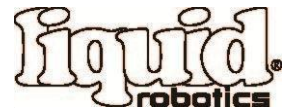


Wave Glider™ Unpacking and Assembly Guide



Revision: A
28 December, 2012
Part Number: 01497

Legal Notices

Wave Glider™ Unpacking and Assembly Guide

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Patents and Inventions

The Wave Glider product is subject to the following patents: Chile (48.628), China (2011 101405179), Egypt (25194), Indonesia (P0027767), Israel (192828), Japan (2009533257), New Zealand (570562 and 592743), Singapore (144487), South Africa (200806769), U.S. (7,371,136, 7,641,524, 8,043,133, and 8,287,323). Additional U.S. and non-U.S. patent applications are pending. All aspects of the Wave Glider product have been developed at private expense by LRI, Inc.

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Address

Liquid Robotics, Inc.
1329 Moffett Park Dr.
Sunnyvale, CA 94089
USA
(408) 636-4200

Revision History

Revision	Changes	Publication Date	Author
1.40	Initial Release	3-14-2011	
A	Major revision to update information for current Wave Glider product.	12-28-2012	PSE

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Before Starting

Please read through this manual in its entirety to familiarize yourself with the Wave Glider assembly process before unpacking the crates.

Take note of the following before unpacking the Wave Glider shipping crates.

Safety

HSSE CONSIDERATIONS: Ensure the Wave Glider components are suitably positioned on a stable surface allowing free access to areas affected by this procedure. Persons performing the service must use Personal Protective Equipment including safety eyewear and barrier gloves to minimize risk.

Risk	Description	Mitigation
Loose debris from environment on wave glider surfaces	Bio-fouling, loose paint	Proper cleaning prior to servicing. Use of PPE (safety eyewear, apron, barrier gloves)
Contact with anti-fouling paint, if present	Anti-fouling paints can contain harmful chemicals.	Use of PPE (safety eyewear, apron, barrier gloves). Refer to MSDS information. Thorough cleansing of tools and equipment after servicing.
Hoisting and positioning	Components of a Wave Glider are best handled by more than one person and or mechanical devices.	Components of a Wave Glider should be moved and positioned utilizing team lifting and or mechanical devices according to local safety procedures.

Requirements

People Required

Unpacking and assembly requires **at least** two people. If possible, three people are recommended for this task.

Space Required

A minimum 5x5 meter (16'x16') area is required for unpacking and assembly.

Tools Required

- Large flat-head screwdriver or claw hammer
- Small Phillips screwdriver
- Rubber mallet
- Torque screwdriver, 4 nm (35 in-lbs) capacity
- Phillips #2 screwdriver
- 4 mm Hex screwdriver
- 7mm wrench
- ¼" T-handle hex wrench
- 8 mm Open-end wrench (if installing a payload drybox)
- ½" Box-end wrench (for installing the AIS antenna)

Materials Required

- Loctite® 243
- Silicon connector lubricant (for Umbilical) 3M Part Number 62-4678-4930-3

Unpack and Assembly Time

If assembling a Wave Glider for the first time, allow **at least** three hours for this task.

Assembly Location

Liquid Robotics recommends that unpacking and assembly be done on shore so the Internet can be accessed during pre-launch testing.

Torque Values

Use a torque screwdriver for all fasteners. Torque values are as follows:

- M4X20 Phillips head cap screw: **3 nm** (26 in-lbs). Used for attaching the wings.
- 5 mm screws: **4 nm** (30 in-lbs). Used for attaching the skeg to the float.

Wave Glider Shipping Crates

The Wave Glider is usually shipped in three crates. The crate type is stenciled on the outside of the crate. Open the crates in the order listed below.

Parts Crate

The Parts Crate contains the following:

- Wave Glider Unpacking and Assembly Guide
- Wave Glider User Manual
- Tool and Spares Box
- Payload Foam Block
- Glider Frame Blocks (x2)
- Launch Stand Parts
- Launch Saddle
- Launch Straps



Glider Crate

The Glider Crate contains the following:

- Glider Frame
- Attached Umbilical
- Glider Wings



Float Crate

The Float Crate contains the following:

- Float
- Skeg
- AIS Antenna
- Payloads -optional
- Mast Equipped Instruments - optional



Unpacking the Parts Crate

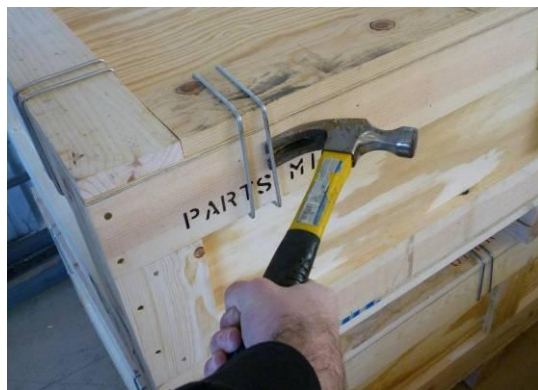
The Parts Crate lid is held on with metal clips. **Save** these clips for possible repacking later.

The following tools are required for this task:

- Large flat-head screwdriver or claw hammer

Removing the Crate Lid

1. Pry the clips off the top of the crate using a screwdriver or claw hammer.



-
2. Lift the lid and place it aside.

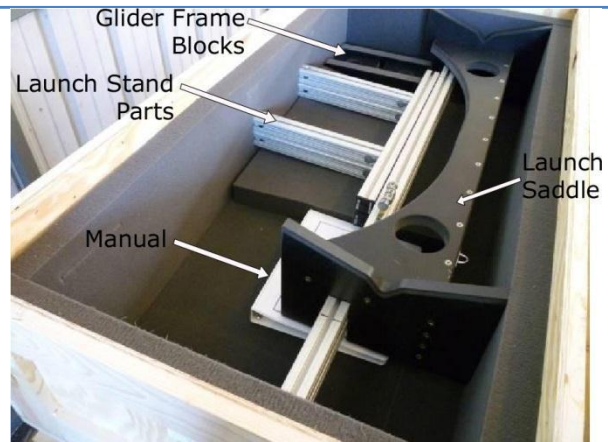
-
3. Remove and save the top foam piece. The Parts Crate should look like the figure on the right.



Removing the Crate Lid

4. Remove the following parts:
- Orange Tool Box
 - Thin black Foam Sheet

NOTE: Do not discard the foam pieces. You may need them later. The box will now look like the figure on the right.



5. Check for the following parts. They do not need to be removed at this time.
- Launch Saddle
 - Wave Glider User Manual
 - Glider Frame Blocks (x2)
 - Launch Stand Parts (4 pieces)

6. Use the black clasp on the side of the tool box to open it.



Removing the Crate Lid

7. Inventory the contents. This box contains both spare parts and tools.
- Spares Bag: The spares bag is located on the top tray of the box. A list of the bag contents is contained inside the plastic bag. Check the contents against the list.
 - Supplied Tools: Lift the top tray to access the tools and supplies in the bottom of the box. A separate list is provided for the tools. Check the contents against the list.



Spares Bag



Supplied Tools

Assembling the Launch Stand

Begin by assembling the Launch Stand. Assemble the stand in the sequence below:

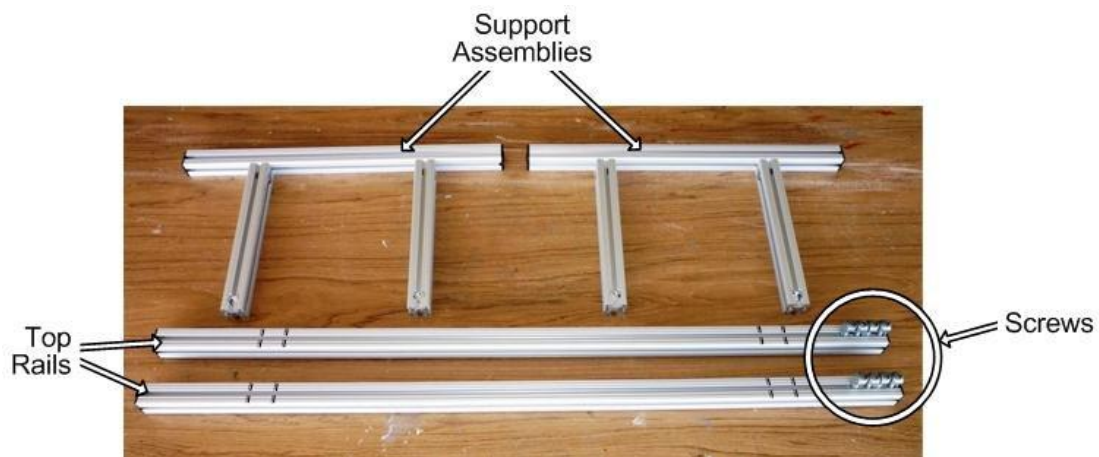
1. Prepare for Launch Stand assembly
2. Assemble the Launch Stand
3. Check the Launch Stand

The following tools are required for this task:

- 1/4" T-handle Hex wrench

Prepare for Launch Stand Assembly

1. Remove the four launch stand parts from the Parts Crate.
 - Support Assemblies (x2)
 - Top Rails with four screws each (x2)



2. Loosen the four screws on each top rail so they can slide back and forth along the rail.



3. Move the screws so one screw is on each side of the marked black lines on each rail. If no lines are marked, position the screws about 6" from the rail ends.



Assemble the Launch Stand

1. Spread the top rails apart.
2. Place the supports on top of the rails between the marked lines. If no lines are marked, position the supports 6" from the rail ends.



3. Slide the screws into the notches on each side of the legs. You may have to loosen some screws to slide them into the notch.



Assemble the Launch Stand

4. Hold the screws in with your fingers and tighten the eight screws.



-
5. Recheck that all screws are tight.
-

Checking the Launch Stand

1. Place the stand on the floor and check that it does not wobble. If it wobbles, retighten the screws.



2. Position the stand for assembly of the Wave Glider.
 - For on-shore assembly, place the stand on a moveable cart.
 - For on-ship assembly, place the stand at the launch location.



Unpacking the Glider Crate

Next, unpack the Glider Crate. The Glider Crate lid is held on with metal clips. **Save** these clips for possible repacking later.

The following tools are required for this task:

- Large flat-head screwdriver or claw hammer

Removing the Crate Lid

1. Pry the clips off the top of the crate using a screwdriver or claw hammer.



2. Lift the lid and place it aside. The Glider Crate should look like the figure on the right.



3. Remove the Glider Wings and set them aside.



Glider Frame Assembly

Perform the following to prepare the glider frame for installation of the wings.

Place Glider Frame on Blocks

1. Remove the Glider Frame Blocks from the Parts Crate. Place the blocks on the floor or table with 1 m (3 foot) clearance on each side and the notches pointed up.



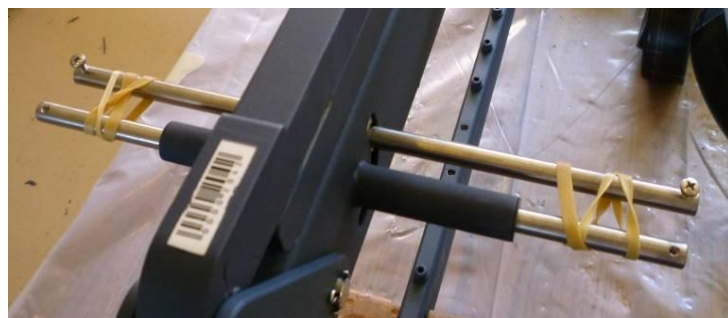
2. Remove the Glider Frame from the Glider Crate, and mount the frame onto the two blocks.

NOTE: Lifting the Glider Frame requires two people.



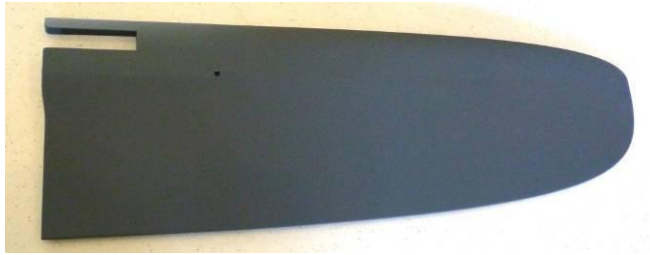
3. Adjust the block positions, moving them toward the front and back of the frame.

NOTE: Do not remove the rubber bands on the rods. Do not remove the screws yet.

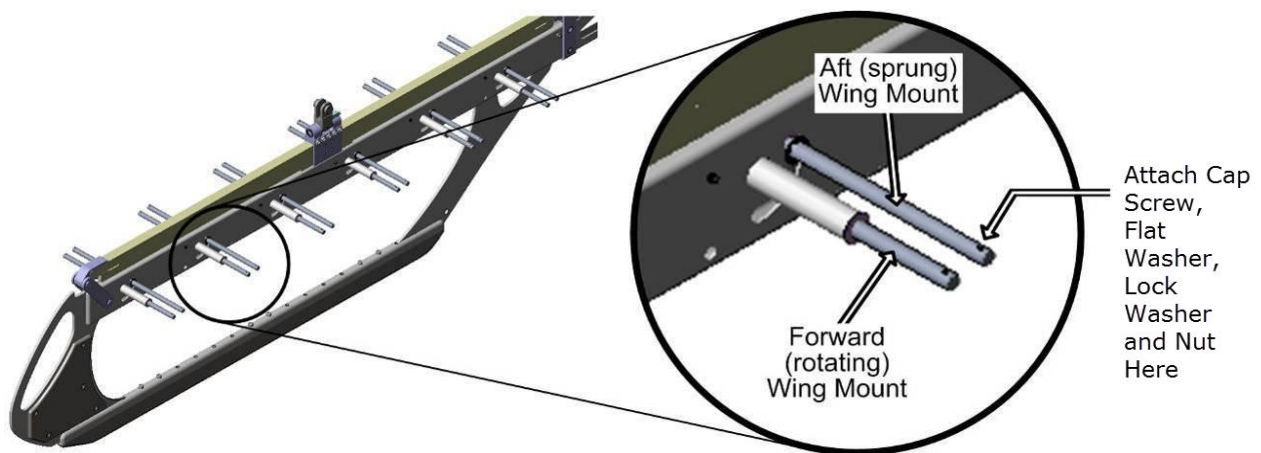


Glider Wings Installation

Before installing the Glider Wings onto the Glider Frame, inspect the 12 wings removed from the Glider Crate. Each wing will have a cured notch at the mounting end.



Each Glider Wing slides onto two rods and is held on with a 20mm long M4X20 Phillips head cap screw coated with Loctite® 243 and threaded in from the top of the Glider Wing. An M4 flat washer, M4 lock washer, and M4 nut are threaded onto the M4X20 Phillips head cap screw the from the bottom of the Glider Wing.



The following tools and materials are required for Glider Wing installation:

- Small Phillips screwdriver
- Phillips #2 screwdriver
- 7mm wrench
- Loctite® 243

Using Loctite

All the screws used during assembly should be prepared with Loctite.

Use just enough Loctite to fill between threads on the bottom half.

If the Loctite “beads up”, there is too much.

Shown below are the correct and incorrect amounts.



Correct



Too Much



Way Too Much!

Installing Glider Wings

1. Remove both rubber bands and the screws
2. While holding both rods on the opposite side at the front of the glider, slide the wing onto the frame.



Installing Glider Wings

3. Insert the small screwdriver into the screw hole to rotate the rod and line up the screw hole with the hole in the wing.

NOTE: Do NOT use pliers to rotate the rod!



4. Place Loctite on the wing screw (20mm long M4X20 Phillips head cap screw). Do not apply too much Loctite. Refer to Figure 3.

5. Use the Philips #2 screwdriver to install the wing screw into the wing. Torque the screw to **3 nm** (26 in-lbs).

Apply Loctite® 243 to the inside of an M4 nut.

Slide an M4 flat washer, followed by an M4 lock washer onto the end of the wing screw on the bottom side of the wing, then thread the Loctite treated M4 nut onto the wing screw.

Tighten the nut to **3NM** (26in-lbs).



6. While holding the mounted wing, slide a matching wing onto the rods on the opposite side.

Repeat steps 4 and 5 above to install a 20mm M4X20 Phillips head cap screw from the top of the wing and an M4 flat washer, M4 lock washer, and M4 nut on the bottom side of the wing.



Installing Glider Wings

7. Fully rotate the first wing pair up and down to check that they do not bind.



-
8. Repeat the steps outlined above to mount the second wing pair from the front.

-
9. Repeat the steps outlined above to mount the third, through sixth pairs from the front.

NOTE: The third pair is located near the Umbilical connection.



Installing the Launch Saddle

Next, install the Launch Saddle (shipped in the Parts Crate) onto the Glider Frame.

Installing the Saddle on the Glider Frame

1. Lift the Glider frame using the forward handle and the rear rudder module, and move it onto the Launch Stand.

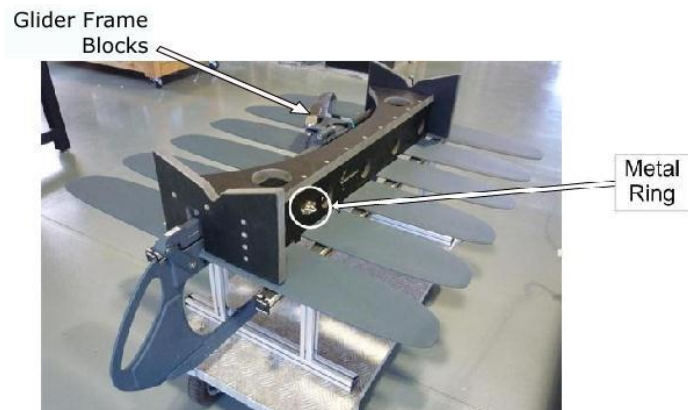
NOTE: Lifting the Glider Frame requires two people.



2. Unpack the Saddle from the Parts Crate.

3. Move the Umbilical to the right side (facing forward) of the Glider and mount the saddle on the Glider frame.

NOTE: The metal attach ring should be at the forward end of the Glider. It is the attachment point for the Quick Release Launch Strap.



Float Unpacking and Assembly

Next, unpack the Float Crate. The Float Crate lid is held on with metal clips. **Save** these clips for possible repacking later.

The following tools and materials are required for this task:

- Large flat-head screwdriver or claw hammer
- 4 mm Hex T-handle hex wrench
- 8 mm Open-end wrench
- 1/2" wrench
- Loctite® 243

Removing the Crate Lid

1. Pry the clips off the top of the crate using a screwdriver or claw hammer.



2. Lift the lid and place it aside. The Float Crate should look like the figure on the right.



Placing the Float on the Glider

1. Move the Glider frame with Saddle near the Float crate.
2. Remove any items from the crate that are on top of the Float.
3. Lift the Float out using the two end handles.

NOTE: A minimum of two people are required to lift the Float.

4. Place the Float onto the Glider in the groove on the Saddle. The Float should face forward (with the lift ring at the front).

NOTE: Be careful not to damage the Skeg Mounting Flange when lifting and placing the Float.



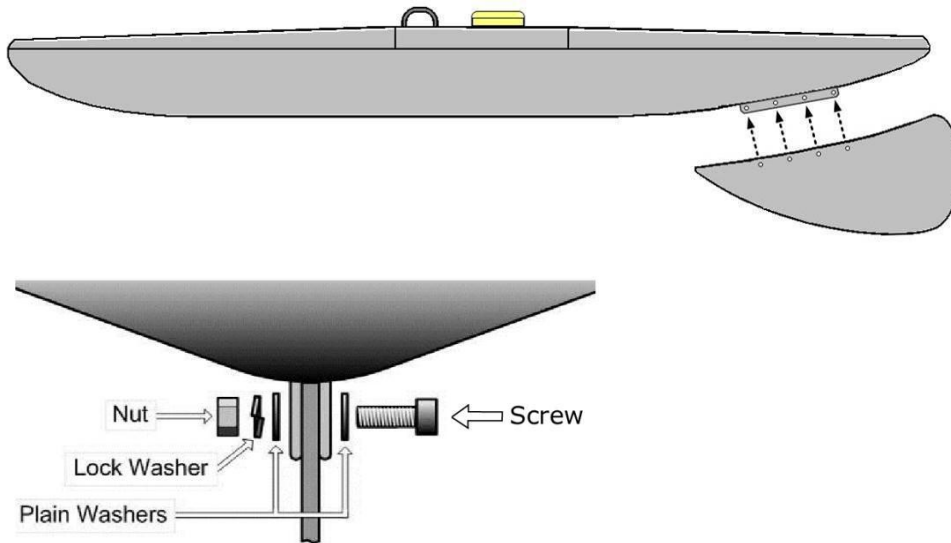
5. Check that the Float and Glider noses are about even with each other.

NOTE: Be sure the shorting pin on top of the C&C Dry Box remains disengaged during Wave Glider assembly. Do not engage the shorting pin until you are ready to power the Wave Glider electrical components.



Skeg Assembly

1. Remove the attachment hardware from the Float Rear Flange. The hardware is stored in the flange holes during shipment. The figure below shows the hardware that holds the Skeg onto the flange.



2. Insert the Skeg into the Flange.
3. Line up the screw holes, and insert the four 5 mm screws.



4. Apply Loctite to the screw threads. Refer to Figure 3 for tips for using Loctite.
 5. Add a plain washer, lock washer, and nut onto each screw.
 6. Torque the screws to **4.0 nm** (30 in-lbs).
-

Attaching the Umbilical to the Float

Next, the Umbilical will be connected to the Command and Control (C&C) Drybox located under the Turtledeck.

The following tools and materials are required for this task:

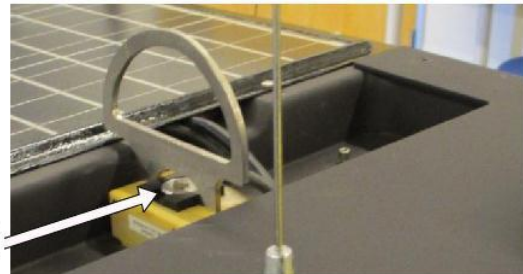
- Phillips #2 screwdriver
- 4 mm Hex wrench
- Large flat-head screwdriver
- Connector lubricant - 3M silicone lubricant Part Number 62-4678-4930-3
- Mallet

Attaching the Umbilical

1. Identify the Umbilical Line Terminator. The Line Terminator is used to attach the Umbilical to the Float.

NOTE: The metal disk on the Line Terminator must be raised above the surface of the black plastic base as illustrated in the photo. You will not be able to attach the Umbilical fitting to the Line Terminator, unless the metal disk is raised up above the surface of the black plastic base. (If the metal disk is flush with the surface of the base, use a flat head screw driver to pry it up until it locks in the raised position as illustrated in step 11.)

Umbilical Line Terminator

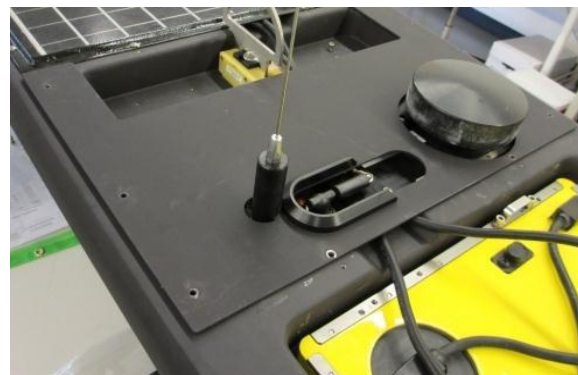


The metal disk must be raised above the black plastic base.



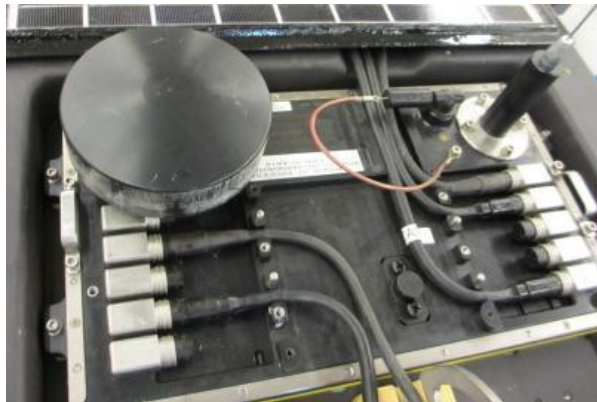
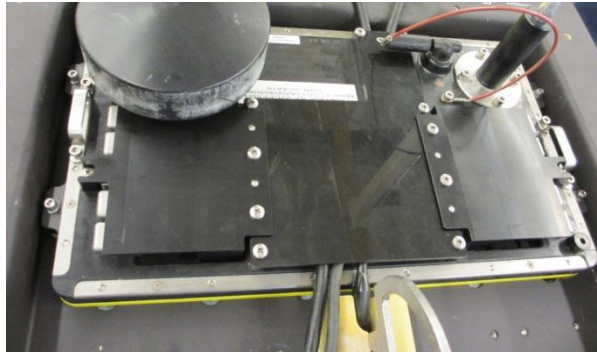
2. Use the Phillips #2 screwdriver to remove the eight screws on the Turtledeck.

NOTE: Do not remove any connectors or connect any loose connectors at this time.



Attaching the Umbilical

3. Use the Phillips #2 screw Driver to remove the two cable covers on the top of the C&C drybox.

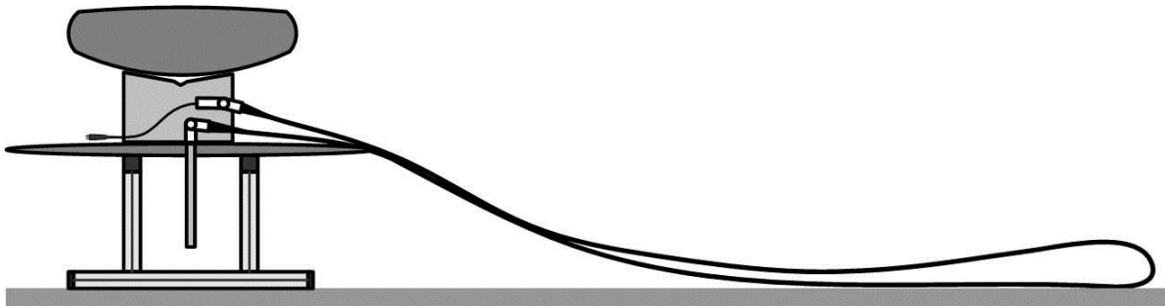


4. Unwrap the Umbilical.

NOTE: The Umbilical has a fitting used to attach the Umbilical on the bottom side of the Float. This photo shows the attachment fitting with Umbilical electrical cable projecting from it.



5. Pull the Umbilical out to its full length.



Attaching the Umbilical

6. Rotate the Umbilical as necessary to remove any twists.

7. Bring the attachment fitting to just underneath the float.

8. Rotate the Float in the Saddle to access the Umbilical Attach Hole.

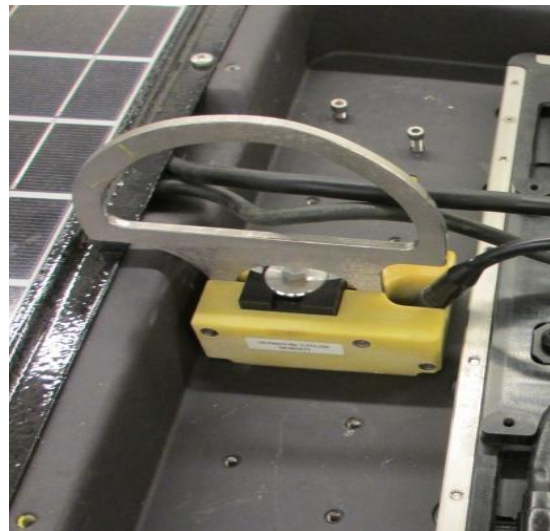
NOTE: Two people are needed to rotate the Float and hold it while a third person attaches the Umbilical.



9. Feed the Umbilical electrical cable through the hole from the bottom.

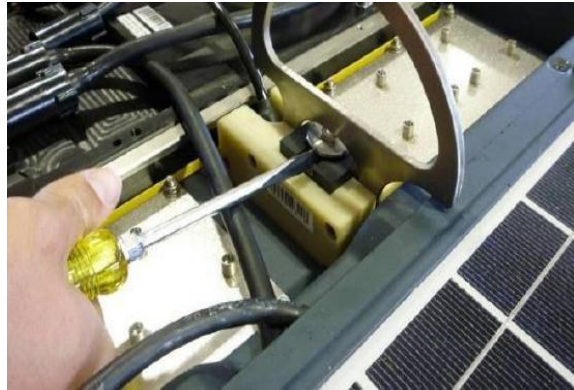


10. Pull the cable to the top side and out through the Umbilical Line Terminator.



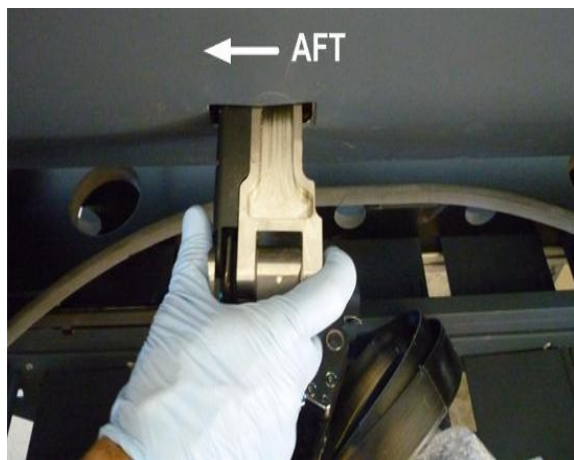
Attaching the Umbilical

11. The metal disk on the Line Terminator should be raised above the top surface of the black plastic base. If it is flush with the surface of the base, use a flat blade screwdriver to raise the metal disk (this will open the Line Terminator latch).



12. Insert the Umbilical fitting into the Umbilical Attach Hole.

NOTE: The fitting is inserted with the Black Plastic Cover facing **aft**.



Attaching the Umbilical

13. Lock the fitting in place by striking the bottom of the fitting with a mallet until it locks in place.



14. When the Umbilical fitting is locked in place, the metal disk on the Line Terminator is flush with the top surface of the black plastic base.



15. Firmly pull down on the Umbilical fitting to confirm that it is locked in place. When the Umbilical attachment fitting is properly locked in place it can be moved very slightly within the Line Terminator, but it will not pull out of the Line Terminator.

16. Lubricate the cable pins on the connector labeled "Umbilical" and attach the cable to the connector.



Payload Drybox Installation (Option)

If a Payload drybox will be installed onto the Wave Glider, perform the following steps. Otherwise, skip to the next section, "Securing the C&C Drybox" on page 31.

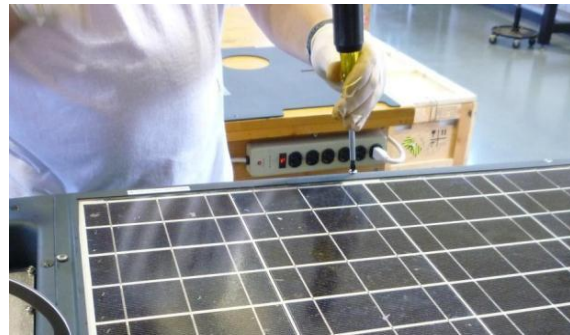
NOTE: Bending or forcing a solar panel during removal or installation can result in damage to the panel.

The following tools are required for this task:

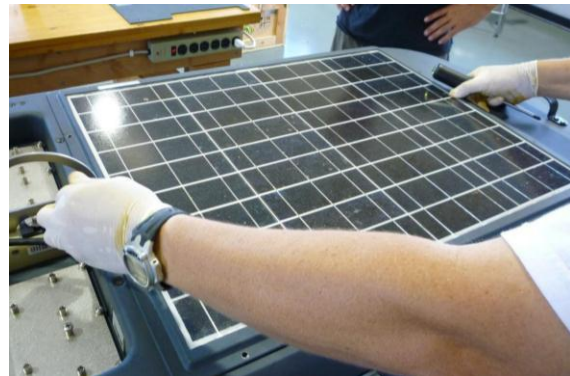
- Phillips #2 screwdriver
- 4 mm Hex wrench
- Connector lubricant - 3M silicone lubricant Part Number 62-4678-4930-3

Removing a Solar Panel

1. Unplug the solar panel cable from the C&C drybox (if necessary).
2. Remove all hold-down screws from the solar panel.



3. Confirm that all screws have been removed and lift the solar panel out.
NOTE: It may be necessary to slide the panel out from under the lifting ring. If the panel does not lift easily, check all screw locations to confirm that all screws were removed.

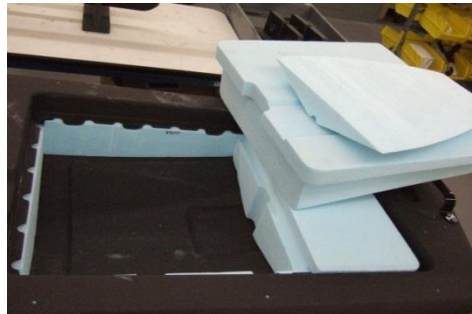


Installing a Payload Drybox

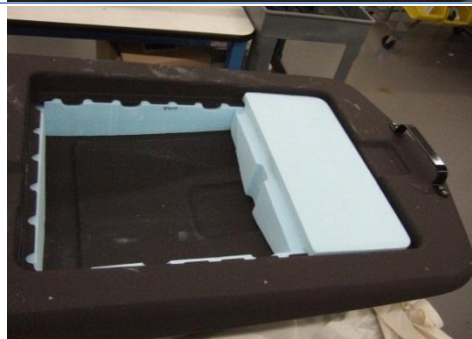
1. If there is no payload dry box, you will see two pieces of blue foam under the panels.



2. Remove the larger foam piece from the aft payload bay, but do not discard (you will need this foam if no payload dry box is installed). If you are installing a standard payload box, leave bottom foam in place. If you are installing a short aft payload box, remove the bottom foam.



3. Leave the smaller foam piece in place.



4. Confirm that there are no loose parts in the payload bay (under the blue foam).

5. Place the payload box into the bay. The payload box must rest on the outer flanges. If the payload box does not seat, remove the payload and check for an object in the bay.



6. Install four M5 X 25 Titanium payload hold-down screws with fiberglass washers and tighten until hand tight.
 7. Torque the screws to **4.0 nm** (30 in-lbs).
-

Reinstalling a Solar Panel

1. Place the panel over the payload box and confirm that all edges are flush with the Float top.



2. Install the screws on top of the solar panel using Loctite® 243.
 3. Torque the screws to **3 nm** (30 in-lbs).
-

Securing the C&C Drybox

Perform the following to connect the payload drybox cables to the C&C drybox and then reinstall the C&C drybox cover.

The following tools are required for this task:

- 4 mm Hex wrench
- Connector lubricant
- Loctite

Connect the Payload Drybox Cables to the C&C Drybox

1. Lubricate the cable pins on the connector labeled "Payld1" or "Payld2", as appropriate, and attach the cable to the connector.

NOTE: Connectors are provided for optional equipment. These are labeled "Aux Pwr", "Light", "Payld3", and "Weather".



2. Check that dummy plugs are placed on all unused connectors.

NOTE: Do NOT connect the two Solar Panel cables at this time.

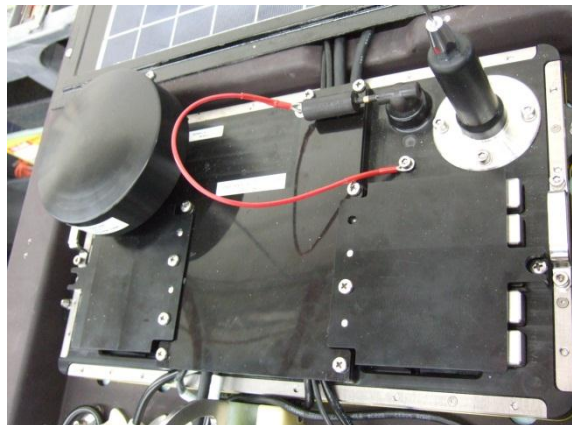


Install the C&C Drybox Covers

1. Confirm that Solar Panel, Payload, or other equipment cables do not cross over each other in a way that will interfere with the installation of the 3-piece C&C Dry Box Connector Cover set.



2. Reinstall the 3-piece plastic C&C Dry Box Connector Cover set. Apply Loctite on the six screws for the two end connector covers. DO NOT apply Loctite to the center cover hold-down screws. Do not over-tighten center cover screws that are threaded into plastic.

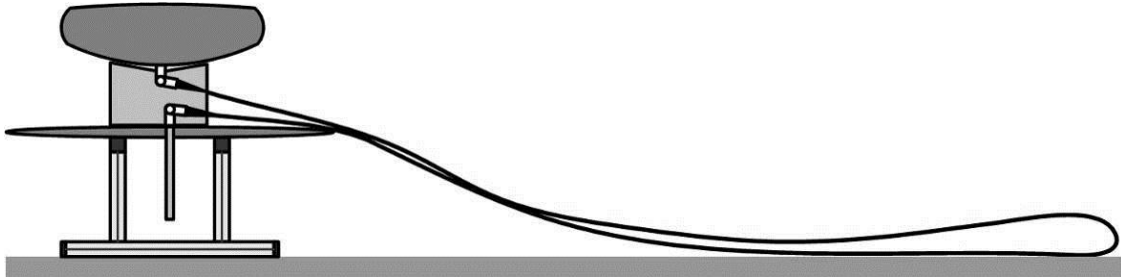


Stowing the Umbilical

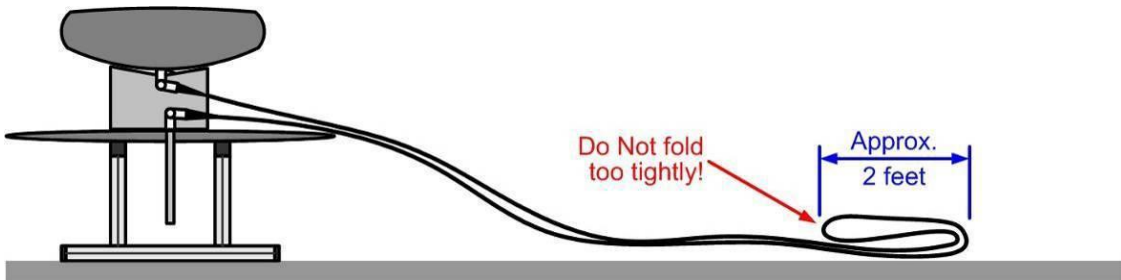
Perform the following to stow the Umbilical before launch.

Folding and Stowing the Umbilical

1. Extend the Umbilical out to its full length and confirm that it is not twisted.



2. Begin folding back the Umbilical from the farthest point in approximately two feet lengths. Do not fold too tightly.



3. Continue folding until the Umbilical is at the Glider.

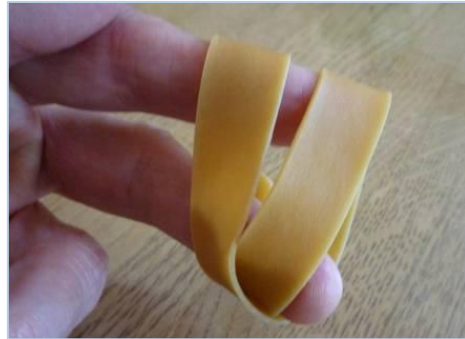


4. Remove the large rubber band from the Parts Crate.



Folding and Stowing the Umbilical

5. Double-over the rubber band.



6. Wrap the band around the Umbilical.
- NOTE:** Do not wrap the rubber band around the Umbilical more than twice.



7. Place the banded Umbilical on top of the Glider wings for stowing. Refer to the figure on the right.



Completing Assembly

Perform the following to complete assembly of the Wave Glider.

The following tools are required for this task:

- Loctite
- 12 mm Box-end wrench

NOTE: Do NOT use an open-end wrench on the AIS antenna.

Final Checks, Turtledeck and AIS Installation

1. Confirm that the Umbilical and connectors to the C&C drybox are tight.
2. Confirm that the solar panel cables can be connected.
NOTE: Do NOT connect the solar panel cables at this time.
3. Ensure there are no loose screws, tools, etc. in the center bay.
4. Add the turtledeck cover and install all hold-down screws.

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5. Remove the AIS antenna from the cardboard tube.



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6. Screw on the AIS antenna by hand, then tighten gently with a wrench – be careful, if you over-tighten the antenna base could be damaged.

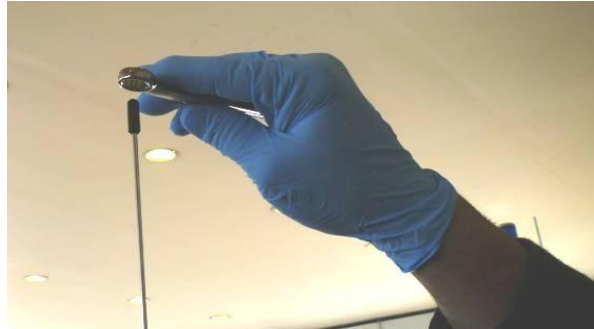
NOTE: Be careful not to damage the threads when attaching the antenna.



Final Checks, Turtledeck and AIS Installation

8. Place the box-end wrench over the antenna from the top and bring it down to the antenna base. Tighten the antenna until snug. Do not overtighten.

NOTE: The AIS antenna ships with STUF Dielectric Water Proofing Filler applied to the attachment threads. You should re-apply STUF (or a comparable product) whenever you detach and reattach the AIS antenna.



9. Engage the shorting pin on top of the C&C Dry Box to provide power to the Wave Glider electrical components.
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Deck Options

For information on installation of Masts and other Deck Options, contact Liquid Robotics Customer Support.

The Liquid Robotics Customer Support organization is available 24/7.

Telephone:

(US) 888-574-4574

(International) 1-408-636-4205

Email:

support@liquidr.com

Before You Contact Us:

Before contacting LRI support, please have available the serial number of the vehicle(s) or part(s) that you are contacting LRI Customer Support about.