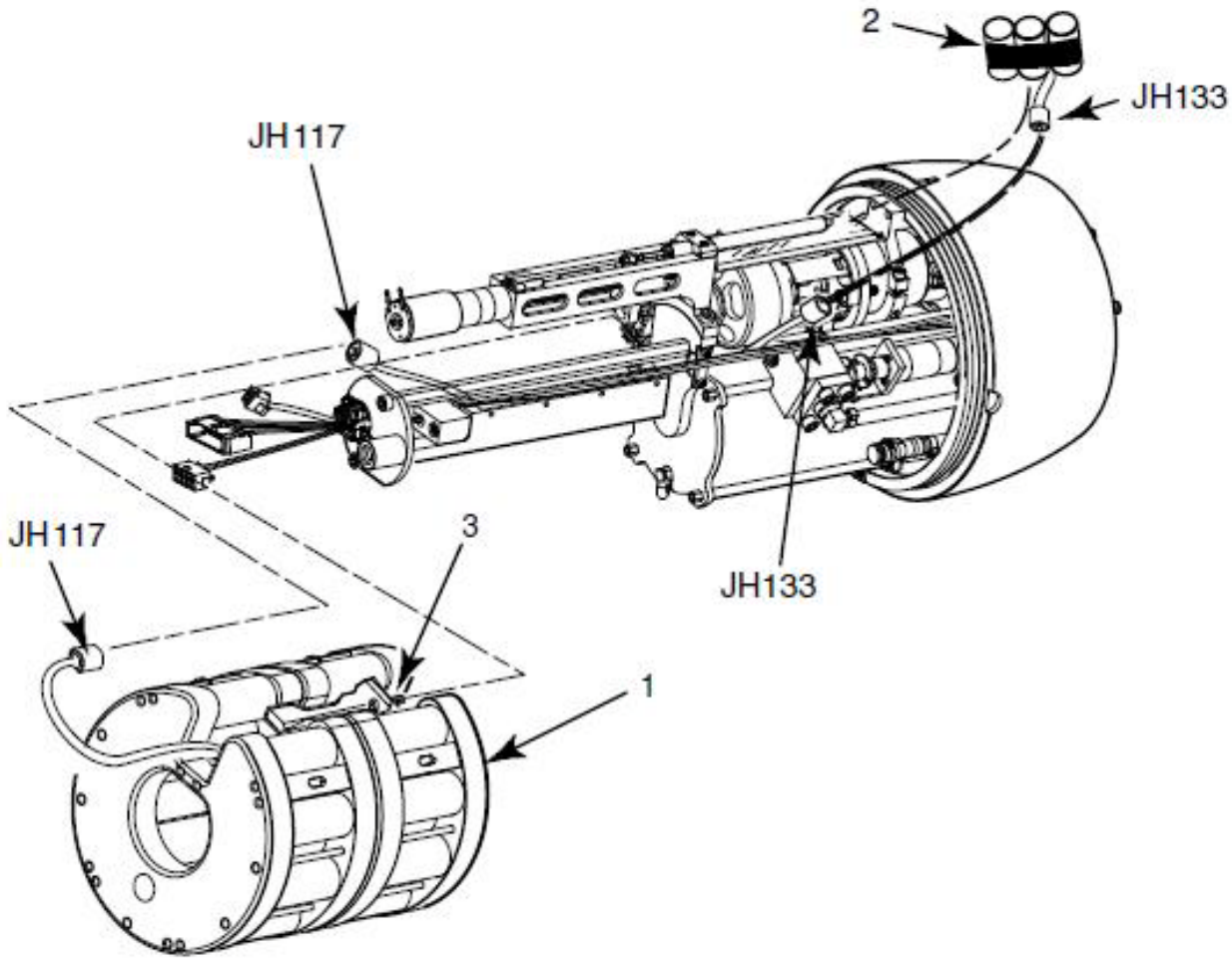


Figure 2-7 Forward/pitch glider battery pack.

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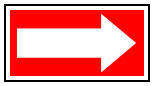


NOTE Moving and adjusting the batteries will affect the glider's ballasting and H-moment. This should be done with care to maintain proper ballasting.

WARNING An improperly ballasted glider may not fly well or can cause mission or vehicle failure.

WARNING When installing new batteries, the m_coulomb_amphr_total sensor must be set to zero by typing `m_coulomb_amphr_total 0`.

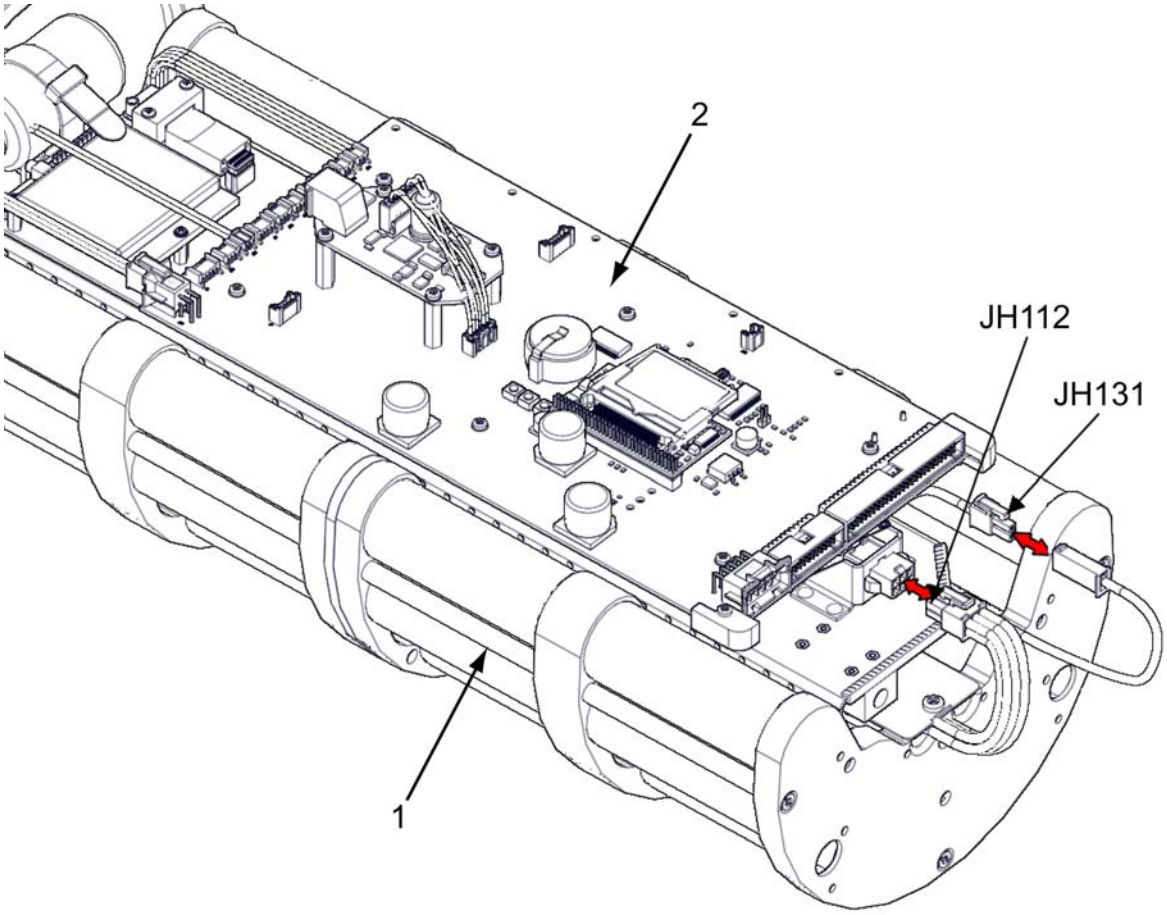


Figure 2-8 Aft glider battery pack.

WARNING Lithium batteries pose a significant hazard when stored or handled improperly. The two hazards associated with lithium sulfuryl chloride batteries and their components are fire and explosion, which could occur if the batteries are crushed, punctured, excessively heated, charged, overdischarged, short circuited, or submerged in water in a non-waterproof enclosure.

Lithium sulfuryl chloride cells are safe to handle when all of their components are adequately wrapped and sealed within a stainless steel casing. When that casing is compromised, an immediate danger is present due to exposure of the contents (and byproducts of these contents) with their new environment. Lithium metal reacts with water to produce lithium hydroxide, a corrosive liquid and hydrogen gas, which is flammable. Sulfuryl chloride (the liquid cathode) is a corrosive liquid that reacts with water to produce hydrogen chloride gas (which is toxic and corrosive) and sulfuric acid, a corrosive liquid.

Remove your jewelry before handling lithium batteries. Wear the appropriate PPE—eye protection and chemical resistant gloves—while handling lithium batteries.

Removing the Glider Battery Pack

1. Unplug the JH117 connection on the pitch battery (Figure 2-7, Item 1) from the forward assembly.
2. Unplug the JH133 connection on the emergency battery (Figure 2-7, Item 2) from the forward assembly.
3. Loosen the screw (Figure 2-7, Item 3).
4. Remove the pitch battery (Figure 2-7, Item 1).
5. Disconnect the JH112 connection on the aft battery (Figure 2-8, Item 1) from the aft electronics tray (Figure 2-8, Item 2).
6. Disconnect the JH131 connection on the aft battery (Figure 2-8, Item 1) from the aft electronics tray (Figure 2-8, Item 2).
7. Remove the aft battery.

Installing the Glider Battery Pack

1. Position the aft battery and connect the JH131 and JH112 from the aft battery (Figure 2-8, Item 1) to the aft electronics tray (Figure 2-8, Item 2).
2. Position the pitch battery (Figure 2-7, Item 1) and tighten the screw (Figure 2-7, Item 3).
3. Connect the JH133 on the emergency battery (Figure 2-7, Item 2) to the forward assembly.
4. Connect the JH117 on the pitch battery (Figure 2-7, Item 1) to the forward assembly.

Leak Detect Assembly

Tools:	Phillips screwdriver
Materials and parts:	Leak detect assembly
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

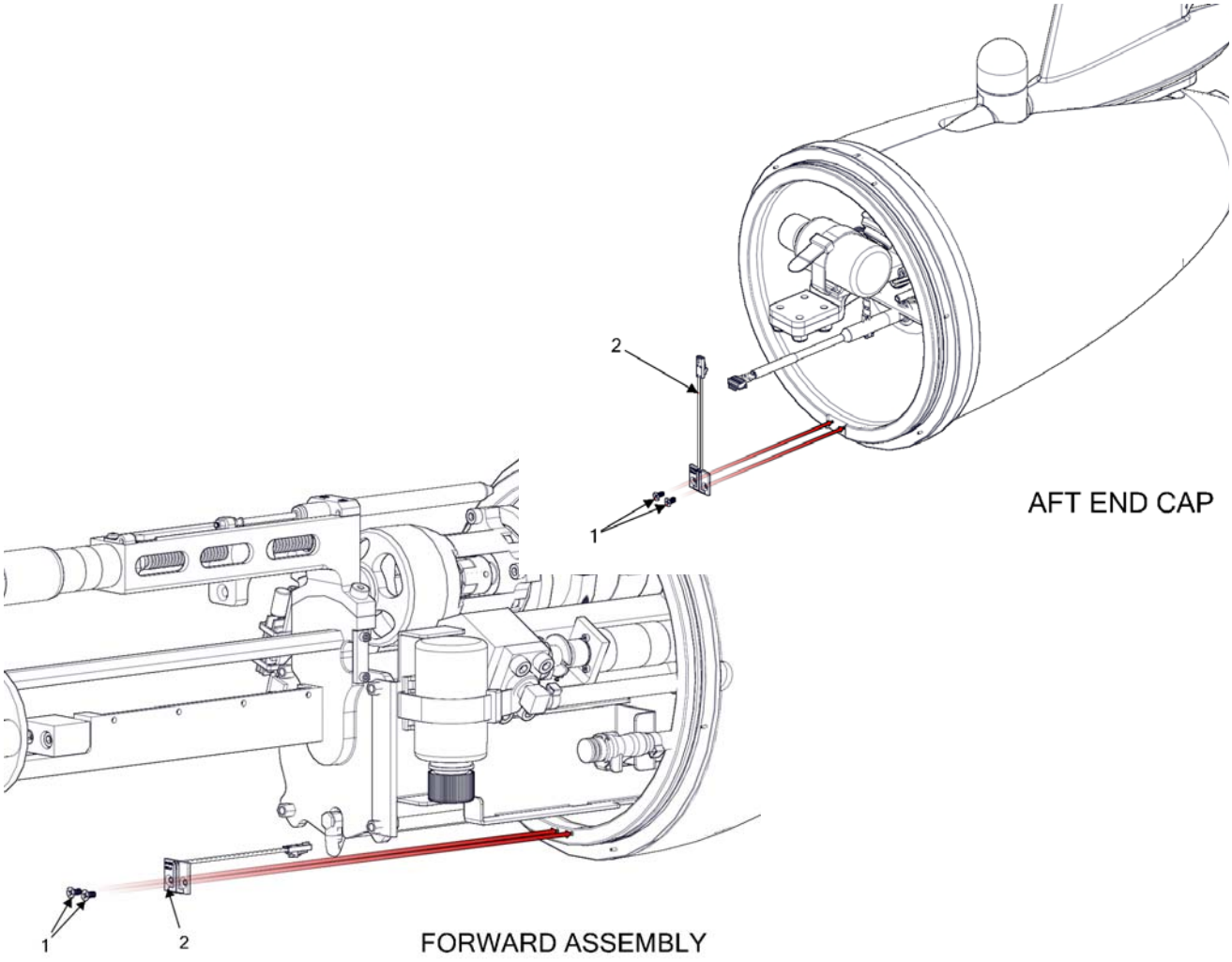


Figure 2-9 Leak detect assembly.

Removing the Leak Detect Assembly

1. Unscrew the two screws (Figure 2-9, Item 1) from either the forward assembly or aft end cap.
2. Unplug the leak detect assembly (Figure 2-9, Item 2) from either the forward assembly or aft end cap.
3. Remove the leak detect assembly (Figure 2-9, Item 2).

Installing the Leak Detect Assembly

1. Place the leak detect assembly (Figure 2-9, Item 2) in position on either the forward assembly or aft end cap.
2. Install the two screws (Figure 2-9, Item 1) to either the forward assembly or aft end cap.

Recovery Assembly

Tools:	Snap-ring pliers Phillips screwdriver
Materials and parts:	Recovery assembly
Personnel required:	1 electronics technician

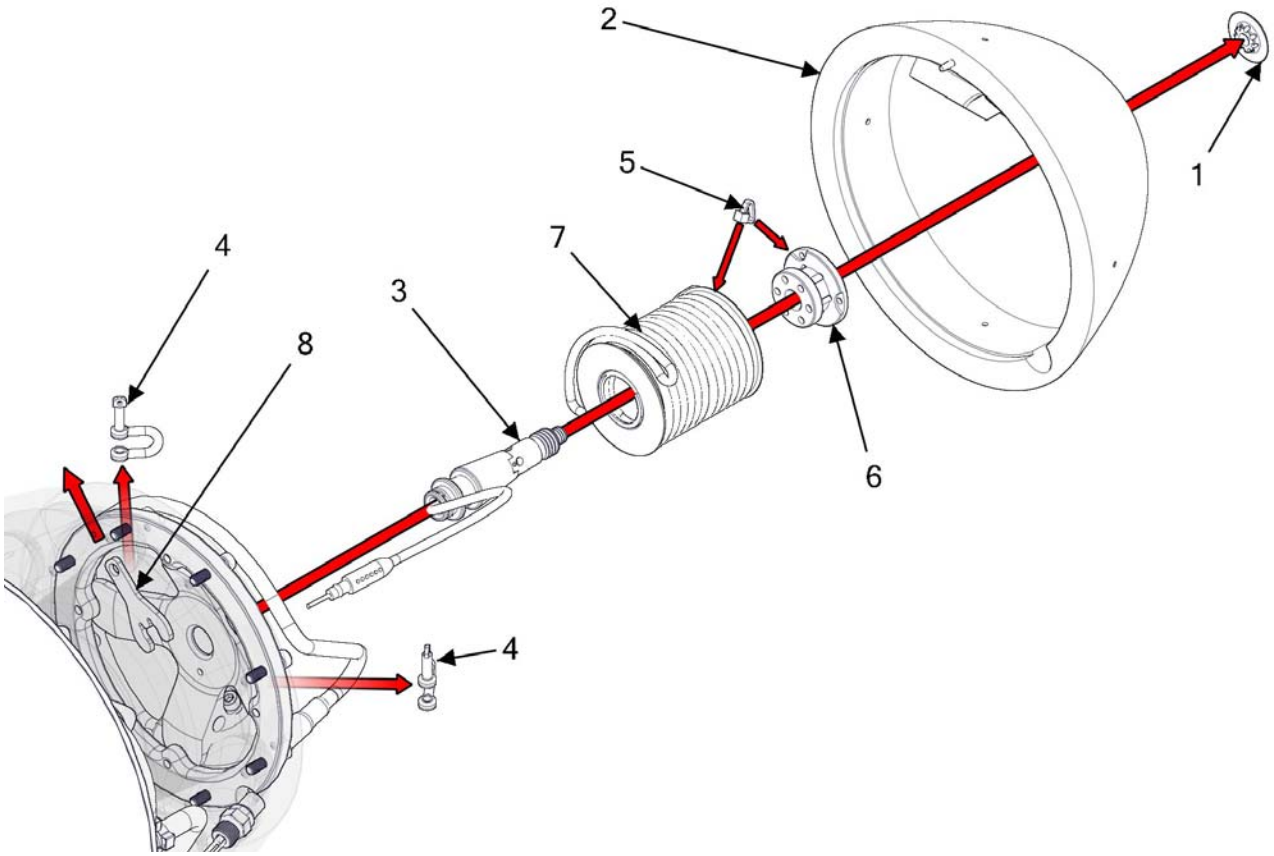


Figure 2-10 Recovery assembly.

Removing the Recovery Assembly

1. Ensure the red plug is installed.
2. Remove the sonar dome vent washer (Figure 2-10, Item 1).
3. Remove the buoyant sonar dome assembly (Figure 2-10, Item 2).
4. Remove the zip ties (Figure 2-10, Item 5).
5. Unscrew the spool nut (Figure 2-10, Item 6).
6. Remove the shackles (Figure 2-10, Item 4) from the recovery spool base.
7. Remove the recovery spool assembly with a line (Figure 2-10, Item 7).
8. Remove the retention clip (Figure 2-10, Item 8).
9. Disconnect the nose release cartridge (Figure 2-10, Item 3) connector from the altimeter.

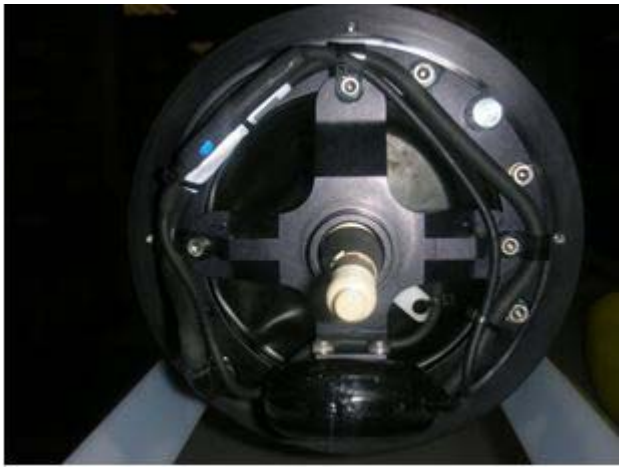
Installing the Recovery Assembly

1. Feed the nose release cartridge wire (Figure 2-10, Item 3) though the center of the recovery spool base, and feed the connector back out at 4 o'clock position.

2. Install the retention clip (Figure 2-10, Item 8) onto the nose release cartridge under the recovery spool base at the 4 o'clock position. Rotate the nose release cartridge so that the center tab on the retention clip aligns with and inserts into the slot on the cartridge base.

3. Connect the nose release cartridge connector to the altimeter, and secure the wire with nylon cable ties. Secure the wire to the hole on the end of the retention clip tab with a cable tie.

NOTE Make sure the cut (sharp) end of the cable tie faces *away* from the ballast pump. Otherwise, the sharp end of the cable ties may puncture the ballast pump's bladder.

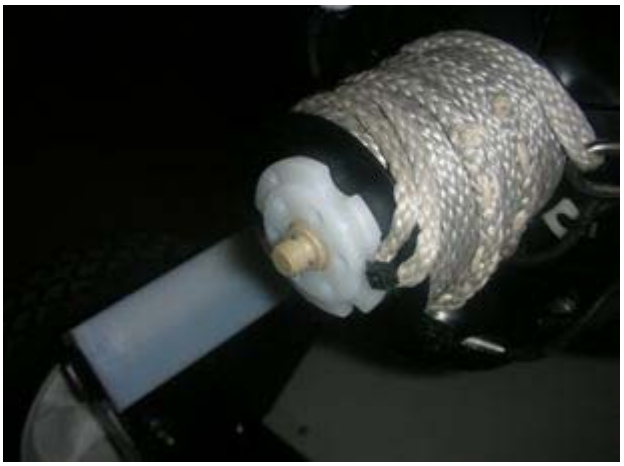


4. Insert a cable tie through one of the outer holes on the large end of the spool nut (Figure 2-10, Item 6) and leave open. Slide the recovery spool assembly with a line (Figure 2-10, Item 7) over the nose release cartridge (Figure 2-10, Item 3).

5. Slide the spool assembly with a line (Figure 2-10, Item 7) over the nose release cartridge (Figure 2-10, Item 3). Tighten the spool nut (Figure 2-10, Item 6) to the nose release cartridge until it is flush with the end of the large threads. The spool should rotate easily.

6. Install the end loop of the line closest to the base through *both* shackles. (Figure 2-10, Item 4).
7. Attach the shackles to the recovery spool base.

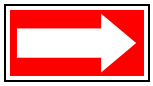
8. Attach the open cable tie on the spool nut to the forward loop on the recovery spool. Tighten the zip tie to secure the line to the spool nut (Figure 2-10, Item 5). Hold the spool nut, and rotate the spool to take up any excess slack in the recovery line.



9. Remove the rubber band or other device securing the line during shipping.

CAUTION Failure to remove the rubber band or other device securing the line could result in the line recovery system's failure.

10. Attach the buoyant sonar dome assembly (Figure 2-10, Item 2) (with flotation foam and index pin on top) to the release cartridge assembly with the sonar dome vent washer (Figure 2-10, Item 1). Use long-nose pliers to tighten.



NOTE If the buoyant sonar dome assembly will not move into the proper position, reposition the zip ties that are securing the wire harness.

Anode Assembly

Tools:	Digital voltage detector with two leads Pliers 10-inch-pound anode installation torque wrench 3/16" hex wrench
Materials and parts:	Anode assembly
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1,"Removing the Recovery Assembly" on page 2-25, and "Removing the Aft End Cap Assembly" on page 2-57.

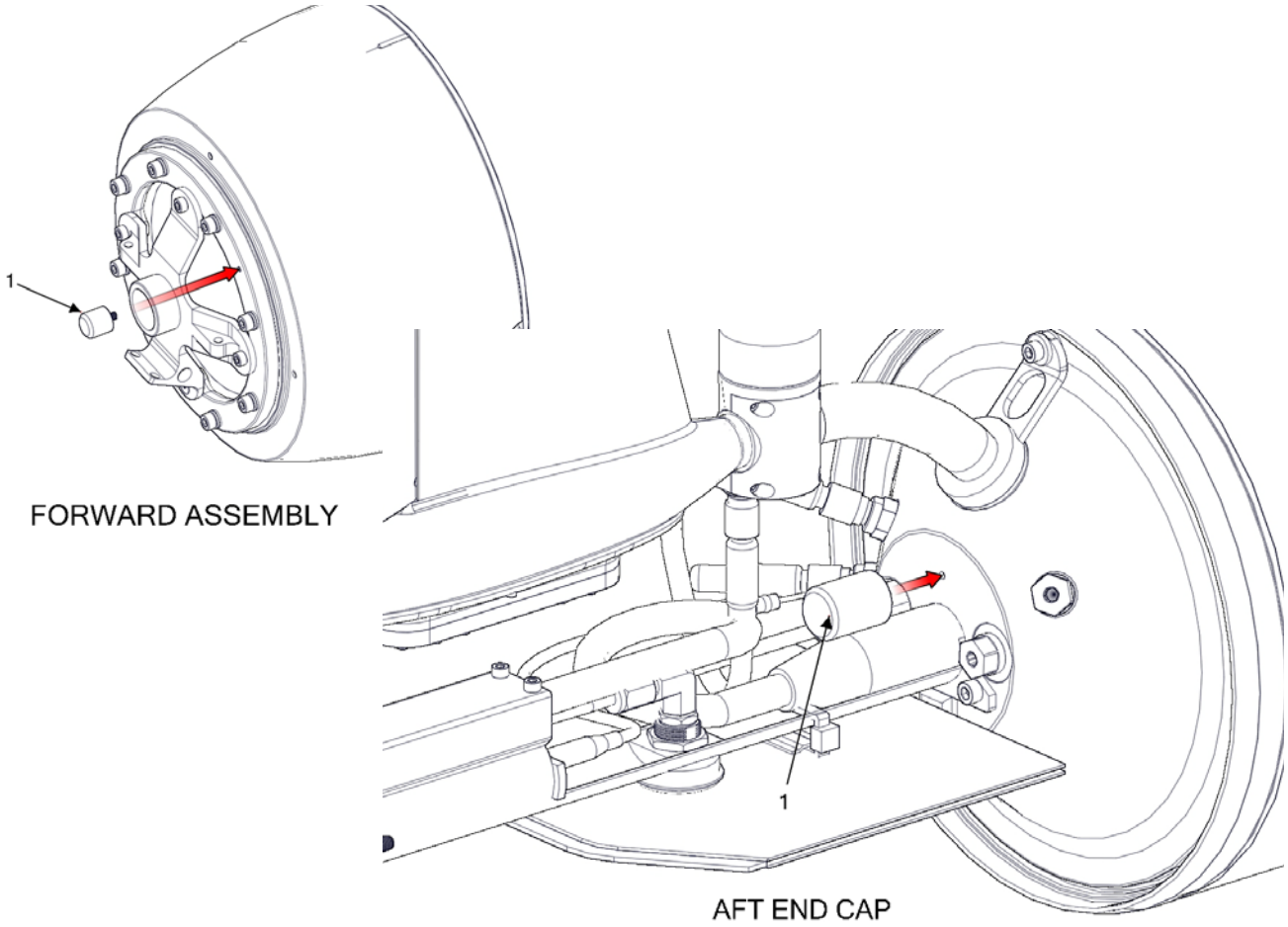


Figure 2-11 Anode assembly.

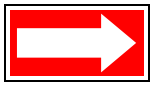
Removing the Aft/Forward Anode Assembly

Using a pair of pliers, grasp the anode assembly and unscrew it from the glider.

CAUTION Do not apply any threadlock compound, such as Loctite, to the threads of the anode assembly. The threadlock compound affects the electrical conductivity, which would prevent the anode from operating properly.

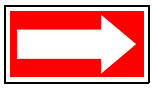
Installing the Aft Anode Assembly

1. Screw the 6-32 x ½" set screw into the ¾" x 1" zinc anode, leaving approximately ¼" of the set screw outside of the anode.
2. Place the O-ring over the set screw at the base of the anode.
3. Screw the anode assembly into the aft end cap by hand.
4. Slip the anode drive socket over the anode and tighten the cap screw using the 3/16" hex wrench.
5. Torque the anode assembly to 10 inch-pounds.



NOTE Overtightening the anode may strip the anode's interior threads, rendering it useless.

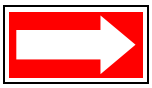
6. If no torque wrench is available, tighten the anode just beyond finger tight.
7. Using a digital voltmeter, ensure that ohms are not present between the center of the anode and any metal surface within the aft end cap.



NOTE Three different sizes of anode are available. The appropriate size used should be based on the deployment length and the corrosiveness of the water. If even larger sacrificial anodes are required, the aft anode assembly can be tapped, and another anode can be screwed into the back of it.

Installing the Forward Anode Assembly

1. Screw the 6-32 x ½" set screw into the ½" x ½" zinc anode, leaving approximately ¼" of the set screw outside of the anode.
2. Place the O-ring over the set screw at the base of the anode.
3. Screw the anode assembly into the aft end cap by hand.
4. Slip the anode drive socket over the anode and tighten the cap screw using the 3/16" hex wrench.
5. Torque the anode assembly to 10 inch-pounds.



NOTE Overtightening the anode may strip the anode's interior threads, rendering it useless.

6. If no torque wrench is available, tighten the anode just beyond finger tight.
7. Using a digital voltmeter, ensure that ohms are not present between the center of the anode and any metal surface within the forward assembly.

Installing the Recovery Cartridge Assembly

Tools:	Wire cutters
Materials and parts:	Cartridge assembly and monofilament
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

1. Align the burn-wire bushing assembly with the metal release housing. Then feed the burn-wire bushing assembly into the metal release housing (Figure 2-12 and Figure 2-13).

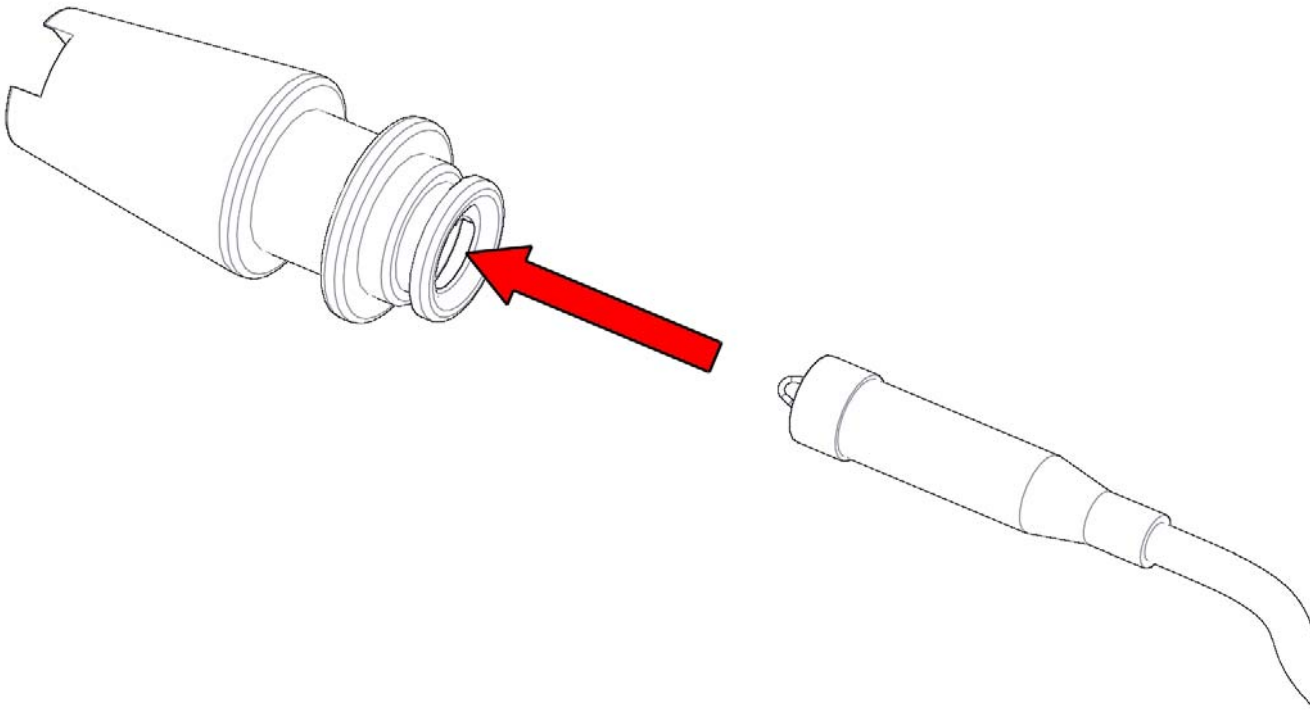


Figure 2-12 Feeding the burn wire assembly into the metal release housing.

2. Slide the threaded peek stud over the wire loop and into the release housing (Figure 2-14).

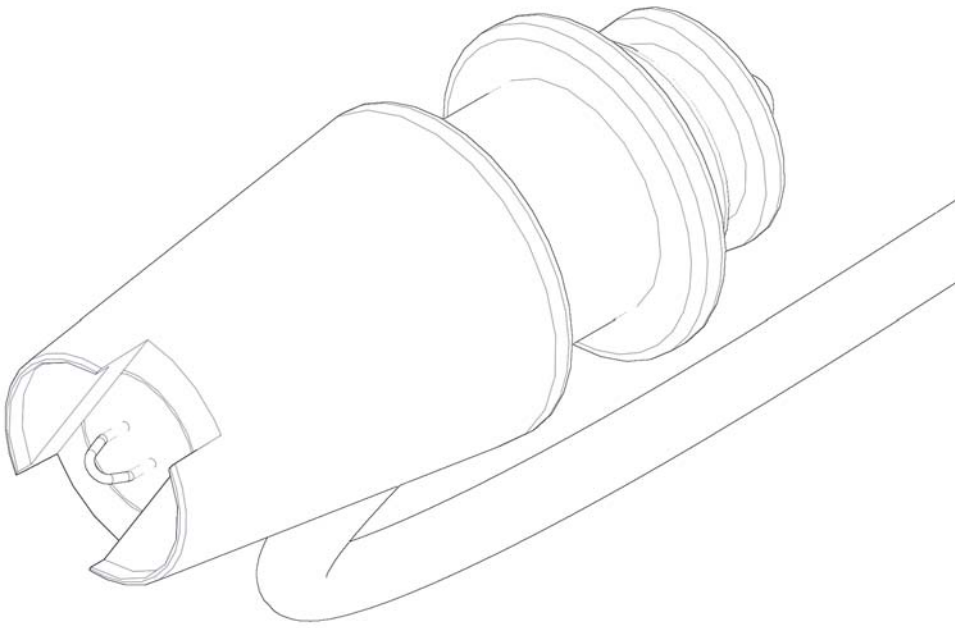


Figure 2-13 Release housing.

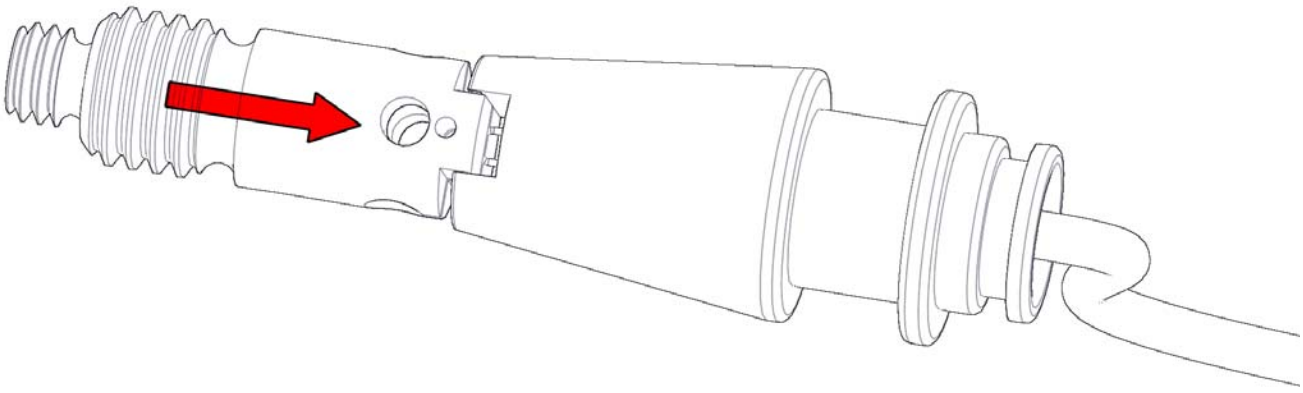


Figure 2-14 Sliding the threaded peek stud into the release housing.

3. Feed a long sharpened piece of monofilament through the small hole in the threaded stud, under the wire loop, and out of the other side of the threaded stud. Pull the monofilament through until it stops at the cut end (Figure 2-15).

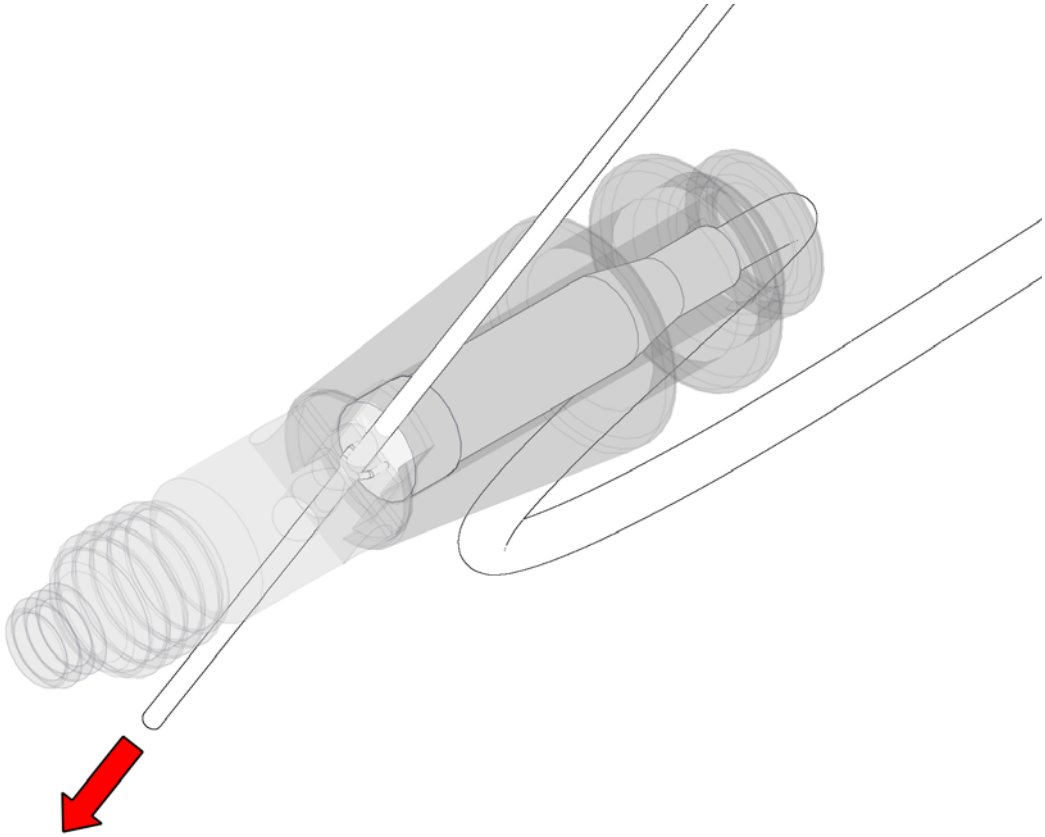


Figure 2-15 Feeding the monofilament.

4. Trim the long end of the monofilament flush to the release housing (Figure 2-16).

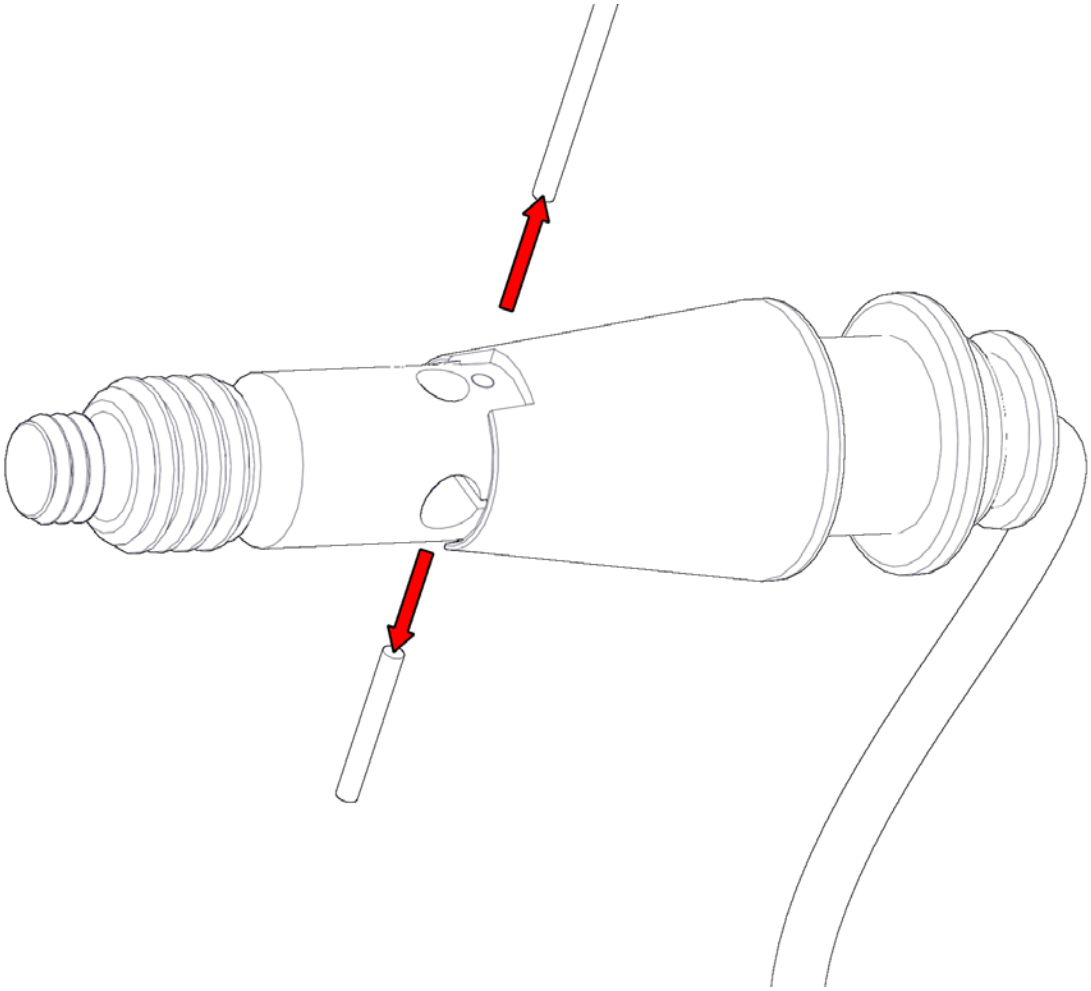


Figure 2-16 Trimming the monofilament.

5. Ensure that the release housing and the threaded stud are securely fastened by attempting to pull them apart (Figure 2-17). They should be attached firmly and not come free.

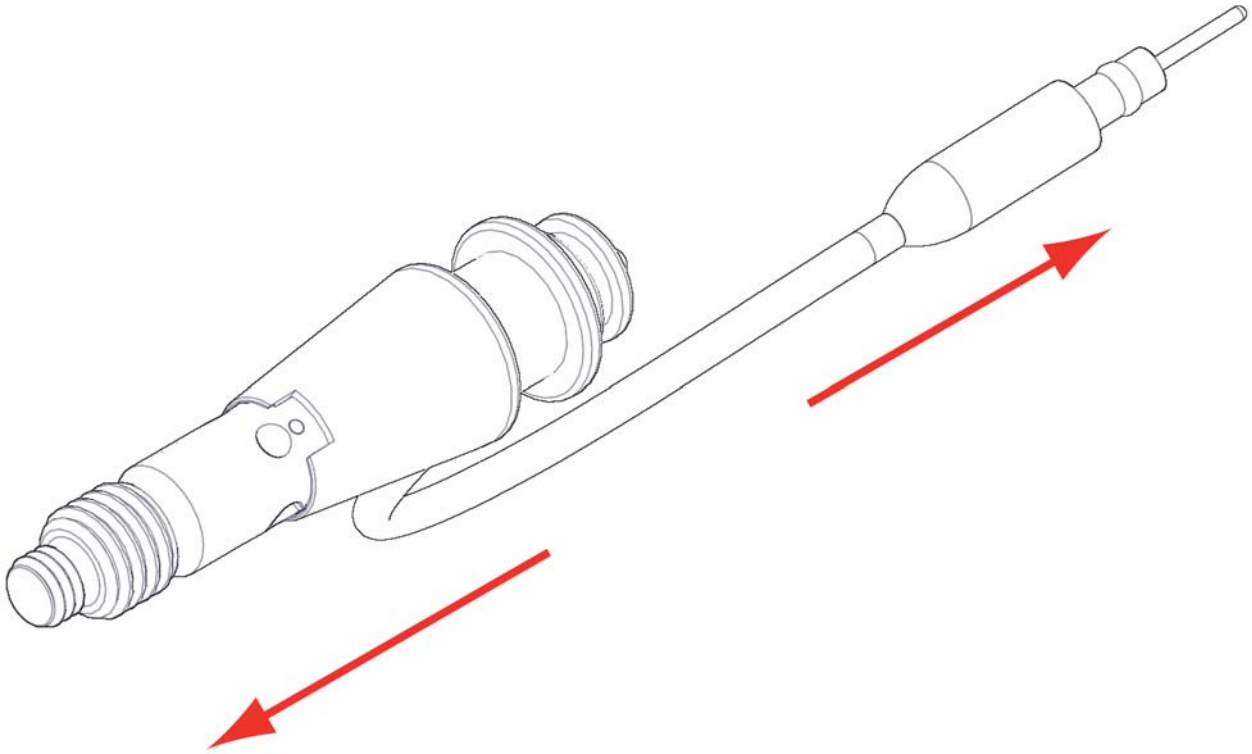


Figure 2-17 Pulling apart the release housing and threaded stud.

Recovery Spool Base

Tools:	Phillips screwdriver
Materials and parts:	Recovery spool base (200/1000M)
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1 and "Removing the Recovery Assembly" on page 2-25.

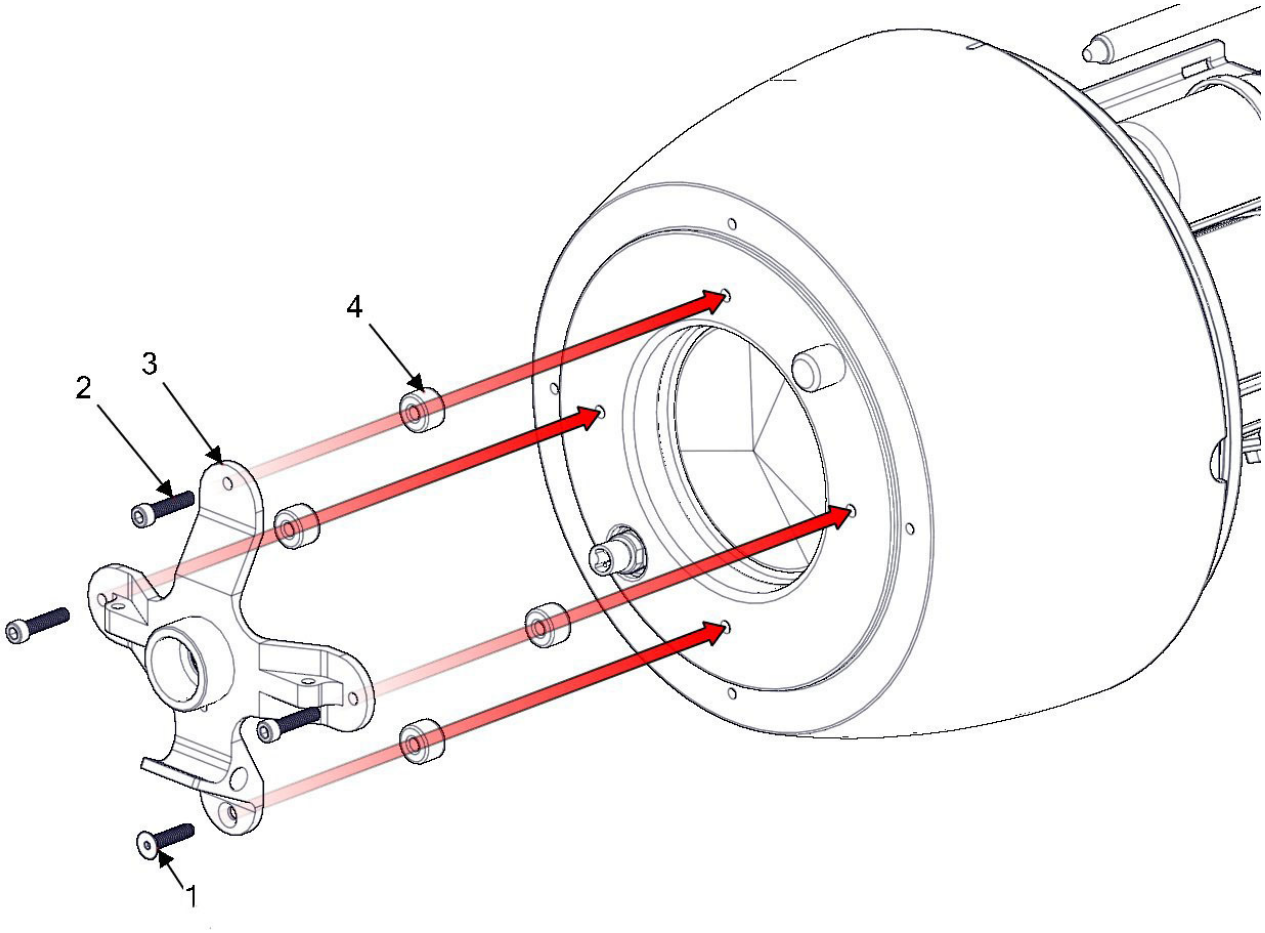


Figure 2-18 Recovery spool base (200-meter).

Removing the 200-meter Recovery Spool Base

1. Remove the single screw (Figure 2-18, Item 1).
2. Remove the three screws (Figure 2-18, Item 2).
3. Remove the recovery spool base (Figure 2-18, Item 3).
4. Remove the four spacers (Figure 2-18, Item 4).

Removing the 1000-meter Recovery Spool Base

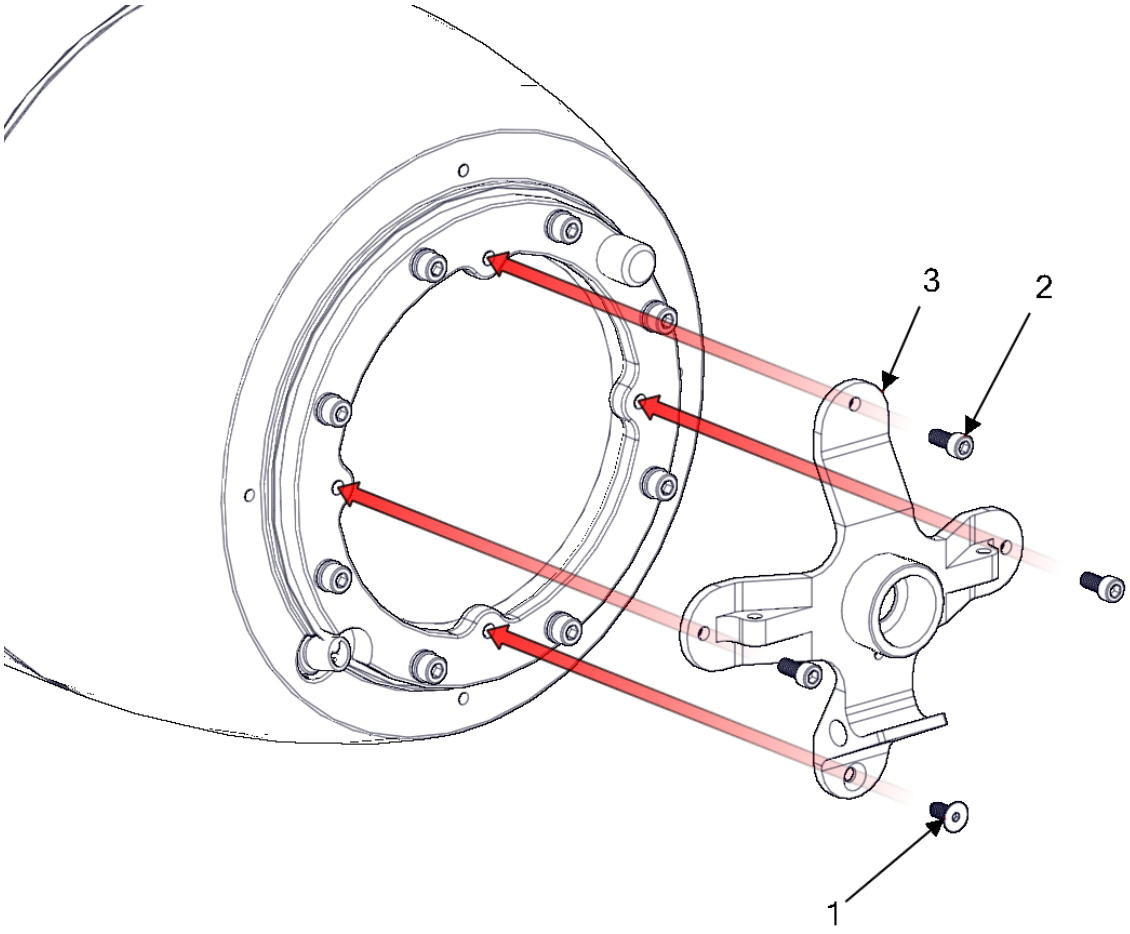


Figure 2-19 Recovery spool base (1000-meter).

1. Remove the single screw (Figure 2-19, Item 1).
2. Remove the three screws (Figure 2-19, Item 2).

3. Remove the recovery spool base (Figure 2-19, Item 3).

Installing the 200-meter Recovery Spool Base

1. Position the recovery spool base (Figure 2-18, Item 3) on four spacers (Figure 2-18, Item 4).
2. Install the three screws (Figure 2-18, Item 2).
3. Install the single screw (Figure 2-18, Item 1).

Installing the 1000-meter Recovery Spool Base

1. Position the recovery spool base (Figure 2-19, Item 3).
2. Install the three screws (Figure 2-19, Item 2).
3. Install the single screw (Figure 2-19, Item 1).

Altimeter Transducer Assembly

Tools:	Phillips screwdriver
Materials and parts:	Altimeter transducer assembly
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Removing the Recovery Assembly" on page 2-25.

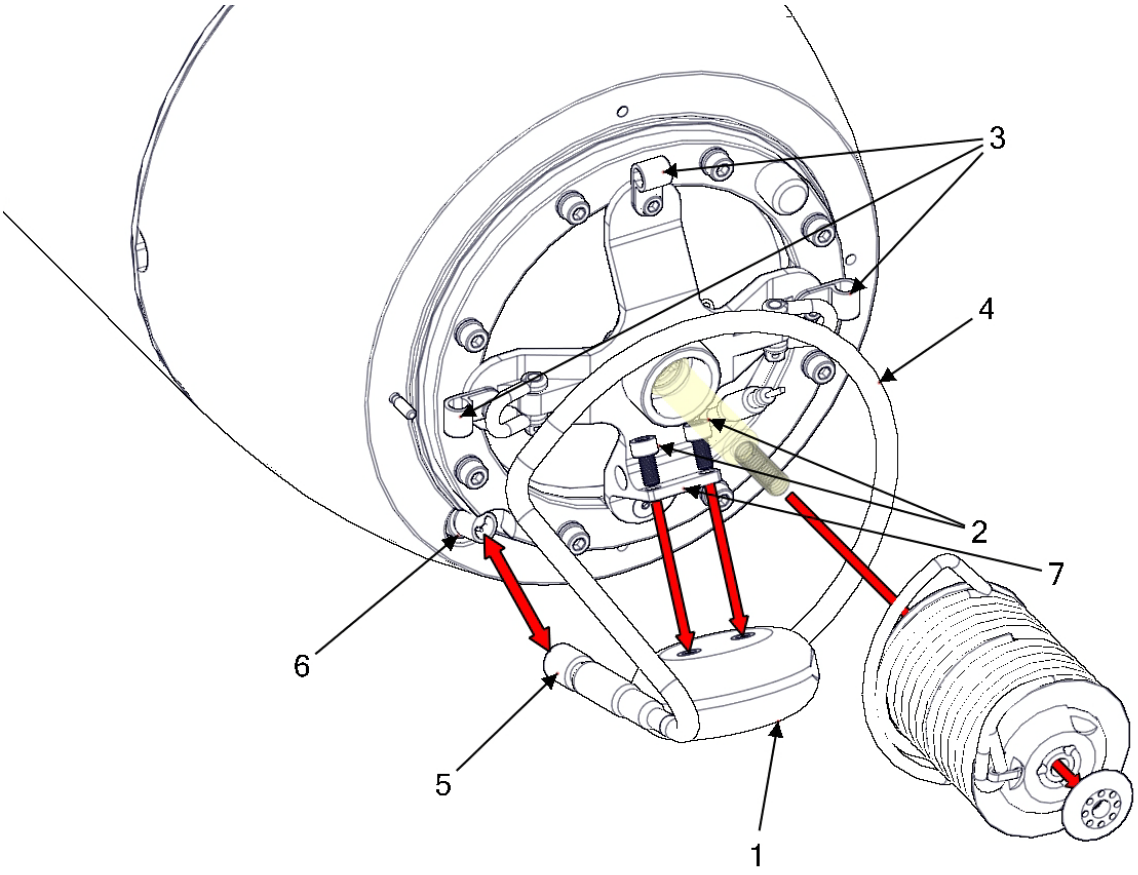


Figure 2-20 Altimeter transducer assembly.

Removing the Altimeter Transducer Assembly

1. Remove the two screws (Figure 2-20, Item 2) from the altimeter transducer (Figure 2-20, Item 1).
2. Unscrew the plastic clips (Figure 2-20, item 3) that secure the altimeter cable pigtail (Figure 2-20, item 4) to the bulkhead.
3. Disconnect the cable connector (Figure 2-20, item 5) located at the end of the altimeter cable from the bulkhead connector (Figure 2-20, item 6).

Installing the Altimeter Transducer Assembly

1. Screw the cable connector (Figure 2-20, item 5) located at the end of the altimeter cable into the bulkhead connector (Figure 2-20, item 6).
2. Secure the altimeter cable pigtail (Figure 2-20, item 4) to the bulkhead by inserting the pigtail into the plastic clips (Figure 2-20, item 3) on the bulkhead and screwing the clips shut.
3. Install the 2 screws (Figure 2-20, item 2) through the recovery spool base (Figure 2-20, item 7) and into the altimeter transducer (Figure 2-20, item 1).

Payload Bay Assembly

Tools:	Phillips screwdriver
Materials and parts:	Payload bay assembly
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

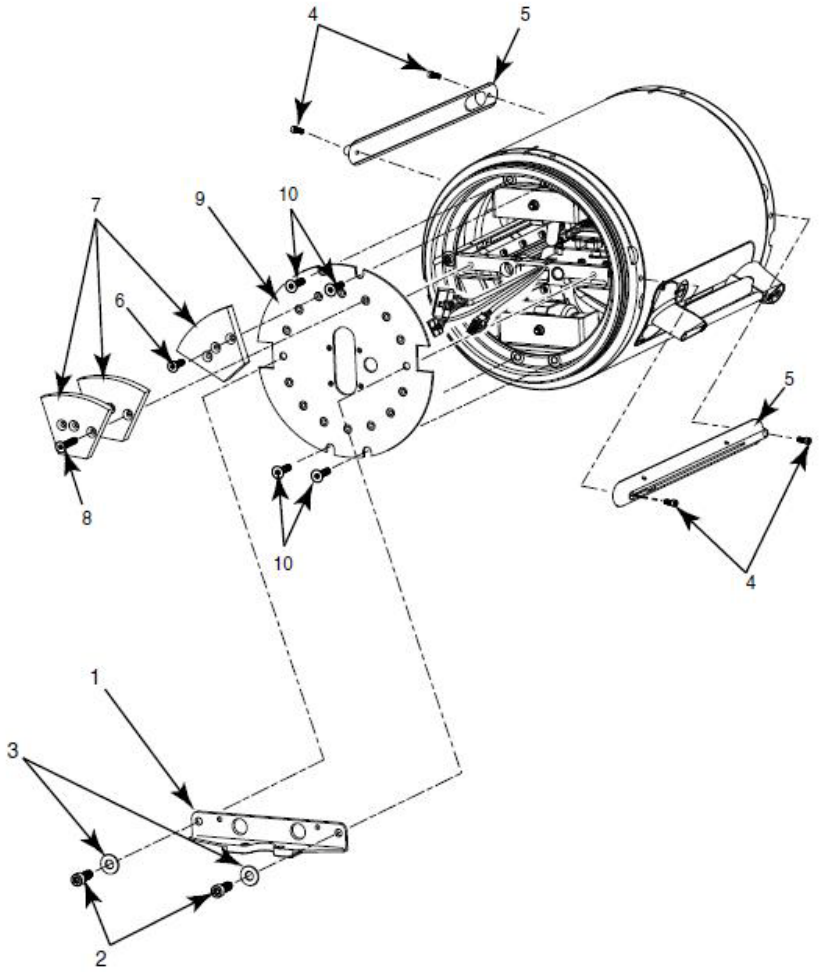
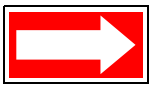


Figure 2-21 Payload bay assembly.

Removing the Payload Bay Assembly

CAUTION If the roll weights are repositioned or replaced, ballasting should be validated.

1. Remove the four screws (Figure 2-21, Item 10) from the aft payload bay guard (Figure 2-21, Item 9).
2. Remove the aft payload bay guard (Figure 2-21, Item 9) from the payload bay by removing the two screws (Figure 2-21, Item 2) and the two washers (Figure 2-21, Item 3).



NOTE With the screws (Figure 2-21, Item 2) and flat washers (Figure 2-21, Item 3) removed, the aft battery receiver bracket (Figure 2-21, Item 1) will be unattached and must be retained.

3. Carefully separate the payload bay hull section from the forward hull assembly and set aside.
4. If using one roll weight (Figure 2-21, Item 7), remove one screw (Figure 2-21, Item 6).
5. If using three roll weights (Figure 2-21, Item 7), remove one screw (Figure 2-21, Item 8).
6. Remove the four screws (Figure 2-21, Item 4) from the snap-in wing support (Figure 2-21, Item 5).
7. Remove the snap-in wing support (Figure 2-21, Item 5).

Installing the Payload Bay Assembly

1. If using one roll weight (Figure 2-21, Item 7), install one screw (Figure 2-21, Item 6).
2. If using three roll weights (Figure 2-21, Item 7), install one screw (Figure 2-21, Item 8).
3. Place the snap-in wing support (Figure 2-21, Item 5) in position on the payload bay.
4. Install the snap-in wing support (Figure 2-21, Item 5) with four screws (Figure 2-21, Item 4).
5. Paying attention to the center line marks, slide the payload hull section over the payload bay and seat squarely on the front O-ring. Use caution to prevent damage to the payload sensors.
6. Install the aft payload bay guard (Figure 2-21, Item 9) to the payload bay by inserting the two screws (Figure 2-21, Item 2) and two washers (Figure 2-21, Item 3), through the aft

battery receiver bracket (Figure 2-21, Item 1) and into the aft payload bay guard (Figure 2-21, Item 9). Do not over tighten.

7. Install the four screws (Figure 2-21, Item 10) to the aft payload bay guard (Figure 2-21, Item 9).

Wings

Tools:	None
Materials and parts:	Wings
Personnel required:	1 electronics technician

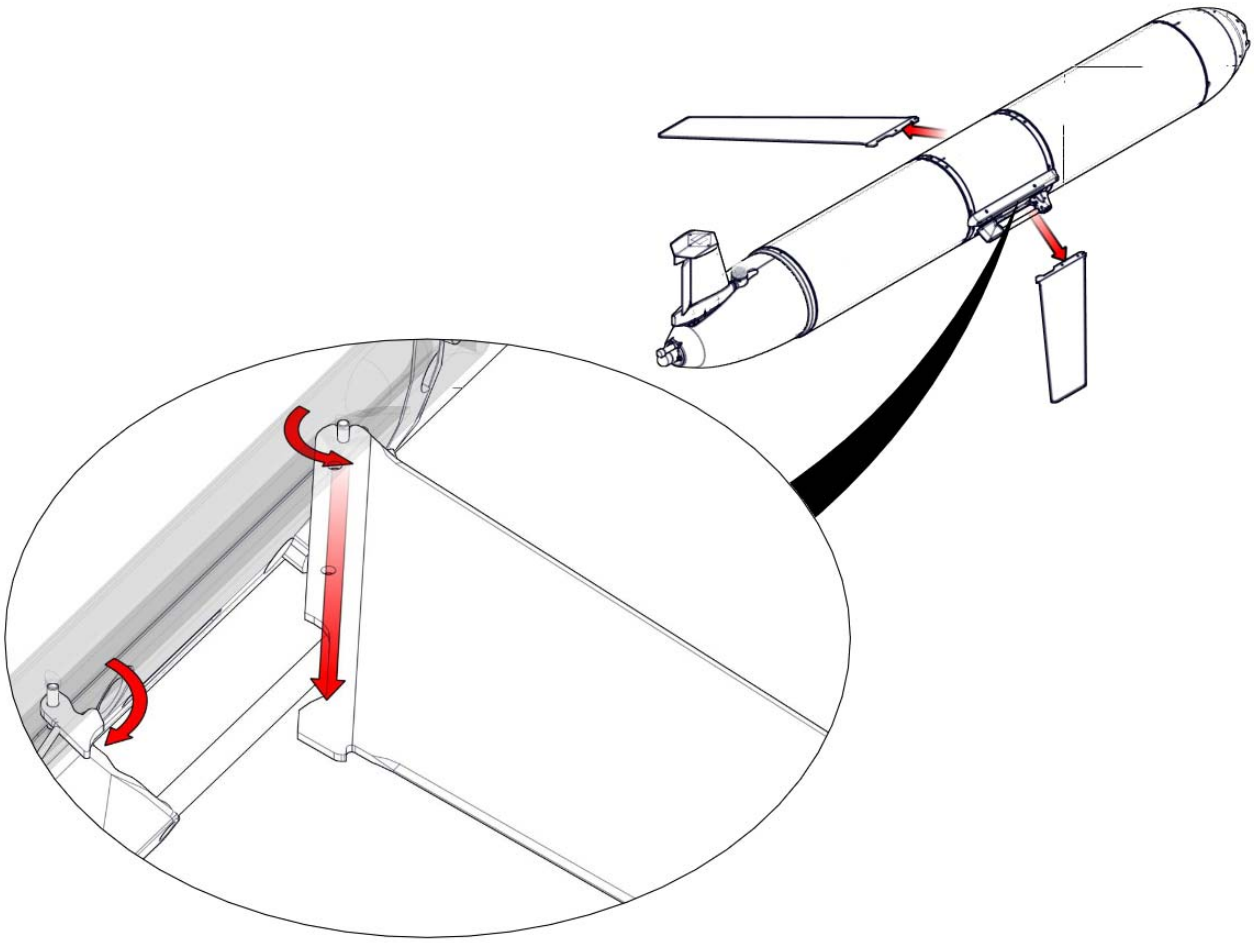


Figure 2-22 Wings.

Removing the Wings

NOTE The glider crate contains soft foam packing for the glider wings.

1. Visually inspect the wings for any nicks, scratches, or gouges upon removal from the glider shipping crate.

CAUTION Take care when removing the wings, as they are not buoyant and will sink if dropped in water.

2. The wings are removed easily from the snap-in wing support by using a quick release click-in, click-out system (Figure 2-22).

Installing the Wings

The wings are installed easily to the snap-in wing support by using a quick release click-in, click-out system (Figure 2-22).

Aft Assembly

Tools:	Phillips screwdriver Hull separation tool
Materials and parts:	Aft assembly
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1 and "Removing the Aft Cover" on page 2-55.

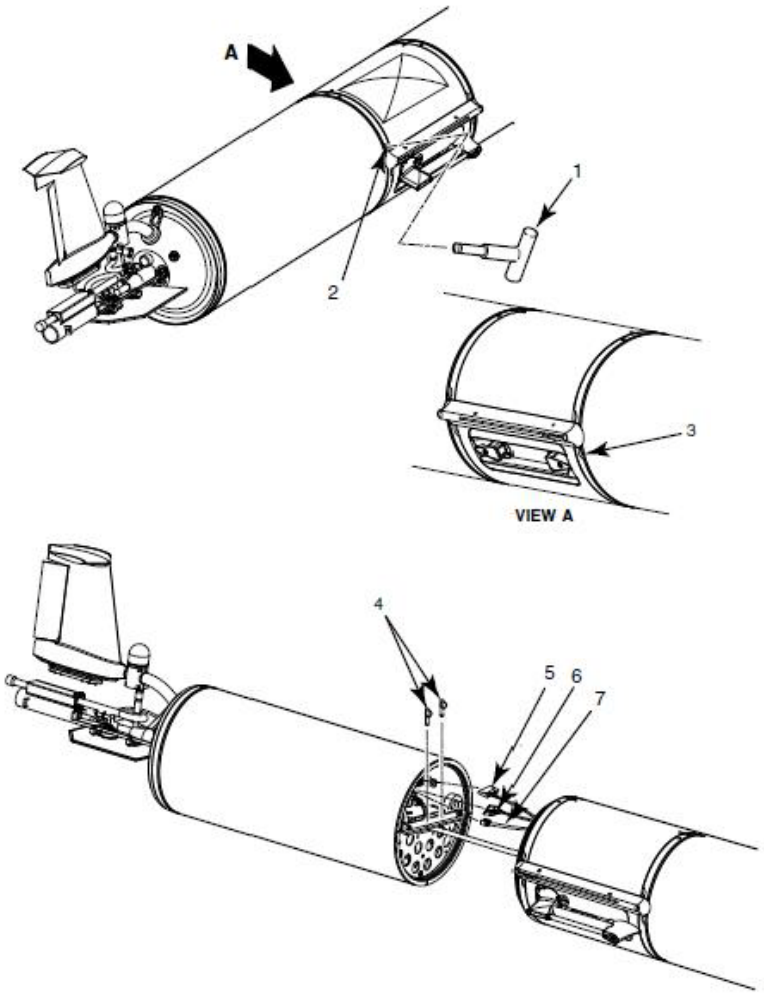


Figure 2-23 Aft assembly

Removing the Aft Assembly

1. Separate the aft hull section from the payload bay (Figure 2-23, Items 2-3) using the hull separation tool (Figure 2-23, Item 1).
2. Remove all connections (Figure 2-23, Items 5-7) from the payload bay to the aft assembly.

WARNING Lithium batteries pose a significant hazard when stored or handled improperly. The two main hazards associated with lithium sulfuryl chloride batteries and their components are fire and explosion, which could occur if the batteries are crushed, punctured, excessively heated, charged, overdischarged, short circuited, or submerged in water in a non-waterproof enclosure.

Lithium sulfuryl chloride cells are safe to handle when all of their components are adequately wrapped and sealed within a stainless steel casing. When that casing is compromised, an immediate danger is present due to exposure of the contents (and byproducts of these contents) with their new environment. Lithium metal reacts with water to produce lithium hydroxide, a corrosive liquid and hydrogen gas, which is flammable. Sulfuryl chloride (the liquid cathode) is a corrosive liquid that reacts with water to produce hydrogen chloride gas (which is toxic and corrosive) and sulfuric acid, a corrosive liquid.

Remove your jewelry before handling lithium batteries. Wear the appropriate PPE—eye protection and chemical resistant gloves—and while handling lithium batteries.

3. If the glider uses lithium batteries, free the aft battery pack from the payload bay by pulling the two pins from the battery bracket (Figure 2-23, Item 8).
4. Separate the aft hull section from the aft end cap assembly (Figure 2-26).

WARNING The forward and aft batteries are heavy and must be supported by the hulls in their respecitive bays at all times. If dissaembly requires removing hulls or the assembly to which the battery is affixed, the batteries should be removed from the vehicle first, or conversly disconnected and left inside in the hulls while the assembly is removed and worked on.

Installing the Aft Assembly

NOTE Refer to O-ring care.

1. Align the aft hull section with the aft end cap assembly.
2. Secure the aft battery pack to the payload bay with the two pins (Figure 2-23, Item 4).
3. Make all connections (Figure 2-23, Items 5-7) from the payload bay to the aft assembly.
4. Align the aft hull section with the payload bay.
5. For final installation, see "Assembling the Glider" on page 2-4.

Stop Plug (Red) and Go Plug (Green)

Tools:	None
Materials and parts:	Stop plug (red) Go plug (green)
Personnel required:	1 electronics technician

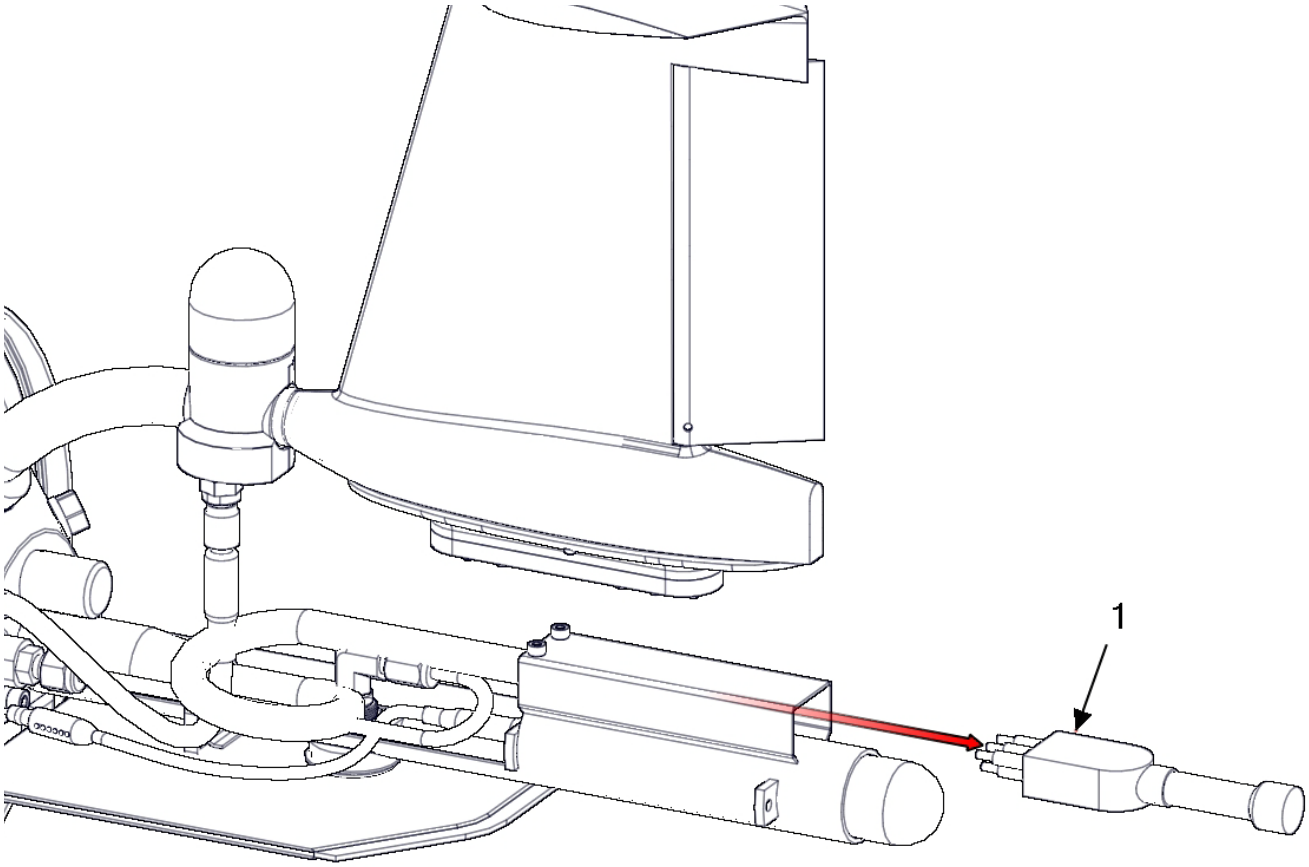


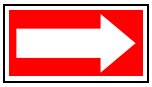
Figure 2-24 Stop plug (red) and go plug (green).

Removing the Stop Plug (Red) and Go Plug (Green)

WARNING The glider operator needs to command the glider to exit and be instructed by the glider that it is OK to remove the power before the plug can be removed. If not handled properly, the file system may become corrupt, rendering the glider inoperable. Before exiting, the operator should instruct the glider to deflate the air bladder

Remove the stop plug (red) or go plug (green) (Figure 2-24, Item 1) from the glider aft end cap assembly by pulling firmly.

Installing the Stop Plug (Red) and Go Plug (Green)



NOTE Once powered, the Slocum Glider will assume it is deployed and will run the mission initial.mi unless communication is established and an operator intervenes.

Before powering the glider, an operator should confirm the preferred communications method is functioning properly and have confidence that this communication method of choice is properly configured. If using Dockserver, see the *GMC Users Guide* at:

ftp://ftp.glider.webbresearch.com/glider/windoze/production/src/gliderMissionControl/Documentation

or see the *Slocum Glider Operators Manual* for instructions for configuring FreeWave and a terminal.

1. Before installing the stop plug (red) or go plug (green) (Figure 2-24, Item 1), ensure that the pins are not bent.
2. Install the stop plug (red) or go plug (green) (Figure 2-24, Item 1), by pushing firmly until it is seated properly.

Aft Cover

Tools:	5/32" hex driver
Materials and parts:	Aft cover
Personnel required:	1 electronics technician

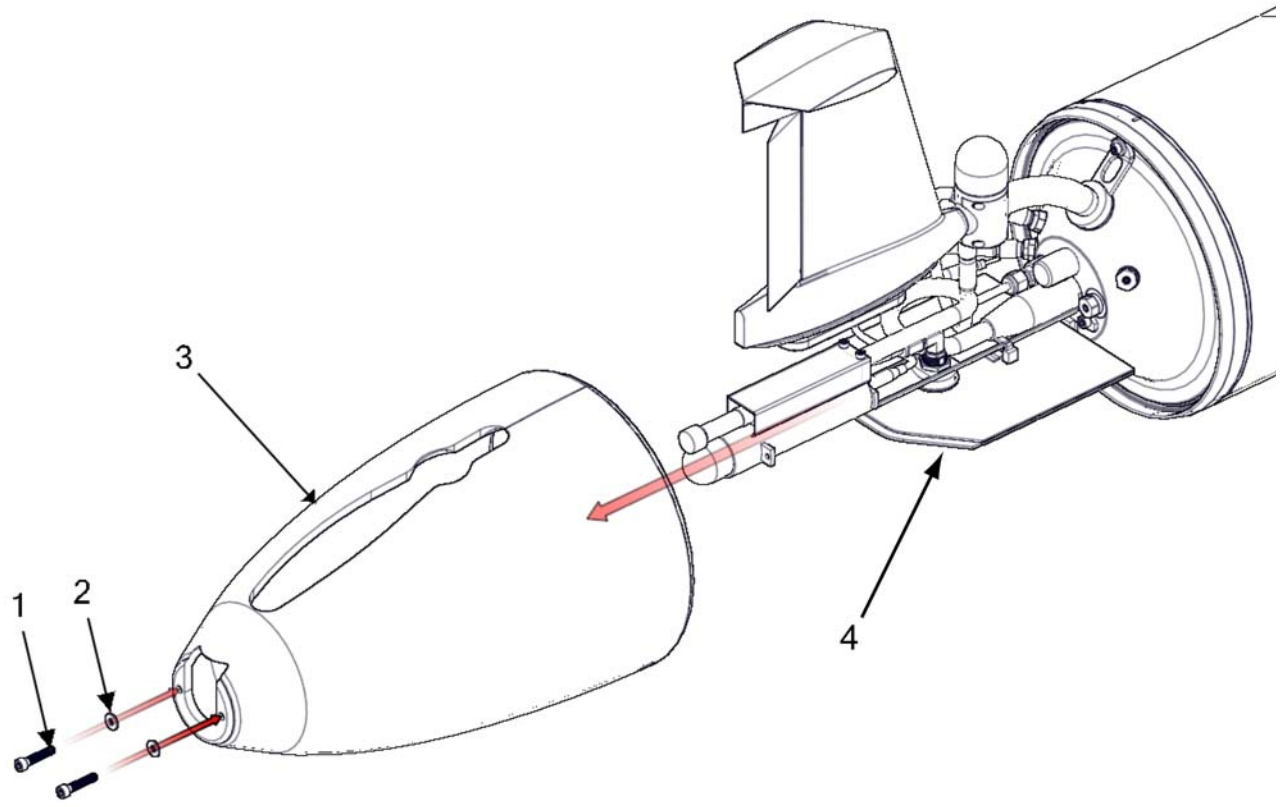


Figure 2-25 Aft cover.

Removing the Aft Cover

1. The glider should be powered down before removing the aft cover (Figure 2-25, Item 3).
2. Turn off the power to glider by removing the go plug (green) or external power cable and replacing with the stop plug (red).
3. The air bladder (Figure 2-25, Item 4) must be deflated in order to remove the aft cover (Figure 2-25, Item 3). To deflate the air bladder, type `put c_air_pump 0` from `lab_mode` or GliderDOS.
4. Remove the two 10-32 SHCSs (Figure 2-25, Item 1) and washers (Figure 2-25, Item 2) that hold the aft cover (Figure 2-25, Item 3) in place.
5. Pull the aft cover (Figure 2-25, Item 3) back, gently separating it at the top to allow it to slide over the antenna tail fin.

Installing the Aft Cover

1. Slide the aft cover (Figure 2-25, Item 3) forward, gently separating it at the top to allow it to slide over the antenna tail fin.
2. Insert the two 10-32 SHCS (Figure 2-25, Item 1) and washers (Figure 2-25, Item 2) that hold the aft cover (Figure 2-25, Item 3) in place.

Aft End Cap and Electronics Tray

Tools:	3/8" hex driver
Materials and parts:	Aft end cap assembly
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

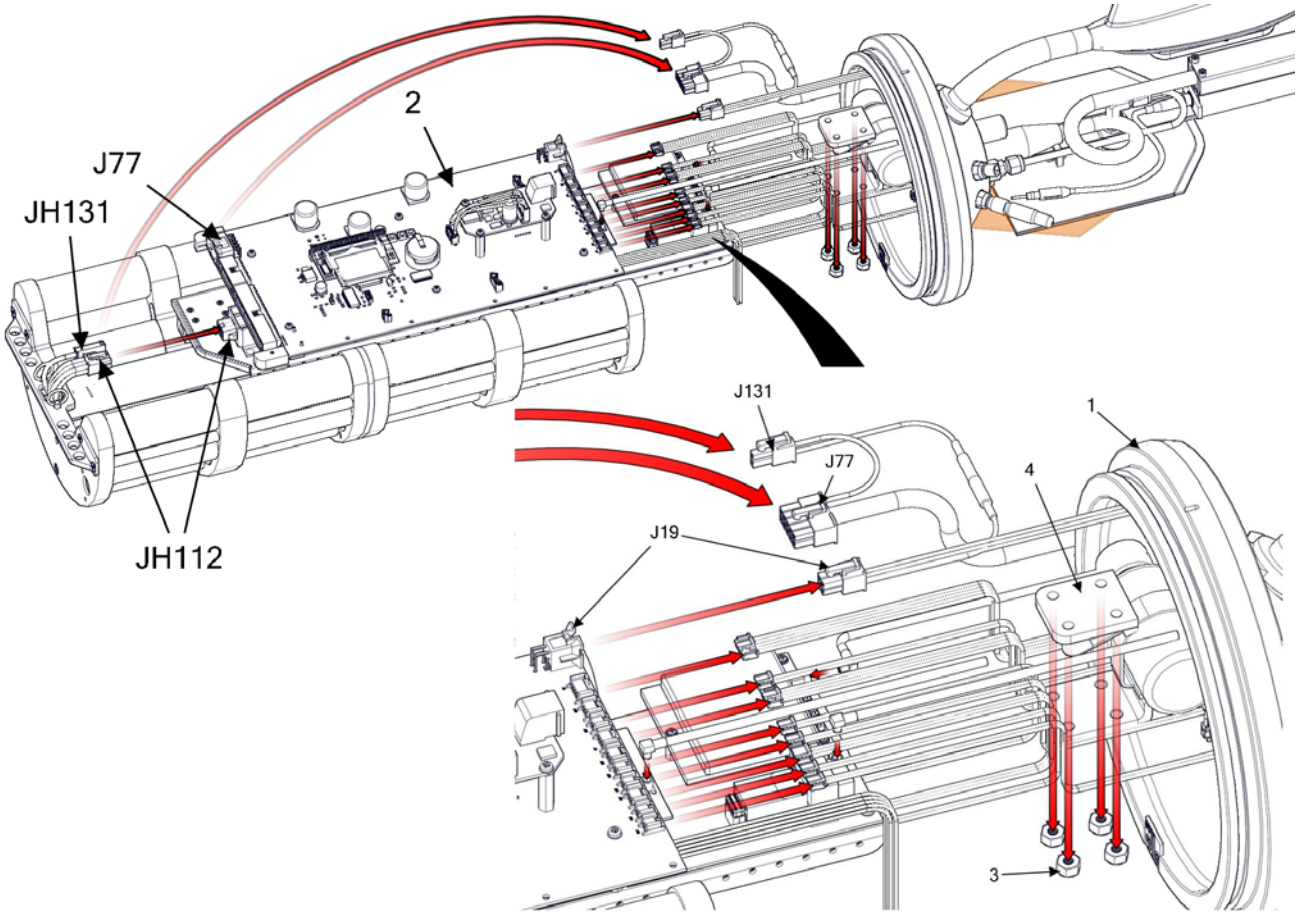


Figure 2-26 Aft end cap assembly.

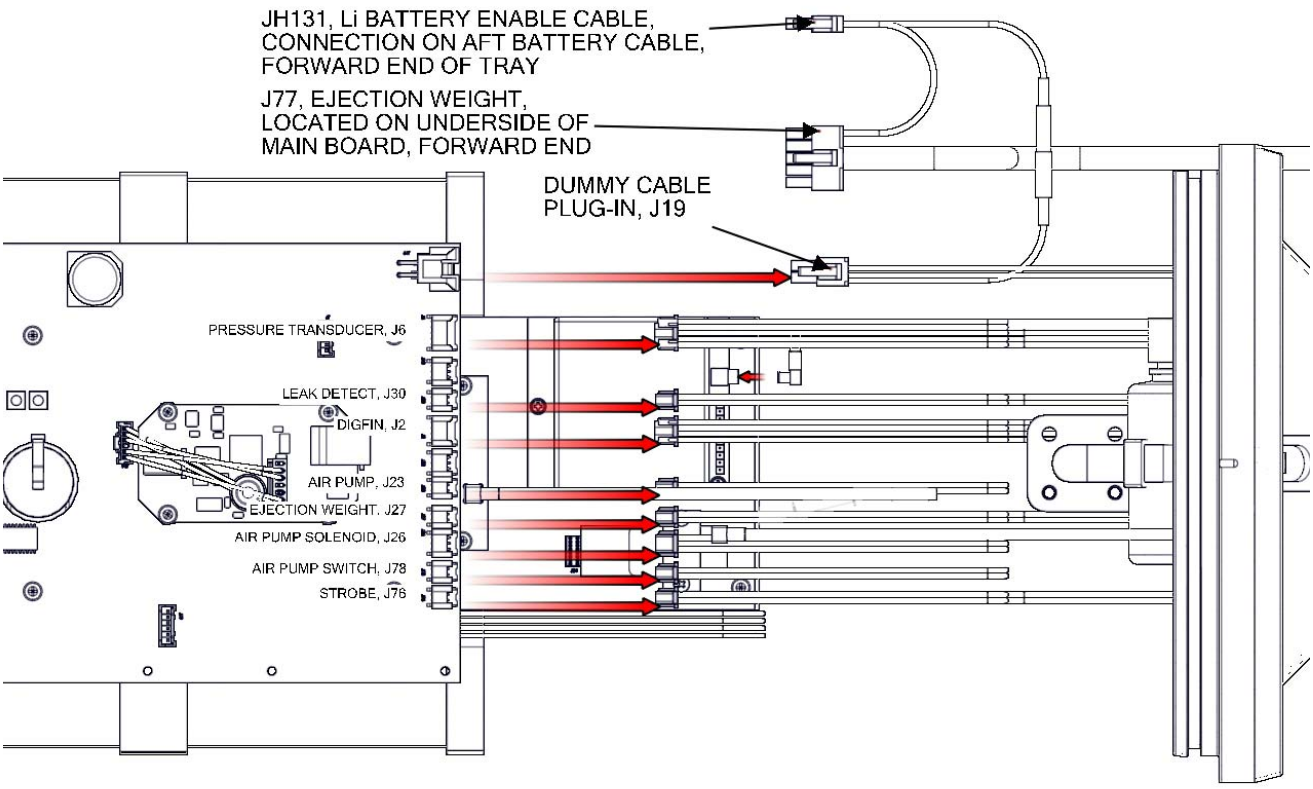


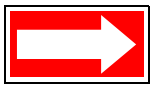
Figure 2-27 Aft end cap assembly detail.

Removing the Aft End Cap Assembly

1. Remove all wiring connections from the aft electronics tray (Figure 2-26, Item 2). Figure 2-27 shows the wiring connections in detail.
2. Remove the four 10-32 nylock nuts (Figure 2-26, Item 3) that attach the aft support spacer (Figure 2-26, Item 4) to the aft electronics tray.

Installing the Aft End Cap Assembly

1. Install the four 10-32 nylock nuts (Figure 2-26, Item 3), that attach the aft support spacer (Figure 2-26, Item 4) to the aft electronics tray (Figure 2-26, Item 2). Figure 2-27 shows the wiring connections in detail.
2. Install all wiring connections from the aft electronics tray (Figure 2-26, Item 2) to aft end cap assembly.



NOTE Be careful when connecting wires, because the pins are delicate.

Glider Main Board

Tools:	Phillips screwdriver
Materials and parts:	Glider main board
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

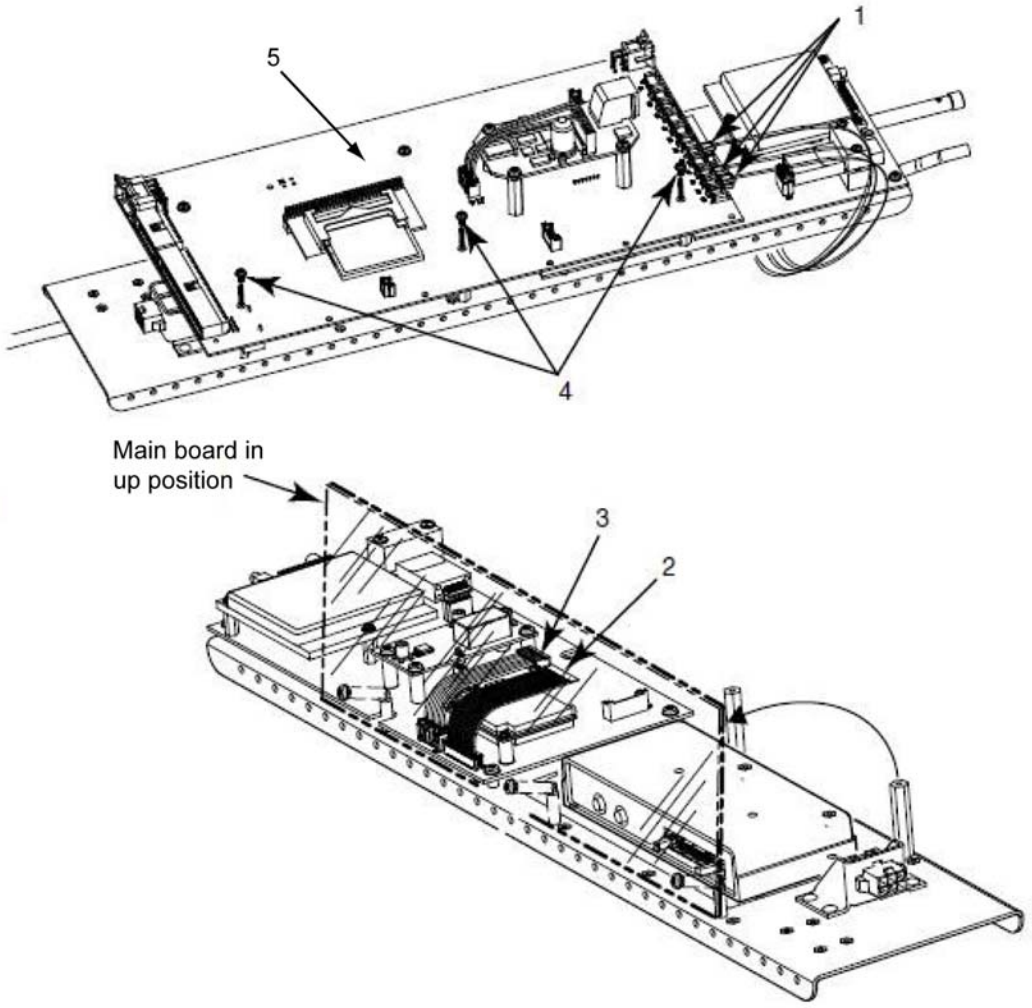


Figure 2-28 Glider main board.

Removing the Glider Main Board

1. Remove the screws (Figure 2-28, Item 4).
2. Disconnect the three wires from the main board (Figure 2-28, Item 1).
3. Remove the glider main board (Figure 2-28, Item 5).

Installing the Glider Main Board

1. Position the glider main board (Figure 2-28, Item 5) and install the screws (Figure 2-28, Item 4).
2. Connect the three wires to the main board (Figure 2-28, Item 1).

Communications Board Assembly

Tools:	Phillips screwdriver
Materials and parts:	Communications board assembly
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

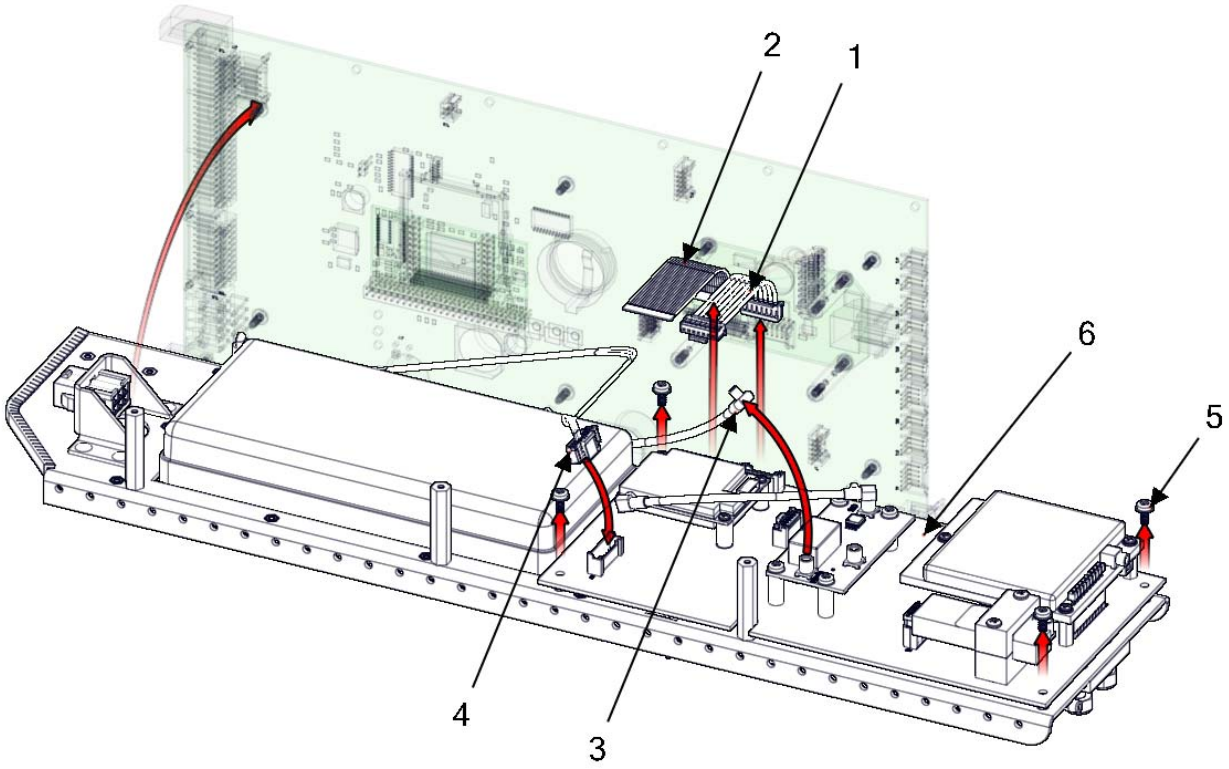


Figure 2-29 Communications board assembly.

Removing the Communications Board Assembly

1. Disconnect the communications board power cable (Figure 2-29, Item 1).
2. Disconnect the flex ribbon cable (Figure 2-29, Item 2).
3. Disconnect the Iridium to LNA cable (Figure 2-29, Item 3).
4. Disconnect the Iridium cable (Figure 2-29, Item 4).
5. Remove the screws (Figure 2-29, Item 5) from the communications board assembly (Figure 2-29, Item 6).

Installing the Communications Board Assembly

1. Install the screws (Figure 2-29, Item 5) to the communications board assembly (Figure 2-29, Item 6).
2. Connect the Iridium cable (Figure 2-29, Item 4).
3. Connect the Iridium to LNA cable (Figure 2-29, Item 3).
4. Connect the flex ribbon cable (Figure 2-29, Item 2).
5. Connect the communications board power cable (Figure 2-29, Item 1).

Glider Iridium Phone

Tools:	Phillips screwdriver
Materials and parts:	Glider Iridium phone
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1 and "Removing the Glider Main Board" on page 2-60.

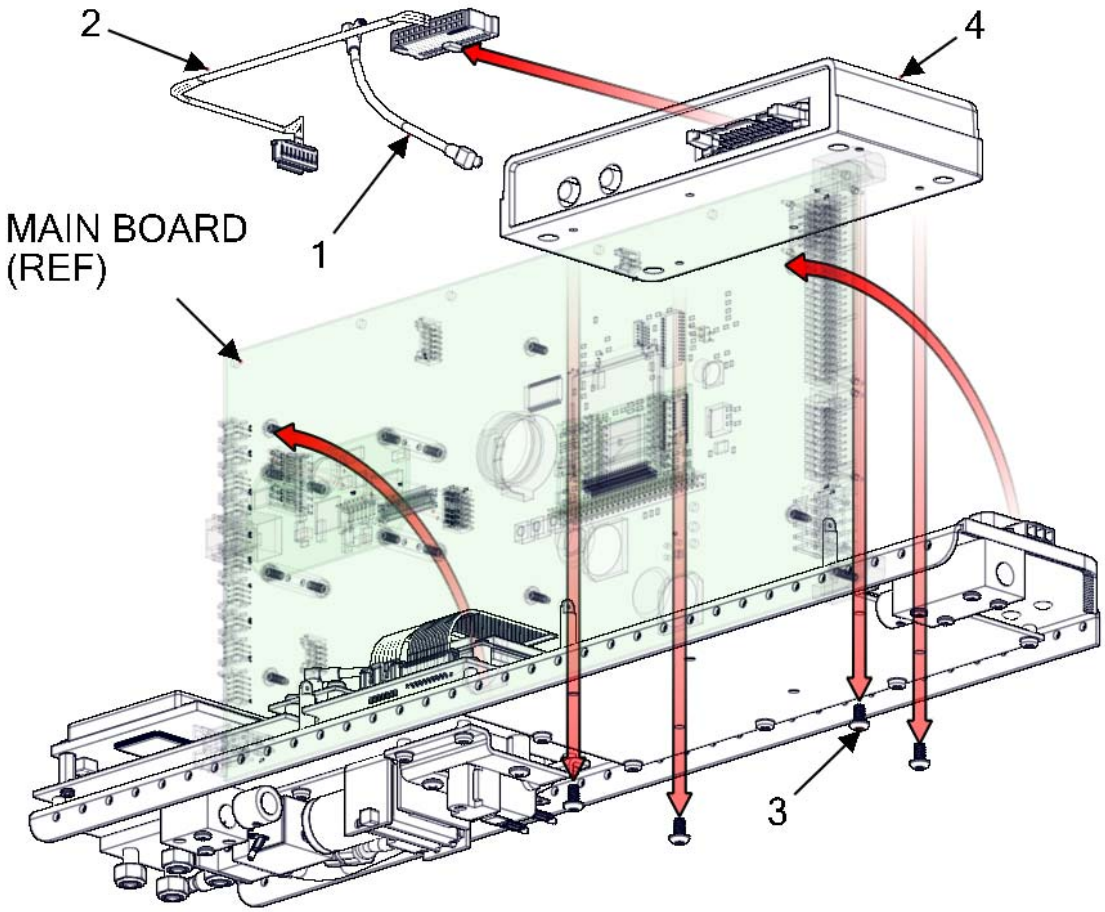


Figure 2-30 Iridium phone modified.

Removing the Glider Iridium Phone

1. Unplug and remove the Iridium to LNA cable (Figure 2-30, Item 1).
2. Unplug and remove the Iridium cable (Figure 2-30, Item 2).
3. Remove the screws (Figure 2-30, Item 3).
4. Remove the Iridium phone (Figure 2-30, Item 4).

Installing the Glider Iridium Phone

1. Position the Iridium phone (Figure 2-30, Item 4) on the glider aft electronics tray.
2. Install the screws (Figure 2-30, Item 3).
3. Install the Iridium cable (Figure 2-30, Item 2).
4. Install the Iridium to LNA cable (Figure 2-30, Item 1).

De-PINning an Iridium SIM Card

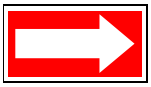
When Iridium SIM cards are delivered from the manufacturer, they are configured so that they will work only when the user inputs a personal identification number (PIN, which is set by the manufacturer to 1111). However, the glider is not equipped to work with PINs and must be reconfigured so that Iridium communications do not require a PIN. This procedure provides step-by-step instructions to properly reconfigure (i.e., de-PIN) an Iridium SIM card that is installed in the glider. Alternatively, the SIM card may be de-PINned by following the instructions on an Iridium phone handset.

Setup

- The Iridium SIM card must be installed in a glider that is assembled as described in "Assembling the Glider" on page 2-4 and powered on.
- Access talk iridium by typing talk iridium from PicoDOS. It is recommended that the de-PINning procedure be performed while in the glider terminal's serial port perspective.

SIM Check

1. From talk iridium, type `at+clck=?`
2. The Low Band Transmitter (LBT) should respond with either:
   - `+clck:("cs")` or
   - `+clck:("cs","sc")`



NOTE Several other arguments may appear in addition to `"cs"` and `"sc"`, but they are not relevant to this procedure.

If the `sc` argument is missing, then the SIM card is either not properly seated in the LBT, or it requires the PIN to be deactivated. Verify that the SIM card is properly seated in the LBT, and repeat the check, if required.

PIN Deactivation Procedure

1. Enter the PIN by typing the command `at+cpin="1111"`.
2. The LBT must respond with `ok`. (Note that the PIN must be surrounded by double quotes.)

   If the LBT responds with error, then either the code was typed incorrectly or the PIN has been changed from the factory default. Repeat steps 1-2 as necessary to attain an `ok` response to this command.
3. On the terminal, type the command `at+clck=?` and verify that the LBT responds with `+clck:("cs","sc")`.
4. Type the command `at+clck="sc",0,"1111"`. The LBT must respond with `ok`.

5. Power cycle the LBT.
6. On the terminal, type the command `at+clck=?`, and verify that the LBT responds with `+clck:("cs","sc")`. The SIM card is now configured properly.

Compact Flash Memory Card

Tools:	Phillips screwdriver
Materials and parts:	Compact flash memory card
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1 and "Removing the Payload Bay Assembly" on page 2-45.

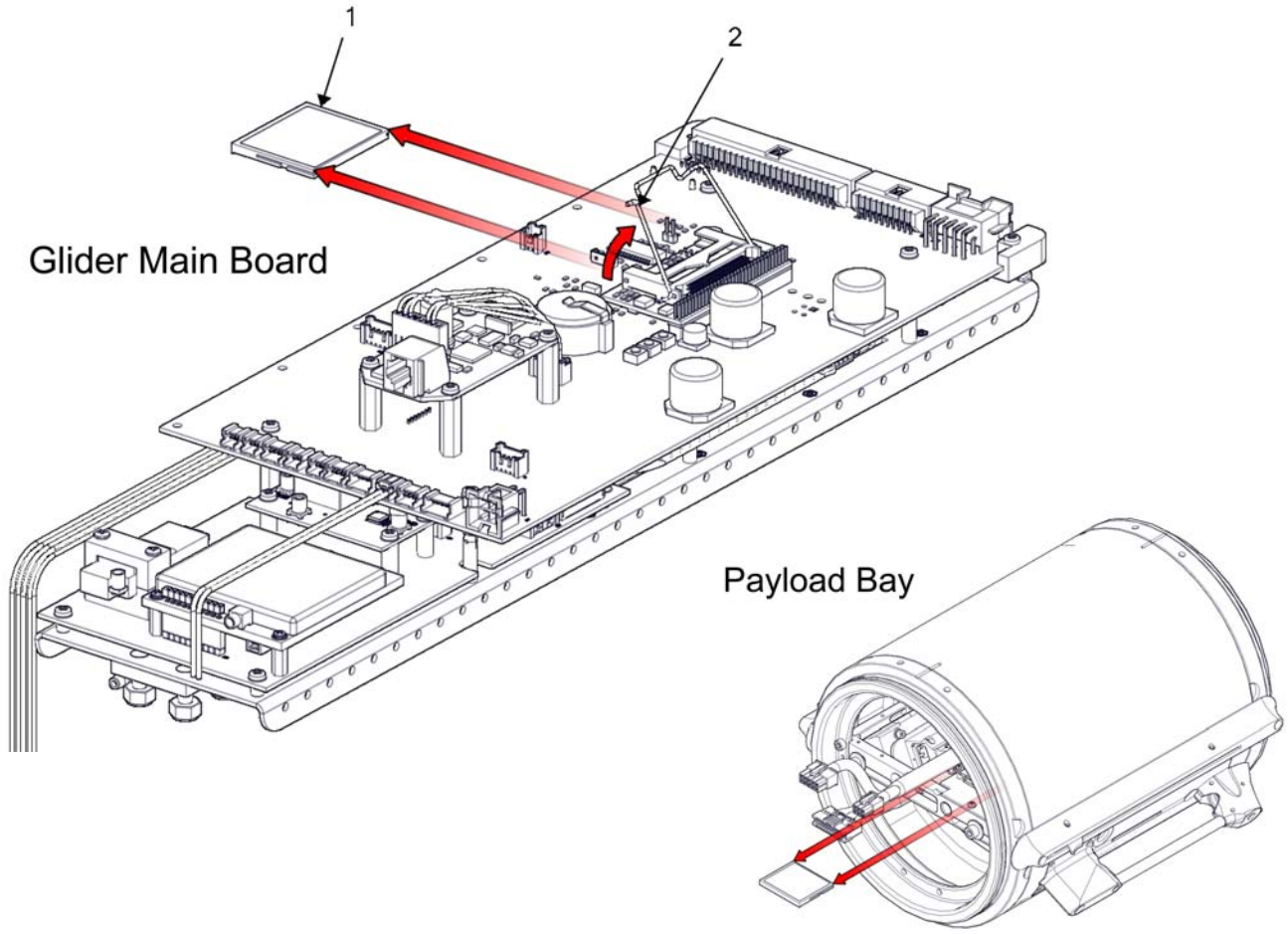


Figure 2-31 Compact flash memory card.

Removing the Compact Flash Memory Card

Payload Bay

1. Disengage the compact flash memory card retaining clip (Figure 2-31, Item 2).
2. Remove the compact flash memory card (Figure 2-31, Item 1).

Glider Main Board

1. Disengage the compact flash memory card retaining clip (Figure 2-31, Item 2).
2. Remove the compact flash memory card (Figure 2-31, Item 1).

Installing the Compact Flash Memory Card

Payload Bay

1. Install the compact flash memory card (Figure 2-31, Item 1). Ensure that the memory card's metal contacts are facing down, and slide the card into the slot until it is firmly seated.
2. Engage the compact flash memory card retaining clip (Figure 2-31, Item 2).

Glider Main Board

1. Install the compact flash memory card (Figure 2-31, Item 1). Ensure that the memory card's metal contacts are facing down, and slide the card into slot until it is firmly seated.
2. Engage the compact flash memory card retaining clip (Figure 2-31, Item 2).

GPS Receiver

Tools:	Phillips screwdriver
Materials and parts:	GPS receiver
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1 and "Removing the Glider Main Board" on page 2-60.

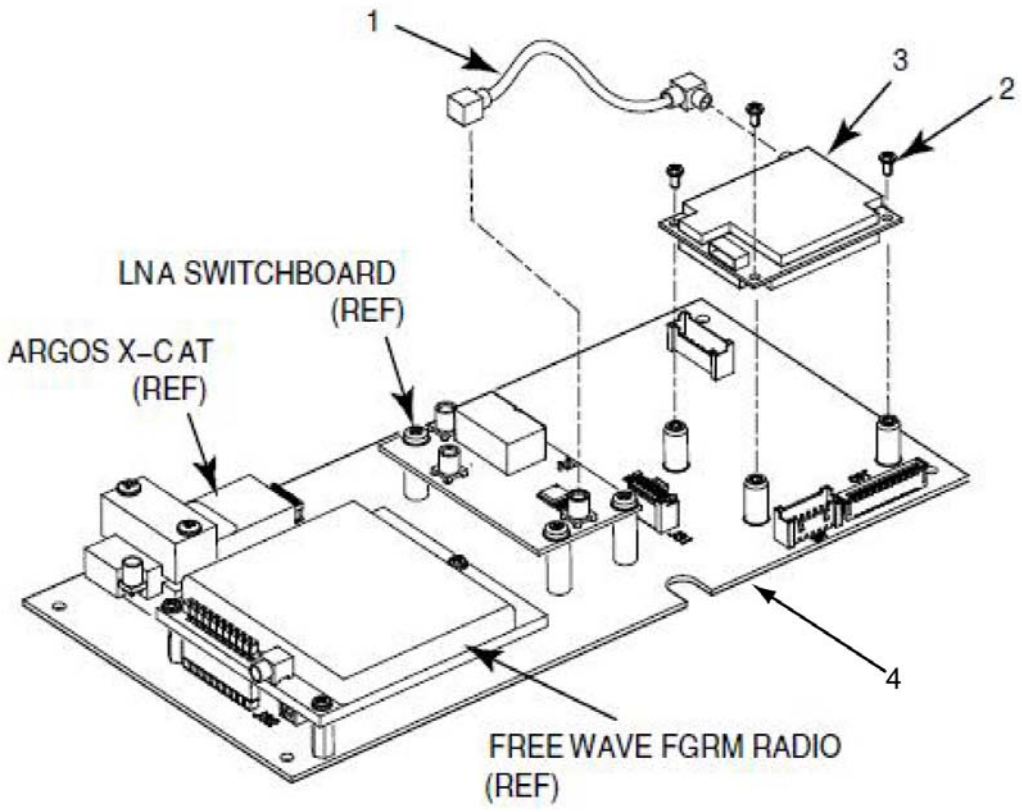


Figure 2-32 GPS receiver.

Removing the GPS Receiver

1. Remove the screws (Figure 2-32, Item 2) that secure the GPS receiver (Figure 2-32, Item 3) to the glider communications board assembly (Figure 2-32, Item 4).
2. Disconnect the GPS to LNA coax cable (Figure 2-32, Item 1) from the GPS receiver (Figure 2-32, Item 3).
3. The GPS receiver (Figure 2-32, Item 3) can now be removed from the glider communications board assembly.

Installing the GPS Receiver

1. Connect the GPS to LNA coax cable (Figure 2-32, Item 1) to the GPS receiver (Figure 2-32, Item 3).
2. Install the screws (Figure 2-32, Item 2) that secure the GPS receiver (Figure 2-32, Item 3) to the glider communications board assembly (Figure 2-32, Item 4).

LNA Switch Board Assembly

Tools:	Phillips screwdriver
Materials and parts:	LNA switch board assembly
Personnel required:	2 electronics technicians
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1 and "Removing the Glider Main Board" on page 2-60.

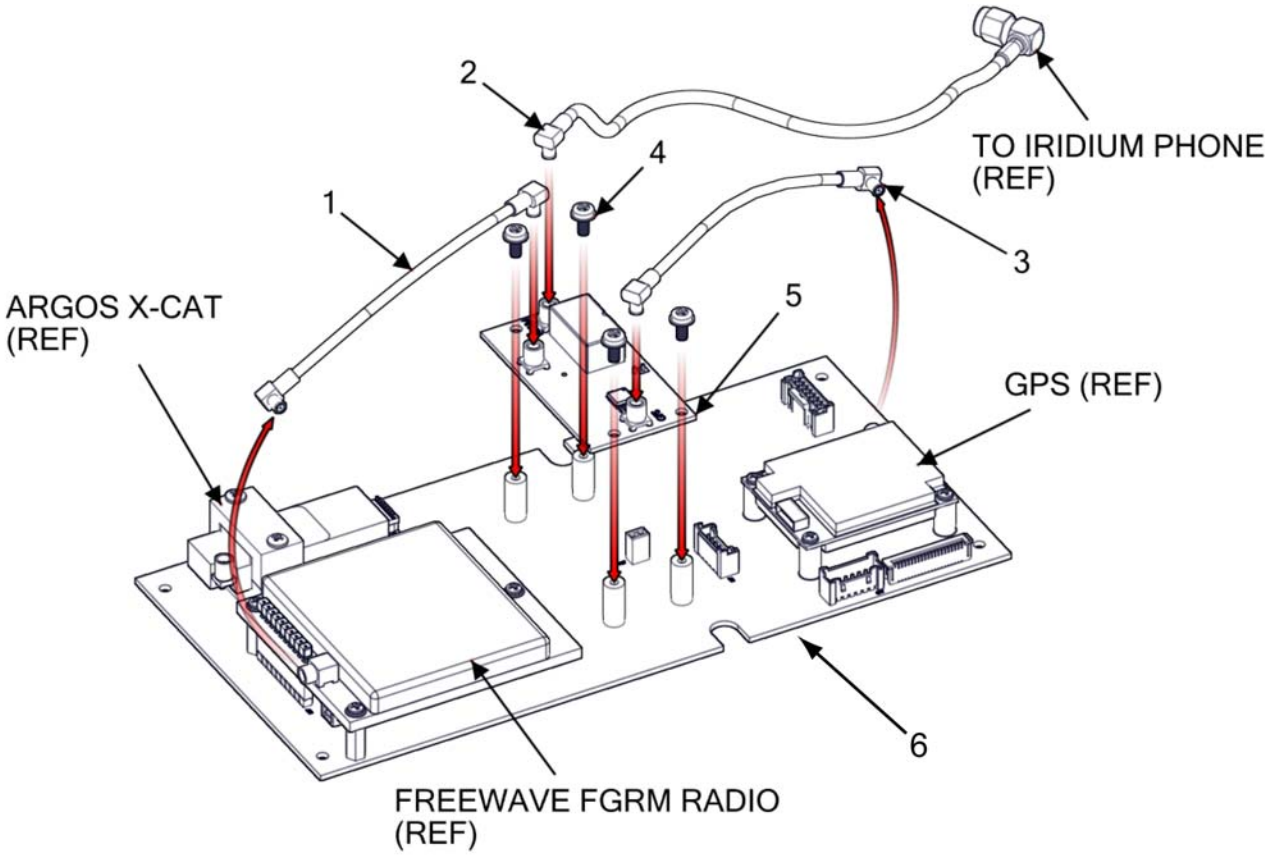


Figure 2-33 LNA switch board assembly.

Removing the LNA Switch Board Assembly

1. Remove the Iridium to LNA cable (Figure 2-33, Item 2) from the LNA switchboard assembly (Figure 2-33, Item 5).
2. Remove the GPS to LNA cable (Figure 2-33, Item 3) from the LNA switchboard assembly (Figure 2-33, Item 5).
3. Remove the screws (Figure 2-33, Item 4) that secure the LNA switchboard assembly (Figure 2-33, Item 5) to the glider communications board assembly (Figure 2-33, Item 6).
4. Remove the LNA switchboard assembly (Figure 2-33, Item 5).

Installing the LNA Switch Board Assembly

1. Position the LNA switchboard assembly (Figure 2-33, Item 5) on the standoffs and install the screws (Figure 2-33, Item 4) that secure the LNA switchboard assembly (Figure 2-33, Item 5) to the glider communications board assembly (Figure 2-33, Item 6).
2. Install the Iridium to LNA cable (Figure 2-33, Item 2) to the LNA switchboard assembly (Figure 2-33, Item 5).
3. Install the GPS to LNA cable (Figure 2-33, Item 3) to the LNA switchboard assembly (Figure 2-33, Item 5).

Power Switch Cable Guide

Tools:	7/64" hex driver
Materials and parts:	Power switch cable guide
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1 and "Removing the Aft Cover" on page 2-55.

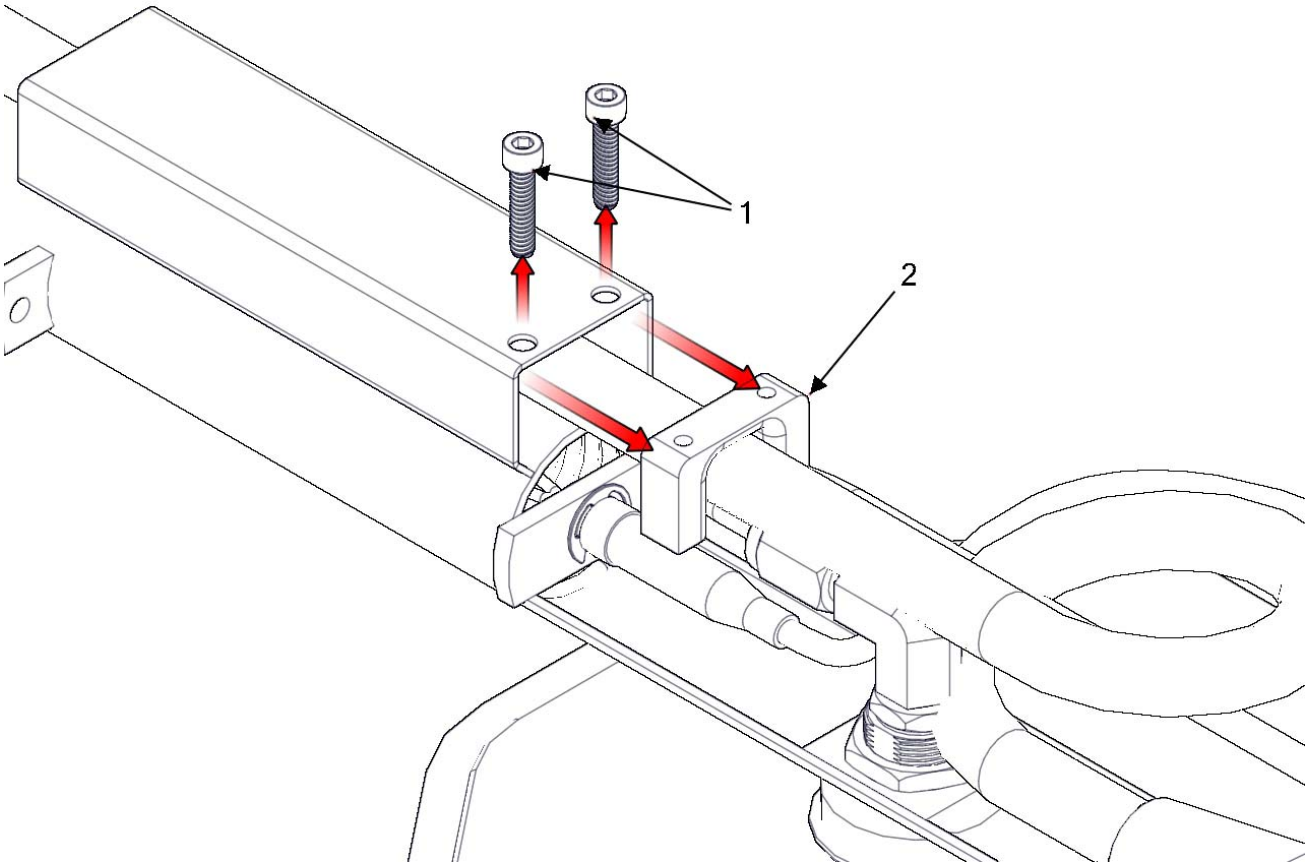


Figure 2-34 Power switch cable guide.

Removing the Power Switch Cable Guide

1. Remove the two 6-32 x 5/8" screws (Figure 2-34, Item 1) that connect the power switch cable guide (Figure 2-34, Item 2) to the glider aft end cap assembly.
2. Remove the power switch cable guide (Figure 2-34, Item 2).

Installing the Power Switch Cable Guide

1. Place the power switch cable guide (Figure 2-34, Item 2) in position on the glider aft end cap assembly.
2. Install the two 6-32 x 5/8" screws (Figure 2-34, Item 1) that connect the power switch cable guide (Figure 2-34, Item 2) to the glider aft end cap assembly.

MS Plug

Tools:	3/16" hex driver
Materials and parts:	MS plug, 6/16"
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

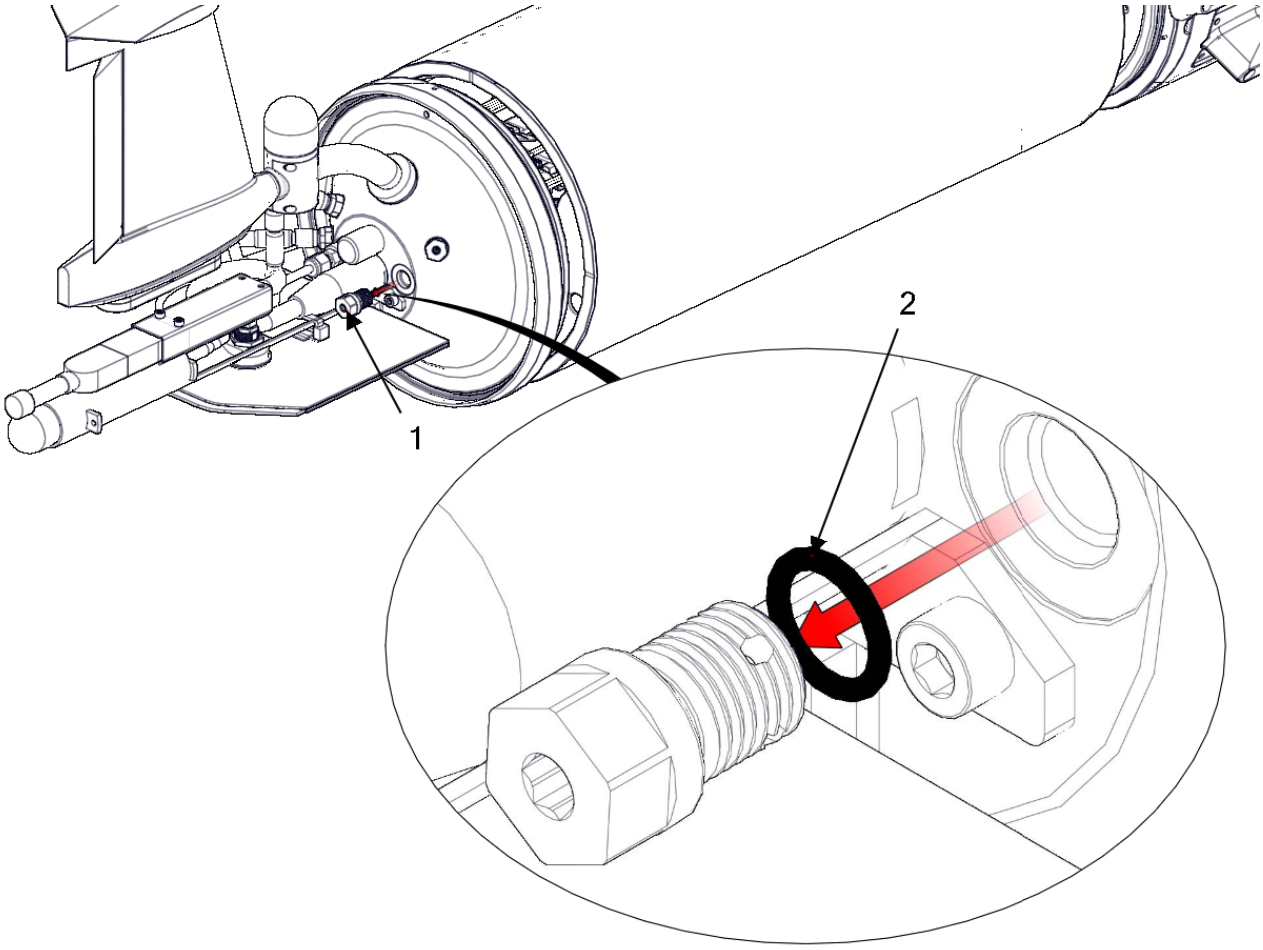


Figure 2-35 MS plug.

Removing the MS Plug

WARNING Before removing the MS plug, the internal pressure can be read from a terminal. If air is heard rushing out, this may be a sign of released hydrogen gas.

MS plugs should be inspected for wear and replaced if worn.

1. Use the hex wrench to remove the MS plug (Figure 2-35, Item 1).

WARNING Peek parts are delicate. Proper tools must be used for peek parts and proper torque applied; otherwise, these parts will snap.

2. Remove the 3-904 O-ring (Figure 2-35, Item 2).

Installing the MS Plug

NOTE Petroleum Naphthenic Oil and Barium Soap, such as Parker Fibrous 884-4 O-Lube, are recommended.

WARNING Parker O-Lube: Avoid contact with skin and eyes. If ingested immediately drink two glasses of water, induce vomiting, and seek medical attention. Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvent is used.

1. Inspect the 3-904 O-ring (Figure 2-35, Item 2) for cleanliness, nicks, slices, scratches, and dents.

2. Lubricate the 3-904 O-ring (Figure 2-35, Item 2).

NOTE Before installing the O-ring, electrician's tape should be used to protect the O-ring from being cut by the threads of the vent plug.

3. Install the 3-904 O-ring (Figure 2-35, Item 2). Ensure that it is properly seated.
4. Install the 7/16" MS plug (Figure 2-35, Item 1) on the starboard side of the aft end cap with a 3/16" hex driver.

WARNING Peek parts are delicate. Proper tools must be used for peek parts and 15" lb torque applied; otherwise, these parts will snap.

Attitude Sensor Wiring

Tools:	None
Materials and parts:	Attitude sensor wiring
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

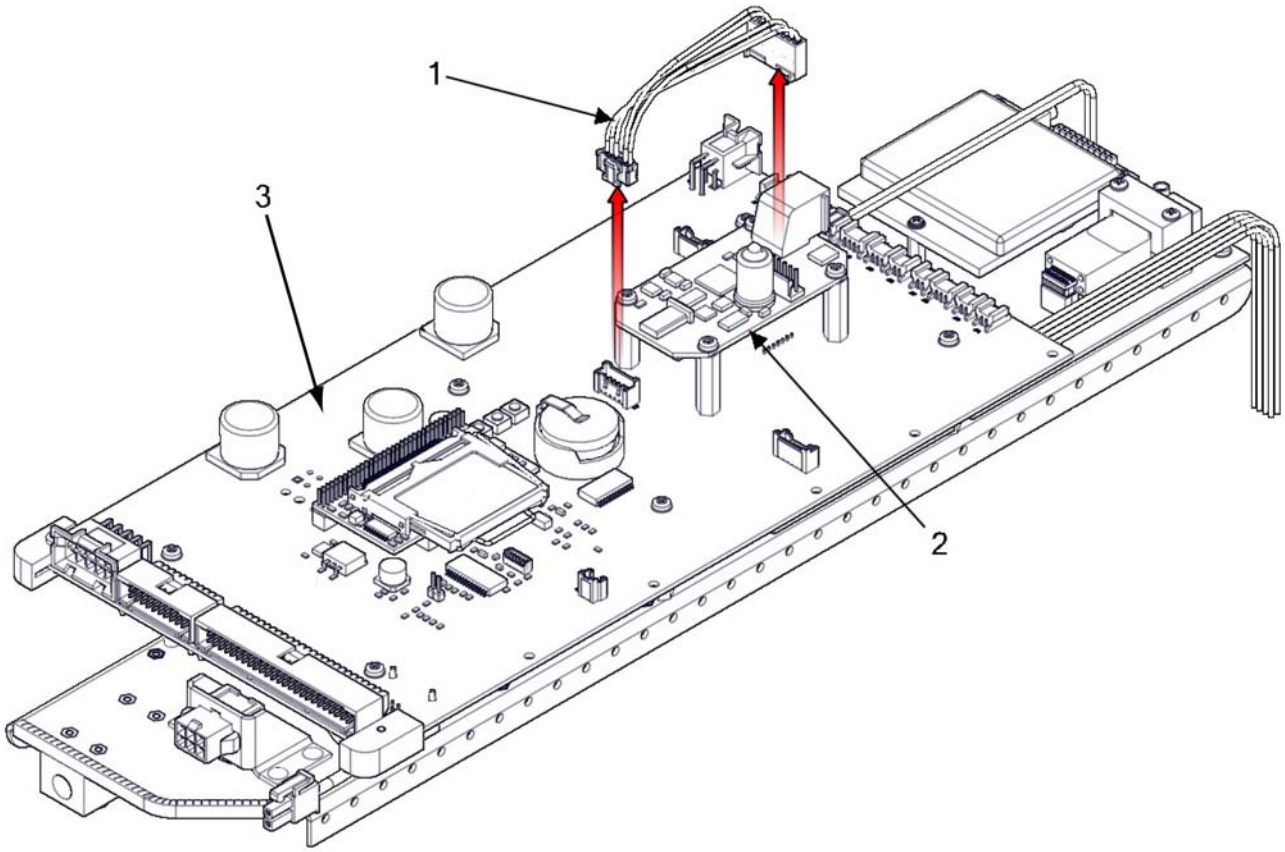


Figure 2-36 Attitude sensor wiring.

Removing the Attitude Sensor Wiring

1. Disconnect the attitude sensor wiring harness (Figure 2-36, Item 1) from the glider main board (Figure 1, Item 3).
2. Disconnect the attitude sensor wiring harness (Figure 2-36, Item 1) from the true north attitude sensor (Figure 2-36, Item 2).
3. Remove the attitude sensor wiring harness (Figure 2-36, Item 1).

Installing the Attitude Sensor Wiring

CAUTION Take care in engaging the connectors. The pins are delicate.

1. Connect the attitude sensor wiring harness (Figure 2-36, Item 1) to the true north attitude sensor (Figure 2-36, Item 2).
2. Connect the attitude sensor wiring harness (Figure 2-36, Item 1) to the glider main board (Figure 2-36, Item 3).

Calibrating the True North Compass

Visit the following protected resource and follow the instructions included in the readme.txt.

For Windows computers:

ftp://ftp.glider.webbresearch.com/clients/compass-calibrator/files-for-windows/

The calibration tool and instructions can also be found in the Dockserver release.

Weight Release Assembly

Tools:	None
Materials and parts:	Weight release assembly
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1.

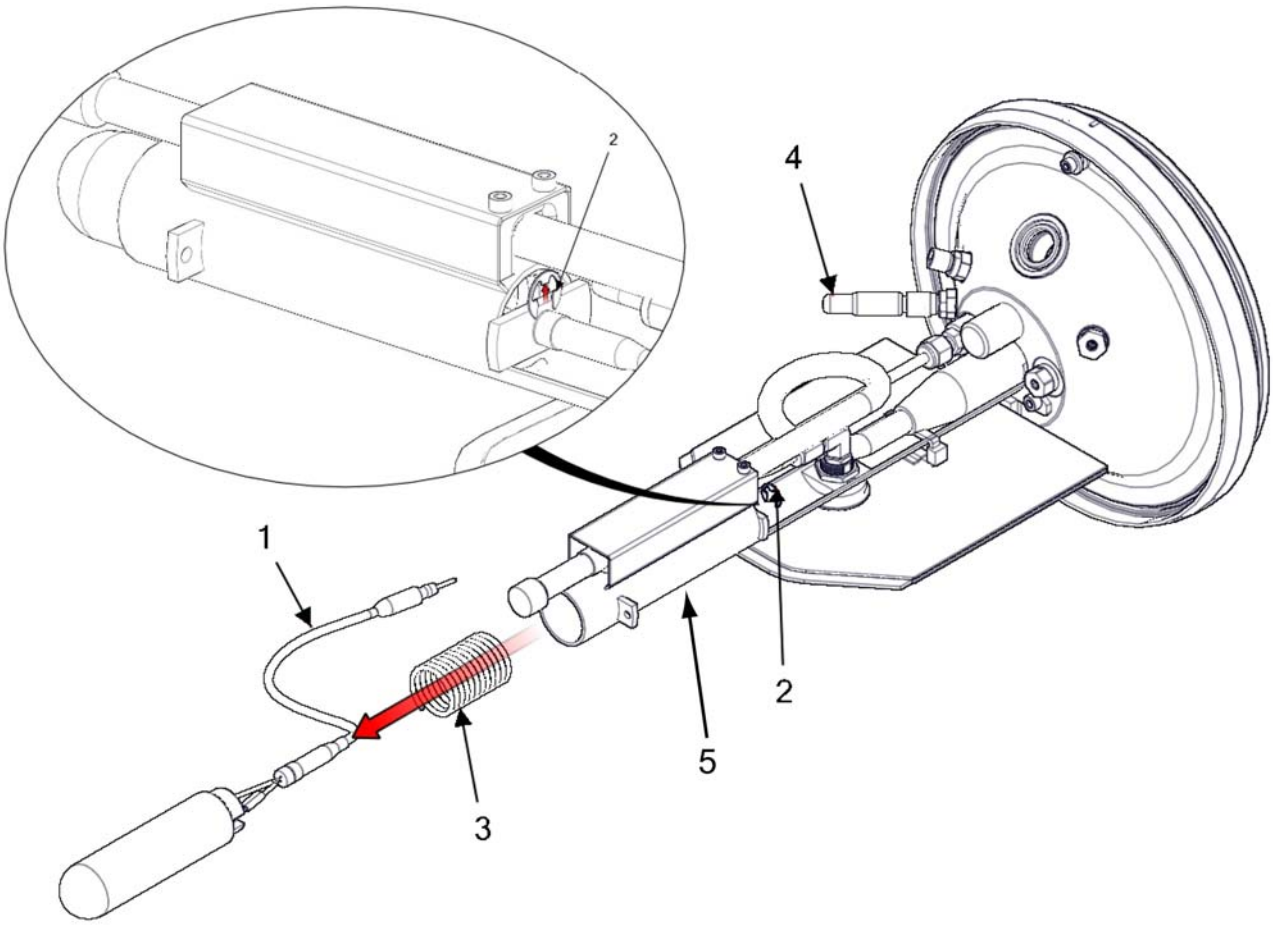


Figure 2-37 Weight release assembly.

Removing the Weight Release Assembly

NOTE The ejection weight is a heavy, spring-loaded object that has the potential to become a dangerous projectile. Do not stand directly behind the ejection weight while removing or installing the weight release assembly. By releasing the E-ring, the ejection weight will be released. Care should be taken to hold on to the ejection weight during this procedure to prevent it from releasing violently.

1. Remove the E-ring (Figure 2-37, Item 2) that secures the weight release assembly (Figure 2-37, Item 1) within the aft channel. It may be necessary to relieve pressure on the E-ring by depressing the ejection weight before the E-ring can be removed.
2. Disconnect the weight release assembly (Figure 2-37, Item 1) from the weight release assembly connector (Figure 2-37, Item 4).
3. Pull the weight release assembly (Figure 2-37, Item 1) out of the aft channel. (No tools are required.)
4. Make sure the ejection weight spring (Figure 2-37, Item 3) remains in the aft channel.

Installing the Weight Release Assembly

1. Insert the ejection weight spring (Figure 2-37, Item 3) into the aft channel (Figure 2-37, Item 5).
2. Install the weight release assembly (Figure 2-37, Item 1) through the aft channel (Figure 2-37, Item 5).
3. Connect the weight release assembly (Figure 2-37, Item 1) to the weight release assembly connector (Figure 2-37, Item 4).
4. Install the E-ring (Figure 2-37, Item 2) that secures the weight release assembly (Figure 2-37, Item 1) within the aft channel.

Replacing the Burn Wire Assembly

If the burn wire assembly has been used and must be replaced:

1. The air bag must be deflated to easily remove the aft tail cowling. In GliderDOS, type `put c_air_pump 0`. Remove the two 10-32 SHCSs and washers that hold the aft tail cowling in place with a 5/32" hex driver.
2. Slide the cowling back and around the antenna tailfin.
3. Disconnect the single-pin Mecca connector.
4. From the single-pin male Mecca connector side, remove the burn wire bushing in the jettison weight tube. Do not discard the used burn wire assembly, because it can be rebuilt at the factory.
5. Remove the E-ring from the new burn wire assembly, complete with the jettison weight attached.
6. Feed the single-pin Mecca connector through the aft end of the jettison weight tube, out the hole on the forward end.
7. With one hand, push the jettison weight into the tube, compressing the jettison weight spring. At the same time, feed the Mecca wire through the hole until the burn wire bushing appears.
8. With the face of the burn wire bushing beyond the edge of the hole, slide the burn wide slightly sideways so that it is resting on the crossbar and does not fall back through the hole.
9. Replace the E-ring on the burn wire bushing, seating it fully.
10. Allow the burn wire bushing to fit back through the hole. It will be stopped by the e-ring on the face of the crossbar.
11. Reconnect to the single-pin Mecca connector. Use Parker O-Lube lubrication (Naphthenic Oil and Barium Soap).
12. Replace the aft end cowling.

Strobe Assembly

Tools:	Phillips screwdriver
Materials and parts:	Strobe assembly
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Removing the Aft Cover" on page 2-55.

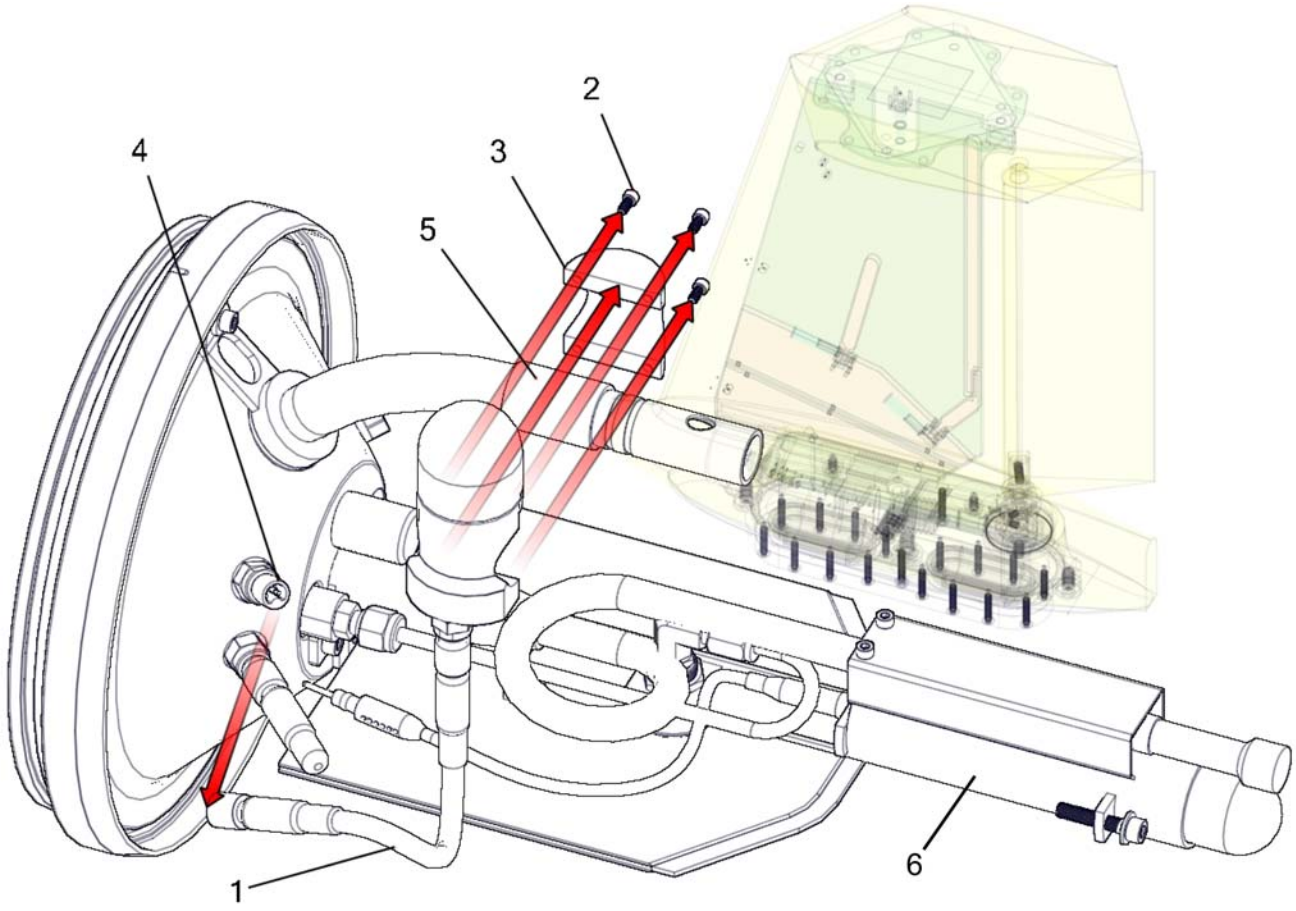


Figure 2-38 Strobe assembly.

Removing the Strobe Assembly

1. Remove the four screws (Figure 2-38, Item 2) that secure the strobe assembly to the digifin channel (Figure 2-38, Item 6).
2. Remove the strobe clamp bracket (Figure 2-38, Item 3).
3. Remove the bushing (Figure 2-38, Item 5).
4. Remove the strobe impulse cable (Figure 2-38, Item 1) from the strobe connector (Figure 2-38, Item 4) on the aft end cap assembly.

Installing the Strobe Assembly

1. Install the strobe impulse cable (Figure 2-38, Item 1) to the strobe connector (Figure 2-38, Item 4) on the aft end cap assembly.
2. Insert the bushing (Figure 2-38, Item 5) and install the strobe clamp bracket (Figure 2-38, Item 3) with the four screws (Figure 2-38, Item 2) that secure the strobe assembly to the digifin channel (Figure 2-38, Item 6).

2-265 O-Rings

Tools:	Phillips screwdriver
Materials and parts:	Recovery spool base (200/1000M)
Personnel required:	1 electronics technician
Equipment condition:	Glider is disassembled according to "Disassembling the Glider" on page 2-1 and "Removing the Recovery Assembly" on page 2-25.

Removing the 2-265 O-Rings

1. Separate the glider hulls and payload bay.
2. Remove the 2-265 O-rings.

Installing the 2-265 O-Rings

WARNING Parker O-Lube: Avoid contact with skin and eyes. If ingested immediately drink two glasses of water, induce vomiting, and seek medical attention. Keep away from open flames, hot surfaces, and sources of ignition. Fire extinguishers should be readily available when solvent is used.

1. Inspect the 2-265 O-rings for cleanliness, nicks, scratches, dents, and slices.
2. Lubricate the 2-265 O-rings with Parker O-Lube.
3. Install the 2-265 O-rings. Ensure that the O-rings are seated properly.

3 Ballasting

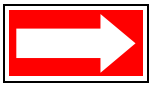
CAUTION Many of the operator instructions below are harmless when used in the lab. Some commands below cannot be used safely when the glider is deployed and in a mission.

CAUTION Never power a glider without a vacuum.

The goal of ballasting is to adjust the mass of the glider so that it is neutrally buoyant and properly trimmed at the surface of the operation site's water when:

1. The displacement pump is set to 0 cc.
2. The pitch vernier is set to 0 inches.
3. The static roll is set to 0 degrees.
4. The air bladder is deflated.

The `ballast` command from lab mode moves these motors to the proper position.



NOTE See Appendix A of the *Slocum G2 Glider Operators Training Guide* for a list of commonly used glider commands.

Checking and Setting the Vacuum

If the glider is not closed with a proper vacuum already, you need to check and set the vacuum before applying power to the glider. For the steps on how to do this, see "Checking and Setting the Vacuum on the Glider" on page 2-7.

Turning on the Science Sensors

When ballasting for a CTD or to confirm science output, you need to display science data in real-time from the glider so that you can make your final weight adjustment calculations from the ballast tank to real-world conditions.

1. Type `put c_science_all_on 0 (off=-1)`. This tells the science computer to sample all science sensors as fast as possible.
2. Type `put c_science_on 3 (off=1)`. This displays that data to the screen.
3. Type `put c_science_send_all 1 (off=0)` to send science data to the flight Persistor.
4. When ballasting, use the water's temperature and conductivity to calculate your salinity and density. Enter this data into the ballasting and H-moment calculator sheet in the appropriate cells. Enter the target water's temperature, density, and salinity into the appropriate cells to get your total weight change from tank to real-world conditions.

Setting the Glider to **`ballast`** Mode

1. Power the glider with either an external power cable (15 VDC), or insert the go plug (green) as described in "Stop Plug (Red) and Go Plug (Green)" on page 2-52.
2. If in PicoDOS, run the application (type `app`) to start GliderDOS.
3. Once in GliderDOS, type `ctrl-c`, when appropriate, to gain control of the glider.
4. Type `callback 30`.
5. Type `Lab_mode on`.
6. Type `ballast`. This will set the ballast pump and pitch vernier to 0, and deflate the air bladder.
7. If external power is used, type `exit`, pull the plug, and replace it with a red dummy plug when the glider states it is OK to remove the power as described in "Stop Plug (Red) and Go Plug (Green)" on page 2-52.
8. If internal power is used, the glider may remain on.

Introducing the Glider to the Test Tank

1. Place the glider in the test tank, making sure to purge the nose cone and aft cover of bubbles. This can be accomplished by gently bumping the glider's nose into the wall of the tank and tapping the aft cover until all bubbles have been eliminated.
2. Insert the wings into the wing rails (see "Payload Bay Assembly" on page 2-44).
   - If your tank is not large enough to attach the wings, lay the stacked wings on top of the aft hull section, aligning the holes of the wings with the aft holes of the wing rails.
   - Hold the wings in place with a wrap of electrical tape around the hull and wings.

Adjusting the Glider's Weight

NOTE The steps below outline the process necessary to properly ballast the glider. To this end, Teledyne Webb Research has developed the Ballast Adjustment Spreadsheet to assist in the ballasting process. Contact Glider Support for a copy and for information and assistance regarding its use.

1. If the glider is too light, add weight to the exterior of the hull in the areas where internal weight adjustments can be made.
   - Weight can be added where the forward and aft end caps attach to the hull, and at the forward and aft ends of the payload bay.
   - In ballasting the vehicle in a tank, it is often desirable to lay external weight on the hull to trim the overall weights and moments. These weights displace water, which should be accounted for before adjusting the vehicle's internal weight.
     - Stainless steel:

       (external air weight) x (0.875) = internal weight to be added
     - Lead:

       (external air weight) x (0.912) = internal weight to be added

- The internal weight and balance of the glider can be altered through changes to stainless steel weights, shot in ballast bottles, batteries, and payload:
  - The forward hull section has room for two ballast bottles (see "Ballast Bottles" on page 2-15). The 200-meter gliders powered by lithium batteries are also outfitted with steel weights mounted in the unused battery brackets.
  - The forward and aft ends of the payload bay can be fitted with pie-shaped stainless roll weights, and the payload itself (such as science packages and batteries) can be shifted. Additionally, weight bars with tapped holes may be installed in the payload bay to which stainless steel plates and/or ballast bottles can be attached.

2. If the glider is too heavy, attach spring scales to the glider where the forward and aft end caps attach to the hull to determine the balance and overall excess weight.
3. Because the glider's mass has been adjusted to make it neutrally buoyant in the tank, these results must be compared to the buoyancy required by the target surface water. The weight that the glider must be adjusted when transferred between bodies of water with different densities and temperatures is calculated from the following equation:

$$W = D_{glider}\left[\propto_{glider} \rho_{target\ water}\left(T_{target\ water} - T_{tank\ water}\right) + \left(\frac{\rho_{target\ water}}{\rho_{tank\ water}} - 1\right)\right]$$

where:

D_{glider}	=	Displacement of glider (assumed to equal the glider's air weight)
α_{glider}	=	Thermal coefficient of expansion for the glider (= 535 x 10^{-6})
$\rho_{target\ water}$	=	Density of target water (in g/L)
$\rho_{tank\ water}$	=	Density of tank water (in g/L)
$T_{target\ water}$	=	Temperature of target water (in degrees C)
$T_{tank\ water}$	=	Temperature of tank water (in degrees C)
W	=	Weight to adjust the glider (g)

Glider Type	Glider Displacement, D_{glider} (L)
G1 (200 m)	52.0
G1 (1000 m)	55.2
G2 (200 and 1000 m)	56.3
LBS (200 and 1000 m)	56.3
Additional science bay	9.0

Calculating the H-Moment

H-moment, or horizontal moment, is the measure in millimeters of the distance between the center of buoyancy and the center of gravity of the glider. This can be thought of as similar to the measure of stability or righting moment in a boat. Unlike a boat, a glider requires the distance between the center of gravity and buoyancy to be relatively close. This proximity and fine-tuning of this small distance is a major component of glider flight dynamics and energy consumption. The recommended distance is 5-6 mm between these two locations.To achieve the proper neutral pitch, the weights may need to be shifted fore or aft internally. The pitch vernier will take care of some offset, provided that the H-moment is ideally set from 5 to 6 mm.

Teledyne Webb Research provides two methods to measure the H-moment value:

- A change in the moment by adding mass to the wing and measuring the vehicle's change in roll.
- Commanding the vehicle to move the pitch battery mass and measuring the vehicle's change in pitch.

Ultimately, a glider with too large of an H-moment or distance between the center of buoyancy and gravity would be considered too "stiff," and energy will be consumed by moving the pitch battery greater distances internally, or if grossly in error, the glider may not be able to dive and climb at all and may only "pancake" through the water column. If the H-moment locations are too close together, the glider is considered too "twitchy" or unstable, and energy will be consumed, continually correcting the vehicle's pitch, or if grossly in error, the glider might flip over.

It is important to remember that you need to make the glider neutral in the ballast tank and do an H-moment calculation. If you intend to measure the glider's H-moment, it should be calculated before making a final mass adjustment.

To calculate the H-moment, with the glider powered and neutral in the tank: Type `report ++ m_pitch m_battpos`. This displays the pitch and battpos of the glider every CPU cycle in radians and inches respectively. Follow the instructions for calculating the H-moment on the ballasting and H-moment calculator spreadsheet.

Adjusting the H-Moment

A properly ballasted glider will measure 5-6 mm H-moment. To increase the H distance, the mass should be moved from high to low. To decrease the H-moment vehicle, the mass should be moved from low to high. Typically the pie shaped masses attached to the payload bay are used to make these adjustments.

4 Parts List and Equipment Returns

This chapter contains a comprehensive spare parts list for the Slocum G2 Glider. Part numbers are also included for ordering convenience. This chapter also contains instructions for returning equipment for repairs or refurbishments.

PART	DESCRIPTION	U / M
ASSY 4101	Wing Rail Assembly, External ballasting	EA
ASSY 4102	Weight Assembly, Wing Rail 15G	EA
ASSY E-483	LNA Switch Board Assembly	EA
ASSY G-1063	Bench Power Supply - Glider	EA
ASSY G-1164	Cart, Glider, Standard	EA
ASSY G-1192	Crate, Glider	EA
ASSY G-123	Weight Release Burn Wire Assembly	EA
ASSY G-1251	Air Pump Assembly	EA
ASSY G-1300	Anode Assembly, Zinc 50g, Size 3/4" OD x 1" Long	EA
ASSY G-1372	Forward Assembly (1000M)	EA
ASSY G-1405	Composite Hull	EA
ASSY G-1412	Forward Assembly (200m)	EA
ASSY G-1426	Communication Board Assembly	EA
ASSY G-1450	Lithium Battery Set, G2 Slocum Glider	EA
ASSY G-1482	Leak Detect Board Assembly	EA
ASSY G-1600	Recovery Spool Assembly, with Line	EA
ASSY G-1630	Buoyant Sonar Dome Assembly	EA
ASSY G-521	Vacuum Tool, Glider	EA
ASSY G-540	Anode Assembly, Zinc 10g, Size 1/2" OD x 1/2" Long	EA
ASSY G-780	Glider Accessories and Tool Kit	EA
B1-104-B	Copper Coated Lead Shot, 10 LBS BAG	BG
E-408	Attitude / Compass Sensor, True North TNT1501 Revolution LX	EA
E-454	Cable, Aft Leak Detect	EA
E-455	Cable, TNT Attitude Sensor, G2	EA
E-456	Cable, Iridium Phone	EA
E-457	Cable, 3" 20 Flat Conductor , Communication to Main Board	EA
E-458	Cable, Communications Board Power	EA
E-463	Glider Main Board	EA
E-490	Cable, GPS to LNA, Coax	EA
E-491	Cable, Iridium to LNA, Coax	EA
E-710	RF CHIRP	EA

PART	DESCRIPTION	U / M
G-016L	CF1 Persistor, Configured	EA
G-017D	Flash Card 2GB	EA
G-024	O-Ring, 2-265 (Glider Hull)	EA
G-067	Ejection Weight Spring	EA
G-1049A	Digifin Tail Cover, with Aanderaa Optode Cut-out	EA
G-1049B	Digifin Tail Cover	EA
G-107	E-Ring, (Ejection Weight)	EA
G-1161	Sonar Dome Vent Washer	EA
G-120	Stop Plug, Red	EA
G-121	Go (Enable) Plug, Green	EA
G-1229	Main Board Corner Guard	EA
G-1359C	Iridiun Phone, Configured	EA
G-1378	Tie Rod Plate	EA
G-1414	Altimeter Transducer Assembly	EA
G-1488	Roll Weight	EA
G-1650	Clip, Retainer, CF Card	EA
G-1719C	Receiver, Garmin GPS, Configured	EA
G-237D	Wing	EA
G-269	Vent Plug, 7/16	EA
G-307	Delrin Hull Separator Tool	EA
G-310	Ballast Bottles, 60ml	EA
G-461	1/4" Socket Drive X 24" Extension	EA
G-462A	Modify Allen Drive Tool	EA
G-464	Tool Hex Key 3/16" x 24" T-Handle	EA
G-465	Tool Hex Key 5/32" x 12" T-handle	EA
G-466	15 inlb Tee Handle Torge Wrench	EA
G-487A	Freewave Modem Antenna And Base	EA
G-488	Freewave Antenna Cable	EA
G-489	Freewave Modem	EA
G-579	Storm Case	EA
G-580	Scale Linear Hanging 1KG/10G Gradian	EA

Ancillary Glider Equipment

This equipment is shown in the table below.

Table 4-1 Ancillary Glider Equipment

Equipment Type	Description
Ballast tank	Minimum size: 8' (2.5 m) long x 4' (1.2 m) X 3' (1 m). This is for a manual setup of the glider. A way to get the glider in and out of the tank (i.e., an overhead winch, a low enough tank to go over the side, or some lifting device).
Vacuum pump	Thomas model #2688CE44, available from Grainger (Grainger item #5Z350) or equivalent, to pull the glider's vacuum.
Gram scale	0-2 kg; to measure the internal ballast.
Hanging gram scale	To measure the weight of the glider in the ballast tank.
Lead shot or ballast material	—
Iridium account	See Appendix F in the *Slocum G2 Glider Operators Manual* for more information.
Argos account and ID	See Appendix G in the *Slocum G2 Glider Operators Manual* for more information.
Land phone line	To receive Iridium satellite, or introduced in 2008, Rudics is available for data transfer.

Instructions for Returning Equipment for Repair or Refurbishment

Contact Teledyne Webb Research Customer Support at apexsupport@webbresearch.com or glidersupport@webbresearch.com for an RMA number before returning equipment. Please forward us your commercial invoice at the time of shipment.

For all returns from outside USA, please specify our import broker listed below.

Ship to: Boston, MA USA, Logan International Airport

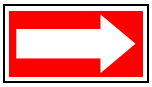
Consignee:

Tehedyne Webb Research, a business unit of Teledyne Benthos, Inc.
ATTN: Clara Hulburt or Louise Mitchell
82 Technology Park Drive, Reference: RMA No. _____
East Falmouth, MA 02536
(508) 548-2077 (phone)
(508) 540-1686 (fax)
webbresearch@teledyne.com

Notify:

Barry International Forwarding
ATTN: Tim Crisman
88 Black Falcon Avenue, Suite 167
Boston, MA 02210
(617) 261-3500 (phone)
(617) 261-3565 (fax)

Include this note on the shipping documents: US MADE GOODS being returned to the manufacturer.



NOTES All large crates (APEX and GLIDER) must be metal banded.

Teledyne Webb Research ships APEX and GLIDER by air. We strongly discourage truck transport over long distances due to the likelihood of additional damages during shipping.

Table 4-2 Schedule B and Harmonized Tariff Codes

Description	Schedule B	Units	Harmonized Tariff	Units	Rate
APEX float	9015.80.8080	X	9015.80.8080	X	Free
Parts and accessories	9015.90.0000	X	9015.90.0090	X	Free
Slocum Glider	9015.80.8080	X	9015.80.8080	X	Free

Typical Crate Dimensions

These dimensions are shown in the table below.

Table 4-3 Typical Crate Dimensions

Product Type	Crate Dimensions
APEX Floats	Single crate—82" x 15" x 17" @ 136 lbs Double crate—82" x 22" x 17" @ 219 lbs If returning APEX floats with lithium batteries installed, follow IATA shipping, labeling, and documentation requirements.
Slocum Glider (large gray shipping crate)	95" x 29" x 34" @ 429 lbs If returning the glider with lithium batteries installed, follow IATA shipping, labeling, and documentation requirements.
Slocum glider battery crate (alkaline)	34" x 12" x 12" @ 70 lbs
Slocum glider lithium battery box	1 UN certified cardboard box 34" x 27" x 15" @ 80 lbs If returning lithium batteries, follow IATA shipping, labeling, and documentation requirements.

Additional Instructions

Floats

If the float has been in the ocean and might contain water, please remove the seal plug for shipping. If the float is active, turn it off, and using the interface cable, issue the command H (hibernate) as described in final test procedure. Use the original shipping crates, and ensure all foam supports are installed.

Gliders

If the glider is suspected to, or has leaked and may contain seawater, please remove the seal plug for shipping. If no leak is suspected, please return the gliders with the appropriate vacuum set. For deep gliders, please retract the oil to -270 cc. Use the original shipping crate, and be sure both black ratchet straps are securely fastened around the glider and are firmly holding the glider and cart into the brackets.

If you are in any doubt or need any additional assistance, please contact customer support at apexsupport@webbresearch.com or glidersupport@webbresearch.com.

A Abbreviations and Acronyms

ABBREVIATION OR ACRONYM	DESCRIPTION
AC or ac	Alternating Current
ASSY	Assembly
BAM	Beam Attenuation Meter
CTD	Conductivity/Temperature/Depth
COTS	Commercial Off-The-Shelf
DC or dc	Direct Current
DG	Dangerous Goods
GLMPC	Glider Mission Planning and Control
GMC	Glider Mission Control
GPS	Global Positioning System
IR	Infrared
ISO	International Organization for Standardization
ISU	Iridium Subscriber Unit
LNA	Low Noise Amplifier
MS Plug	Military Standard Plug
MSDS	Material Safety Data Sheet
OC	Operations Center
OEM	Original Equipment Manufacturer
QCP	Quality Control Process
PPE	Personal Protective Equipment
RHEL	Red Hat Enterprise Linux
RHN	Red Hat Network
RUDICS	Router-based Unrestricted Digital Internetworking Connectivity System
SE	Systems Engineering
SHCS	Socket Head Cap Screw
SN	Serial Number
SOP	Standard Operating Procedure
SSL	Secure Sockets Layer

ABBREVIATION OR ACRONYM	DESCRIPTION
STE	Secure Telephone Equipment
TWR	Teledyne Webb Research
U.S.	United States
USB	Universal Serial Bus
UUV	Unmanned Undersea Vehicle
VAC	Volts Alternating Current

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