Customer Training Guide
Pre-Launch
Wave Glider® SV3
Customer Training Guide

Pre-Launch
Wave Glider® SV3

Copyright © 2016 LRI, Inc.

Legal Notices

Confidential and proprietary information. Valid license or other authorization from LRI, Inc. required for possession, use or copying.

Trademarks

LRI®, LRI, Wave Glider, Wave Glider Management System, WGMS, and SHARC are worldwide trademarks of LRI, Incorporated. Other products and company names mentioned herein may be the trademarks of their respective owners.

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.

Warranty

The information contained herein is subject to change without notice. The only warranties for LRI, Inc. products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as a warranty. LRI, Inc. is not liable for technical or editorial errors or omissions contained herein.
Table of Contents
Chapter 1. Definitions ........................................................................................................................................ 1
Chapter 2. SV3 Pre-Launch Checklist .............................................................................................................. 2
  Date: Auto filled .............................................................................................................................. 2
  Tech(s): .............................................................................................................................................. 2
  Payload(s): ........................................................................................................................................ 2
  Ship/Op Area: ..................................................................................................................................... 2
  Glider Name: Auto filled .................................................................................................................... 2
  Organization: ....................................................................................................................................... 2
  Project: ................................................................................................................................................ 2
Chapter 3. Software Information ..................................................................................................................... 3
  Id: Auto filled ...................................................................................................................................... 3
Chapter 4. Communication ............................................................................................................................. 3
  WiFi Connection: Auto filled ............................................................................................................... 3
  Virtual Relay: Auto filled ..................................................................................................................... 4
  WGMS Iridium: Auto filled .................................................................................................................. 4
  Vehicle Telemetry received: ................................................................................................................ 4
  Tracker Telemetry received: ................................................................................................................ 4
Chapter 5. Configuration .................................................................................................................................. 5
  Topside Radio Direction Finder (RDF) Frequency: .................................................................................. 5
  Hull RDF Frequency: ........................................................................................................................... 5
  Drybox/CCU WGMS name: ................................................................................................................ 6
  Float name: .......................................................................................................................................... 6
  Glider name: ........................................................................................................................................ 6
  Thrudder Serial Number: Auto filled .................................................................................................... 6
  Event definitions: .................................................................................................................................. 6
  Vehicle and tracker op area defined: ..................................................................................................... 7
  Escalation list created/populated: ......................................................................................................... 8
Chapter 6. Vehicle Status ................................................................................................................................ 8
  Battery [Wh] > 700 Wh: Auto filled ....................................................................................................... 8
  Solar Power Indicators: > 0.00: Auto filled ........................................................................................... 9
  AMPS Domains: Auto filled .................................................................................................................. 11
    Adaptable Modular Power System (AMPS) ......................................................................................... 11
G1, G2, G3 - General Purpose Expansion Port Connectors .................................................. 11
D1 - Debug Port Connector .................................................................................................. 12
Domain_Name=Host, Node=1: Auto filled ........................................................................ 12
Domain_Name=Thrudder: Auto filled .................................................................................. 12
Domain_Name=Bat: Auto filled ........................................................................................... 12
Domain Status: ................................................................................................................... 13
Chapter 7. Float ................................................................................................................... 13
Wet-mates connected/lubed: .............................................................................................. 13
Connector covers secure: ..................................................................................................... 14
Drybox secure: .................................................................................................................... 15
Contact info secure: ............................................................................................................ 15
Hull: .................................................................................................................................... 16
Skeg/Fin: ............................................................................................................................. 16
Chapter 8. Sub ...................................................................................................................... 17
Hardware secure: ................................................................................................................ 17
Umbilical visual inspection: .................................................................................................. 17
Roll pins inserted: ................................................................................................................ 18
Wings: ................................................................................................................................ 19
Thrudder: ............................................................................................................................ 19
Chapter 9. Vehicle Functionality ......................................................................................... 19
Thruster Spin: ....................................................................................................................... 19
Rudder Range of Motion: ..................................................................................................... 20
Rudder right, left, center: ..................................................................................................... 20
Fixed heading test (spin): .................................................................................................... 22
Waypoint course test (spin): .............................................................................................. 22
Octopus Cable 01: Auto filled ............................................................................................ 23
Octopus Cable 02: Auto filled ............................................................................................ 23
AIS Status: Auto filled ........................................................................................................ 24
Photo Document: ................................................................................................................ 24
Chapter 10. Vehicle Communication and Telemetry ......................................................... 24
WX reporting: Auto filled .................................................................................................... 24
Airmar GPS: Auto filled ....................................................................................................... 26
Torpedo GPS: Auto filled .................................................................................................... 26
Water speed readings: Auto filled ................................................................. 26
Obstacle Avoidance Status: Auto filled ....................................................... 26
RDF beacon tested w/receiver: ................................................................. 27
Check alarms: ......................................................................................... 27
Chapter 11. Comments ........................................................................... 27
Chapter 12. Technician Signature ............................................................ 27
Chapter 13. Save & Submit .................................................................... 28
Chapter 14. Print ..................................................................................... 28
  Upload photos to gallery website with album name YYYY-MM-DD: .......... 28
  Log vehicle modifications in notebook: ............................................... 28
Chapter 15. Post Launch Procedures ....................................................... 29
  Clear alarms: ....................................................................................... 29
  Vehicle on mission: ............................................................................. 29
  Create LAUNCHED comment in WGMS: .......................................... 29
Chapter 1. Definitions

This checklist is designed to provide trained personnel with a framework for preparing a wave glider for autonomous operation. Simply filling out this form does not insure that a wave glider is ready for launch.

The Pre-Launch checklist can be found on the OBSP under: Checklist< SV3 Pre-Launch.

Note: It is recommended that at least two OBSP pages be opened to conduct the Pre-Launch. Refreshing the OBSP Pre-Launch page will clear any information already entered, There is no refresh of fields, so values you grab at the time of starting onboard Pre-Launch are a snapshot. In order to capture all relevant information, be sure that all payloads, sensors and services are turned on. Finally, when you print a hard copy or pdf of the pre-launch, the comments section will only show five lines.

AIS: Automatic Identification System
AMPS: Adaptable Modular Power System
APU: Auxiliary Power Unit
CCU: Command and Control Unit
MPU: Modular Payload Unit
OBSP: On-Board Server Page. This is the Wave Glider web page that users can access directly via WiFi connection or via cellular communication if the user connected to the LRI VPN (Virtual Private Network) and the wave glider is in cell range.
PDC: Power Domain Controller
RTF: Radio Tracker Frequency
SN: Serial Number
STP: Standard Temperature and Pressure
Wet-mates: Alternate term for Wave Glider connectors.
WG: Wave Glider
WXS: Weather Station
Chapter 2. SV3 Pre-Launch Checklist

Date: Auto filled
  - Date of inspection.

Tech(s):
  - Name of individual(s) responsible for Pre-Launching the Wave Glider.

Payload(s):
  - Types of payloads and sensors connected to the system.

Ship/Op Area:
  - Name of vessel deployed from and where the Wave Glider will be operating (e.g. Po'okela/Kawaihae).

Glider Name: Auto filled
  - Name of Wave Glider.

Organization:
  - Name of WGMS organization that the Wave Glider will be operating in (e.g. training.wgms.com).

Project:
  - Name of the current project that the Wave Glider will operate under (e.g. Training).
Location: Auto filled

- Auto filled with the system GPS coordinates.

Chapter 3. Software Information

Id: Auto filled

- Auto filled report of wave glider name, Serial Number (SN), Software Version and Production Build.

Chapter 4. Communication

WiFi Connection: Auto filled

- This is to test if the vehicle is broadcasting WiFi. Open Network and Sharing Center – View available networks and see if desired vehicle is an option.

Logging onto the vehicle webpage:

- Click on the WiFi icon and select desired Glider
- Password for WiFi connection will be, for example:
  1. SV3-010:password = sv3-010-50m
  2. Aquaman: password = aquaman-50m
- Open a web browser (preferably Google Chrome) and enter 192.168.100.1 in the address bar to access the vehicle log in page.
  1. Username: Individual Specific - Pass: Individual Specific

WGMS – SV3 Commands – VehicleID – Expert – Add User – New user Id (Enter desired user ID) – Password (Enter desired password) – Virtual Cell/Iridium – Click Add User – Once added you can now enter ID and Password on login page.

Note: The username and password will be visible in the command log. Insure that this password is not a common personal password.
Note: If you do not see a vehicle on WiFi, you can turn it on with SV3 Commands

- WiFi ON/OFF = SV3 Commands - Services - wirelessAccessPoint - Com channel Cell/Iridium - WIFI On - WIFI Off

**Virtual Relay:** Auto filled

- WGMS – Click vehicle icon – Click Raw Outputs – in left hand column check for VR Cell.

**WGMS Iridium:** Auto filled

- WGMS – Click vehicle icon – Click Raw Outputs in left hand column – Iridium will be in the same section that VR Cell is. It will be labeled IridiumStatus under Structure Type. Under the IMEI section it will be labeled by a combination of numbers.

Note: Iridium will always be on. This way if the Wave Glider goes out of Cell range it will maintain communication

- OBSP - Setup – All Vehicle Parameters – Enable – Look for Iridium Modem – Box checked = ON

- OBSP – Status – Amps – Host Domain – Slot 32 #1 – View if ON or OFF

Note: Always power up the Wave Glider outside (Clear view of sky). When an SV3 is powered on Iridium is defaulted to ON. This will also allow the default GPS system to boot up properly. **DO NOT SET DEFAULT COMM CHANNEL. THIS WILL CAUSE VERY SERIOUS ISSUES!**

**Vehicle Telemetry received:**

- WGMS- First information box when scrolling down (Communications) – If all 0.00 It will be an alarm. – If there is information double click it to see if it was sent via Cell or Iridium. This information can also be viewed from the vehicle icon - telemetry tab.

**Tracker Telemetry received:**

- Xeos Resilient Tracker: (White & Black tracker in bow, also known as the Resilient Tracker) WGMS – Click the drop down menu (searching for gliders and trackers) - By default; Resilient Trackers will be labeled with a “Res. Tracker”. The numbers are the last four of the tracker’s IMEI, which can be found printed on the tracker. Information
Note: All trackers can have individual names. It is the responsibility of the operator to name the trackers appropriately.

- Battery Power – Click on the “Vehicle” icon – Telemetry - Battery level will be in the Battery column.
  1. It is recommended that the Resilient Tracker battery pack power level is at least 13.4 volts.
  2. Battery will be depleted “around” 9.0 volts.

- Report Rate can be set on Xeos (online.xeostech.com). Resilient Tracker GPS and battery status is reported over Iridium at regular pre-configured intervals. The Liquid Robotics factory configured Resilient Tracker reporting frequency is every 720 minutes (12 hours), but you can set the reporting rate at 5 minute intervals from 10 minutes up to 1440 minute (24 hour) intervals, depending on your mission requirements.
  1. WGMS
  2. Click on the “Vehicle” icon – Telemetry – view report rate history to calculate report rate.
  3. It is recommended that you only use Energizer Industrial (AA) batteries
  4. Upon start-up, a tracker reports every 10 minutes for the 1st hour.
  5. After the first six reports it will return to its default report rate.

Chapter 5. Configuration

Topside Radio Direction Finder (RDF) Frequency:
- Radio beacon that was used in the past to track Wave Gliders with a Yagi antenna at ranges of 10's of kilometers in cases where all other communications methods failed. This equipment has been phased out in most applications.

Hull RDF Frequency:
- See Topside RDF Frequency.
Tracker WGMS name:
- See Tracker telemetry received. This should be the name that appears within the Wave Glider Management System (WGMS).

Drybox/CCU WGMS name:
- Name of CCU in WGMS, also the physical label on the CCU.

Float name:
- Same as CCU name unless parts/components were transferred between Wave Gliders.

Glider name:
- Refers to the Sub, same as CCU name unless parts/components were transferred between Wave Gliders.

Thrudder Serial Number: Auto filled
- OBSP – Status – AMPS – Thrudder Domain – 3rd line down – Last 6 digits of S/N

Event definitions:
- WGMS – Vehicle icon – Event Definitions in left hand column – View definitions to ensure they are set up correctly.
Vehicle and tracker op area defined:

- WGMS – Click vehicle icon – Click Operation Polygons – Check to see if the appropriate Polygon is enabled. Note: 11/11/2015 If two operational polygons (Inclusion) are enabled the smaller polygon should give one alarm. Once the glider crosses the second polygon it will send continuous alarms.

- There can be multiple Exclusion Zones enabled at one time.

- Enabling operational polygons during a prelaunch will cause the wave glider to produce out of bounds errors. It is recommended to enable the operational polygon before launching the wave glider. Once the Wave Glider is launched, place it on mission. When a vehicle is on mission alarms will be sent to individuals that are on the escalation list. During this process also look at the waypoints that are loaded onto the vehicle. Insure that all courses are set up and loaded correctly.
Escalation list created/populated:

Once a vehicle is on mission, the individuals that are on the populated escalation list will receive alarms created by the Wave Glider.

- WGMS – Click vehicle icon – Click Lists in left hand column – Click “New” if there is no populated list – Name List – Save - Double click Escalation List/Newly created list – If not on list click New – Type in Item Name (example = John Email) – Click Related Entity – Click on your name on the list, then click save.

- If not on Related Entity list, click New – Fill out information (Email, Name Etc.) – Click save

Chapter 6. Vehicle Status

Battery [Wh] > 700 Wh: Auto filled

A new and fully charged CCU or APU reports 850-980Wh depending on the version of battery installed. To read battery status:

(Option 1) OBSP – Status – AMPS – AMPS System Summary – Total battery Power Available
(Option 2) WGMS – Hover over battery icon (This will be updated every hour)

![Battery Power Level: 743.39 Wh](image)

**Note:** Minimum battery level for launch depends on weather conditions and Payload type + quantity of Payloads. Weather conditions consist of sea state, current strength/direction, and the amount of sunlight in the given area. It is recommended that wave gliders launch fully charged.

- Auxiliary Power Units (APU’s) can be added to provide additional battery power when needed. Each APU provides 850Wh to 980Wh depending on version and age of batteries. Each APU occupies 1 MPU of space, and plugs into an expansion port. A maximum of one APU can plug into the backside of another APU, allowing a total of 6 APU’s to be added to the system.

**Solar Power Indicators:** > 0.00: Auto filled

(Option 1) OBSP – Status – AMPS – Host Domain – Slot 9 #1 – Slot 10 #1 & #2 Note: Slot 9 #2 will always be reading 0.00 and that’s ok.

**Slot 9:** Solar Input Module
Firmware Version: 0x000035d2, Boot Loader Version: 0x0000381e
Mfg. S/N=V57399
HW ID=0x003700383030303406473333
Reported Arena Part Number = 4188A (matches manifest)
Module Type = 11
Found in Manifest by Serial Number.

- #1: Solar Panel Status=0x00000001 : Currently Generating= 6.334 W
- #2: Solar Panel Status=0x00000000 : Currently Generating= 0.000 W

**Slot 10:** Solar Input Module
Firmware Version: 0x000035d2, Boot Loader Version: 0x0000381e
Mfg. S/N=v59822
HW ID=0x0026002830343311473233
Reported Arena Part Number = 4188A (matches manifest)
Module Type = 11
Found in Manifest by Serial Number.

- #1: Solar Panel Status=0x00000001 : Currently Generating= 5.926 W
- #2: Solar Panel Status=0x00000001 : Currently Generating= 8.684 W
(Option 2) WGMS – More Commands – Comment Section – Retrieve Power Status – Command Reason (Pre-Launch) – Com Channel (VirtualRelayCell) – Send

- Vehicle Icon – Vehicle Data Forum – AMPS Solar Input Port Report – (The vehicle will give a report every hour unless requested). Readings will be in module 1, 3, and 4. Data will be given in Panel Pwr, Panel Volt, and Panel Cur.

Note: If anything is blocking the solar panels (shadows, tools, etc.) it will cause low reporting.

If testing a fully charged system, the solar panels will also give a low report rate and 1 or more panels may report zero output. If you cover one of the panels that is reporting, the system will start reporting a value of zero for the covered panel.
A good test is to compare the three panels against each other. All three should be giving similar power status readings. Another test that is recommended is to completely cover/uncover each panel. Take readings on each panel while covered/uncovered. AMPS may take a few minutes for values to update.

**AMPS Domains: Auto filled**

Domains will autofill in the pre-launch checklist if they are turned on and operating correctly. See example below. At a minimum, the Host (CCU) and the Thrudder domains must be present. CCU and payload pressures should be between (130 kPa and 105 kPa absolute) at standard temperature and pressure (STP). Oil filled Thrudder pressure should be between 200 kPa and 170 kPa (absolute) at STP.

<table>
<thead>
<tr>
<th>Item/Procedure</th>
<th>AMPS Hardware Status</th>
<th>Temperature (°C)</th>
<th>Pressure (kPa)</th>
<th>Hardware Uptime</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain_Name=Host, Node=1, HW_SerNum=0x3132471639323730035002c On=Y</td>
<td>OK</td>
<td>34.1</td>
<td>138.8</td>
<td>Uptime: 4 days, 17:38:45</td>
<td></td>
</tr>
<tr>
<td>Domain_Name=Bat:0x33351143733030020019, Node=3, HW_SerNum=0x333361143733030020019 On=Y</td>
<td>OK</td>
<td>26.9</td>
<td>136.3</td>
<td>Uptime: 4 days, 17:31:17</td>
<td></td>
</tr>
<tr>
<td>Domain_Name=Thruder-1, Node=4, HW_SerNum=0x3332470b323603200250022 On=Y</td>
<td>OK</td>
<td>27.4</td>
<td>132.2</td>
<td>Uptime: 4 days, 17:29:11</td>
<td></td>
</tr>
</tbody>
</table>

**Adaptable Modular Power System (AMPS)**

The Adaptable Modular Power System (AMPS) enables extremely efficient power management for a wide range of possible Wave Glider configurations. By generating data on individual power producers and power consumers in prioritized power domains, AMPS facilitates optimal mission specific power management. AMPS is defined by a 3-wire power distribution system that includes hierarchical communications capability for monitoring and control.

- AMPS extensibility supports:
  1. Scaling the number of power domains.
  2. Scaling power generation inputs.
  3. Scaling power storage capacity.

**G1, G2, G3 - General Purpose Expansion Port Connectors**

The G1, G2, and G3 General Purpose Expansion Port connections to the CCU support AMPS power management logic and also provide Ethernet switching capability for flexible payload-to-payload and payload-to-CCU communications management. They are designed to support payloads with multiple sensors or devices that require communications channels with other payloads and also with the CCU. This is in contrast to the S1, S2, S3, and S4 sensor supply, with direct communications connections to the CCU.
D1 - Debug Port Connector

The Debug Port Connector is the primary maintenance port for the CCU. It is identical to a General Purpose sensor port except that the SPARE1 and SPARE2 lines are dedicated to providing access to the VMC’s serial console port. This connector is also used for an external battery charger, although an external battery charger can be plugged into any CCU Expansion Port.

**Domain Name=Host, Node=1:** Auto filled

- CCU (Command and Control Unit) = (Host) Filled with Nitrogen to 122 kPa Absolute at STP (WGMS Will give a reading in kPa)

<table>
<thead>
<tr>
<th>Domain_Name=Host, Node=1, HW_SerNum=0x31324716338373800190035</th>
<th>OK</th>
<th>32.2</th>
<th>12.4</th>
<th>Uptime: 4 days, 23:34</th>
</tr>
</thead>
</table>

**Domain Name=Thrudder:** Auto filled

- Thrudder = (Thrudder) Filled with oil and Nitrogen to minimum of 170 kPa-Absolute. 200 kPa-Absolute at STP is the recommended operating pressure (WGMS gives a reading in kPa-Absolute).

**Domain Name=Bat:** Auto filled

- Battery Pack = APU, this is a battery pack containing 850Wh-980Wh of additional power to the system. Battery’s may vary in full charge depending on the age of the battery. APU’s will plug into G1, G2, or G3 depending on the configuration of the system.

- APU’s will have the same pressure and temperature characteristics as CCU’s. Filled with Nitrogen to 122 kPa - Absolute at STP (WGMS Will give a reading in kPa - Absolute)

| Domain_Name=Bat, HW_SerNum=0x333351143733300002e019, Node=3 | OK | 25.0 | 110.3 | Uptime: 4 days, 17:31:17 |
Turning On/Off APU’s:

(Option 1) SV3 Commands – Devices – Either G1, G2, or G3 depending on what it’s plugged into – Power On Expansion Port (ON) – Power Of Expansion Port (OFF)

(Option 2) OBSP – Operate – Power Devices – Turn on G port that the APU is plugged into.

Domain Status:

- (Option 1) OBSP – Status – Overall – AMPS Manager.

Note: Expansion port (G1, G2, and G3) payloads are controlled by a PDC board (Power Domain Controller).

- (Option 2) WGMS - SV3 commands – Amps Manager – Domain Statuses – Commands Log (Bottom of WGMS Home page) – Once Acked, Hover over Combined Acts to view Pressure and Temperature

- Host = CCU
- Thrudder = Thrudder
- Bat = APU
- Payload = Payload/Unknown

Chapter 7. Float

Reference the (Torque Specs for SV3 Fasteners) document for tools needed and torque specs.

Wet-mates connected/lubed:

- All connectors were installed with 3M Silicone Lubricant Spray (or appropriate equivalent, i.e. Dow Corning 4). Inspect for any damage in the system.
Connector covers secure:

- CCU cable Bridges are secured and Thrudder connector covers are installed.

Cable Bridge

14 in-lbs. (4mm Hex Key)
Drybox secure:

- Blue foam is installed. Wiggle test to ensure no movement from CCU/APU/Payloads.

Contact info secure:

- Sticker is installed on the cover/name plate with contact information.
**Hull:**

- Inspect hull of float for any damage.

**Skeg/Fin:**

- Inspect the Skeg for any damage and ensure hardware is secured with Loctite 243.

Note: Torque values remain the same for fiberglass Skeg’s and rubber Skeg’s.
Chapter 8. Sub

Reference the (Torque Specs for SV3 Fasteners) document for tools needed and torque specs.

**Hardware secure:**

- Ensure all hardware is secured and torqued to proper value.

**Umbilical visual inspection:**

- Inspect umbilical for any visible damage. Small amounts of pitting/imperfections in the umbilical potting are common. Inspect the cable for signs of wear at the bend radius sections, these are at the knuckles where the cable goes into the float and sub.
**Roll pins inserted:**

- Ensure there are four roll pins inserted into each knuckle. Check the float knuckle and the sub knuckle. Check for bushing wear while inspecting roll pins as well.
Wings:

- Inspect each set of wings for smooth movement. There should be no rubbing/binding/sticking. Ensure all hardware is secure with both nut and bolt.

Thrudder:

- Inspect all hardware. Wash with fresh water prior to Rudder checks if it was not cleaned after recovery. Salt deposits can hinder Rudder function checks.

Chapter 9. Vehicle Functionality

Note: During these tests make sure that Line Following and Obstacle Avoidance are turned off.

Thruster Spin:

(Option 1) OBSP – Operate – Thrudder – Thruster Power, Thruster RPM – Slow – Stop

(Option 2) WGMS – SV3 Commands – Devices – Thruster – Slow – Stop

Note: The thruster will not spin if the Thrudder is on a right or left rudder. It will also not thrust if it is on a Center (Forced) through the OBSP. If the Thruster is not responding – Enter Stop Forcing Rudder – OBSP
Note: If the Thruster is turned on first, you can force the rudder Right, Left, and Center.

**Rudder Range of Motion:**

- Both the rudder and the thruster are magnetically coupled and should spin freely by hand. Physically move the rudder left and right to ensure it is not binding and to check the range of motion. Similarly, spin the thruster.

**Rudder right, left, center:**

*(Option 1)* OBSP – Operate – Thrudder – Rudder – Rudder Right – Rudder Left - Rudder Center

*Status Checklist Config Operate Setup Help*

- Enter script command
- Float Recovery Device
- Reboot
- SV3 Payloads
- Thrudder
- User Data
- Write Console Script
- Logout
- Mast light
- SV2 Payload ports
- Telegraph Office
Rudder

Port is on
rack angle: 19.9°, post angle: 10.0°, Heading: 274.69918, Desired Heading: 320.7617, av decouple angle: 1.9000000 (corrected), status=0x3400810B

rudderStatus=0x3400810B
EnableNav
NavMode=heading
WatchdogMode=rudderPos
DefaultSensors=remote
ActualMode=Heading
codeVer=34000000

Heading: 274.69918
Position: 10.0

Heading:
Set Rudder Heading:

Position:
Set Rudder Position:

← Rudder Left → | Rudder Center | → Rudder Right →

Stop Forcing Rudder Sample Rudder Now

(Option 2) WGMS – More Commands – Click Comment – Rudder Right, Left, Center – Enter command reason (Prelaunch) – Set Com Channel (Virtual Relay Cell) – Send
Thrudder Compass Correction: Auto filled

- The system has been converted from manually entering compass heading corrections to a new automated system. In the information box the text should read “Thrudder compass is NOT corrected”.

Fixed heading test (spin):

*(Option 1)* WGMS – Follow Fixed Heading – Heading (deg) Example (270) – Enter command reason – Set Com Channel - Click Send – Once command has acted, physically spin glider and see if it aligns with the heading given. (Ensure Auto Avoidance is turned OFF)

*(Option 2)* OBSP - Operate - Thrudder - Heading (Set Heading) - Set Rudder Heading
Note: Double check fixed headings by looking at Desired Heading (deg) and Sub Heading (deg) SH. Once aligned 5 degrees difference between the two is OK. This test is performed to observe that the Thrudder moves as expected once in the water.

Desired Heading (minus) Actual Heading = Navigation Error

- Navigation Error (times) 80% (No Thrust) 50% (Thrust) = Rudder Angle

- Example: Desired Heading = 260° - Actual Heading = 270° / Navigation Error = 10°
  
  1. Rudder Angle = 8° (No thrust/Pre-Launch)

Note: It is possible to change these parameters in the OBSP – Operate – Thruster – It is NOT recommended to change these factory settings.

Waypoint course test (spin):

At Liquid Robotics (Sunnyvale) there are 4 waypoints dropped around the corners of the building. They then set vehicles on the sequential course and roll the Wave Glider to the points making sure they navigate in each direction, and change direction once in the arrival distance range.

At Liquid Robotics (Hawaii) the WG is set on the sequential course that it will be running while on mission. The glider is then rotated in a circle to view the Thrudder operating while targeting the first initial WP.

- WGMS – Follow Sequential Course – From Waypoint (X) - To Waypoint (Y) - Target Waypoint will be the waypoint the glider will go to first. – Enter command reason – Set Com Channel - Click Send - Physically spin/turn the glider to see if it will target the desired waypoint. (Ensure Auto Avoidance and Line Following are turned OFF)

Note: There needs to be WP’s loaded onto the WG and WGMS before this process can take place.
Buoy Release Mechanism:

(Option 1) OBSP – Operate – Float Recovery Device – Arm Device – Deploy

(Option 2) WGMS – SV3 Commands – Devices – FloatRecoveryDevice – Arm Device – Deploy

Note: Have a person ready to catch the float upon deployment or something soft to land in. Ensure that the float comes out on its own. If it fails to come out on its own but you hear the motor working, start fix by reaming the bottom alignment pin hole out.

Octopus Cable 01: Auto filled

If readings are OK then it passes the function test.

- 01 = Octopus (Port side on Wave Glider) 4 cables total.
  1. 1 - Custom LRI 01 (16 Pin) Cable connecting to the CCU
  2. 1 - Mid Solar Panel (5 Pin)
  3. 1 - Aft Solar Panel (5 Pin)
  4. 1 - Water Speed Sensor (8 Pin)

Octopus Cable 02: Auto filled

If readings are OK then it passes the function test.

- 02 = Octopus (Starboard side on Wave Glider) 5 cables total.
  1. 1 - Custom LRI 02 (16 Pin) Cable connecting to the CCU
  2. 1 - Light (2 Pin with, 1 alignment rod)
  3. 1 - Radar Target Enhancer (8 Pin)
  4. 1 - Forward Solar Panel (5 Pin)
  5. 1 - Buoy Release Mechanism (3 Pin with locking collar)

Note: The Octopus Cables have a resistor embedded in the molding. The value of the resistor is different for Octopus 1 than Octopus 2. The purpose for this is to enable the automated Pre-Launch software to detect if Octopus 1 is plugged into Octopus 2’s port and vice versa.
This resistor is also checking if the Octopus system is working properly. If an OK is not seen on the Pre-Launch the resistor/system could be damaged. If the system is working properly an older version that did not have the chip could be installed.

The older versions without the chip can function properly without having the OK reading. Regardless, if all components associated with a given Octopus cable are functioning properly, then the Octopus cable is OK.

**AIS Status:** Auto filled

AIS Antenna is mounted to the CCU box. It is a small silver antenna. It receives Automatic Identification System (AIS) reports from class A and class B vessels in the vicinity of the Wave Glider. These reports provide vessel ID, Position, heading and other standard AIS data.

**Photo Document:**

- Take pictures of the float and sub.
  1. Overall
  2. Name Plate/CCU area
  3. Knuckles
  4. Umbilical
  5. Sub
  6. Thrudder
  7. Specific Payloads if any.

**Chapter 10. Vehicle Communication and Telemetry**

**WX reporting:** Auto filled

*(Option 1) OBSP – Status – Overall – GPAirmarWeather – View to see if it is accurate*  
*(Double check local weather)*
(Option 2) WGMS – Vehicle Icon – Vehicle Data Form – Weather Reports

- To turn ON/OFF the Weather Station in WGMS - SV3 Commands - Devices - airmarWeatherDeviceDriver - Channel Cell/Iridium - Turn Device On / Off - True = ON/False = Off.
UBLOX GPS: Auto filled
Ublox is the primary system GPS of a standard wave glider.

- OBSP – Status – Overall – GPSUblox (Located in the CCU)

Airmar GPS: Auto filled

- OBSP – Status – Overall – GPSAirmarWeather – (Located in the Weather Station)

Torpedo GPS: Auto filled

- OBSP – Status – Overall – GPSTorpedoGPS – (Located in the CCU)

Water speed readings: Auto filled

- To check if system is drawing power - OBSP - Status – AMPS – Host Domain – Slot 4 - #5 AirmarWaterspeed: Power Used. Power used should be close to 1.4 W – 1.5 W if working correctly.

Note: You can simulate a Wave Glider in the water by spraying the sensor with a hose or holding a completely full cup of water against the sensor to get a reading. When doing either method it needs to be active while the vehicle takes a telemetry reading.

Obstacle Avoidance Status: Auto filled

(Option 1) OBSP - Operate - Thrudder - Navigation Section - If box is checked = ON - If box is not checked = OFF

(Option 2) WGMS – SV3 Commands – Navigator – Avoid Obstacles – False – click Avoid Obstacles – Check on SV3- XYZ Commands log to see if it acted.

Note: The WGMS page will display False as the default. This page is designed to give commands only, not to check vehicle status.
**RDF beacon tested w/receiver:**

- Radio beacon that was used in the past to track Wave Gliders with a Yagi antenna at ranges of 10’s of kilometers in cases where all other communications methods failed. This equipment has been phased out in most applications.

**Check alarms:**

- WGMS – Health (Green, Yellow, Red, circle) – Click Alarm/Health Icon. Look at all alarms if any. Depending on alarms continue with Pre-Launch or escalate as necessary.

- To clear alarms – Click Alarm/Health Icon – Click ALARM under Status – Enter clear reason (Pre-Launch) – Do this for each Alarm

- To clear ALL Alarms – Vehicle Icon – Errors – Actions – Clear all Alarms

**Chapter 11. Comments**

- Umbilical length
- Types of Payloads and what port they are plugged into (G, S, and T1)
- Notes of issues or items that are being addressed.
  1. (Example 1) A glider has low power when the Pre-Launch is being conducted. The exception is that it is being charged and noted.
  2. (Example 2) The solar panels are all reading 0.00 yet the Pre-Launch is being conducted at night. When looking into the solar panel reports they all had good reports when it was daylight.
- WSS power draw is reading close to 1.4W

**Chapter 12. Technician Signature**

- Name of individual(s) conducting the Pre-Launch
Chapter 13. Save & Submit

- This will save/upload the Pre-Launch into the system.
  1. CELL: if the vehicle has cell, it will upload to shore (swab - just like the system logs)
  2. IRIIDIUM: the vehicle will also initiate a new file available via Iridium, whenever you hit submit you should see this message in the command log: “sending prelaunch checklist to WGMS” and a txt file will be present in the attachments
  3. VMC: the most recent checklist is saved on the vehicle "/root/Regulus/conf/checkList.txt"

LRI Field Operations protocols require that a completed PDF printed pre-launch checklist and photos be shared with the Operations Center as soon as possible to complete the Mission Plan requirements.

Chapter 14. Print

- This will allow you to save the document.

Upload photos to gallery website with album name YYYY-MM-DD:

- Store photographs and Pre-Launch checklist together with name and date. At Liquid Robotics, we use an online file sharing system for Pre-Launch record keeping and multi-user accessibility.

Log vehicle modifications in notebook:

Log all updated information into a written log for future reference.
Chapter 15. Post Launch Procedures

Clear alarms:

- WGMS – Health (Green, Yellow, Red, circle) – Click Alarm/Health Icon – Click on ALARM – Enter Comment (Clear for Pre-Launch) - OK

Vehicle on mission:

- WGMS - Click Begin Mission (red box) – Select mission name or give mission a name – Once on mission box will become green labeled End Mission.

Create LAUNCHED comment in WGMS:

- WGMS – Comment – Enter comment (Launched from vessel X) – Com Channel Cell/Iridium – Send