

Wave Glider® SV2 Integrated Sensor User Guide

Teledyne RD Instruments Workhorse Monitor ADCP

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Wave Glider® SV2 Integrated Sensor User Guide: Teledyne RD Instruments Workhorse Monitor ADCP

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01491	A	January 2013	This is the initial release of this document.
01491	B	October 2013	Revised to include: - Expanded information on issuing commands to the ADCP using WGMS (Chapter 4) - Information on WGMS custom reports for the ADCP (Chapter 6) - An explanation of LRI "WHAM" commands syntax (Appendix A) - Wave Glider integrated ADCP best practices (Appendix C)

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Preface

This guide provides information on operating the Liquid Robotics Wave Glider SV2 with the Teledyne RD Instruments (Teledyne RDI) Workhorse Monitor ADCP integration option. It provides an overview of the mechanical, electronic, and software aspects of the Wave Glider SV2/ADCP integration. It includes descriptions of the command structure, data formats, and data retrieval methods supported by the Wave Glider SV2 when operating the ADCP. This guide also includes specific considerations for the ADCP during operational planning, launch, recovery, storage, troubleshooting, and maintenance.

This guide assumes a working familiarity with the Liquid Robotics Wave Glider SV2 and the Teledyne RDI Workhorse Monitor family of ADCPs. It focuses primarily on the information unique to ADCP integration with the Wave Glider SV2. This manual also assumes that the ADCP has been tested according to the Teledyne RDI Workhorse Technical Manual. Make sure you have the most recent versions of the following documents available when operating the Wave Glider SV2 with an integrated ADCP:

- *Workhorse Monitor ADCP User's Guide* (Teledyne RD Instruments)
- *Workhorse Technical Manual* (Teledyne RD Instruments)
- *Workhorse Commands and Output Data Format* (Teledyne RD Instruments)
- *VmDas User's Guide* (Teledyne RD Instruments)
- *Acoustic Doppler Current Profiler Principles of Operation* (Teledyne RD Instruments)
- *WinSC and PlanADCP User's Guide* (Teledyne RD Instruments)
- *Wave Glider SV2 Interface Control Description* (Liquid Robotics)
- *Wave Glider User Manual* (Liquid Robotics)

Teledyne RD Instruments manuals are available at:

- http://www.rdinstruments.com/Support/login/Login.aspx?ReturnUrl=%2fsupport%2fdocumentation%2fcc_documents.asp

Liquid Robotics manuals are available on the documentation CD included with each Wave Glider and by contacting the Liquid Robotics Support Organization at:

- Telephone:
(US) 888-574-4574
(International) 1-408-636-4205
- Email: support@liquidr.com

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.

Chapter 1. Introduction

The Liquid Robotics, Inc. (LRI) integration of the Teledyne RD Instruments Workhorse Monitor series of ADCPs provides a mobile, long endurance platform for measuring currents and bathymetry and specialized software for data generation, retrieval. This chapter provides an overview of the Wave Glider SV2 ADCP integration option. See the [Glossary](#) for definitions of terms used in this manual.

System Overview

The Teledyne RDI Workhorse Monitor ADCP is installed in the rear payload bay of the Wave Glider SV2. The ADCP is powered by the Wave Glider's electrical system, which includes photovoltaic solar cells and Wave Glider on-board batteries. No additional battery pack is required for the ADCP.

The Wave Glider SV2 with integrated ADCP supports a specialized command set developed by LRI to simplify configuration and management of the ADCP. The ADCP is controlled by the on-board LRI Sensor Management Computer (SMC). PD0 ensembles (data) generated by the ADCP can be stored indefinitely in the SMC, post-processed by the SMC, and sent to shore using standard Wave Glider communications channels, or other on-board modems. During Wave Glider SV2 deployment, the ADCP can be reconfigured dynamically from shore to reflect changing mission objectives and constraints.

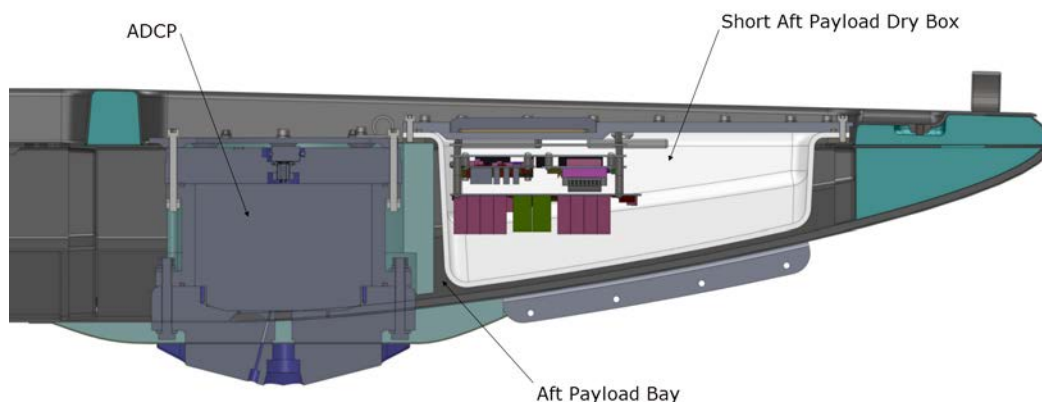
PD0 ensembles generated by the Wave Glider SV2 integrated ADCP are corrected for vehicle pitch, roll, and motion over ground prior to being stored.

LRI recommends using Teledyne RDI's PlanADCP software tool for generating ADCP configuration files and using Teledyne RDI tools such as VmDas and WinADCP for analyzing the PD0 ensembles generated by the system. PD0 ensembles on-board the SMC are stored in Teledyne RDI-compatible formats to facilitate the use of Teledyne RDI's software tools. Refer to Teledyne RDI's documentation and web site (<http://www.rdinstruments.com/>) for information on Teledyne RDI programs and data formats.

Mechanical Design

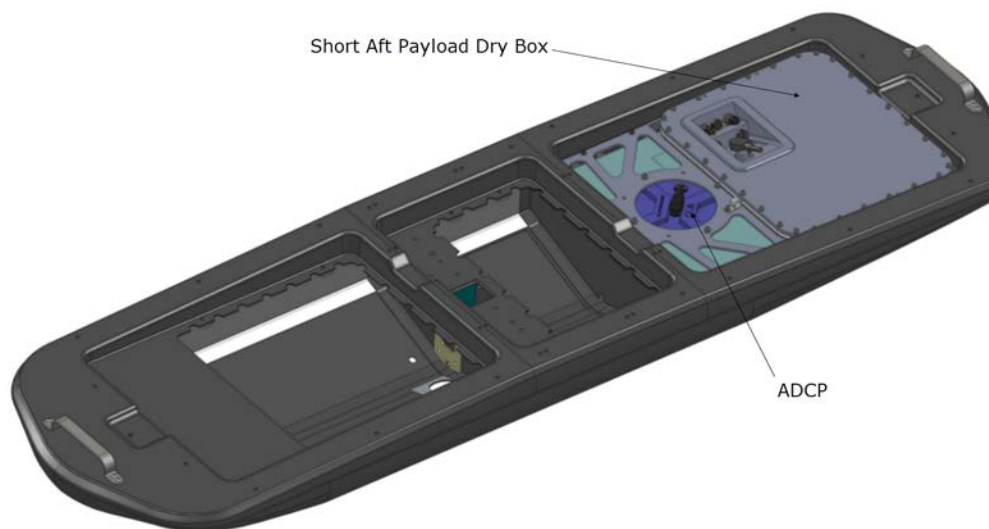
The ADCP is mounted in the Wave Glider SV2 rear (aft) payload bay, under the rear solar panel. The Wave Glider SV2 float must include the Faired Hull option. This option provides a streamlined bottom penetration in the aft payload bay.

Figure 1.1. ADCP Mounted In Aft Payload Bay (cross section)



The ADCP is mounted through a hole in the fairing, as shown. It secures to the Wave Glider SV2 via a backing plate that connects to the base of the ADCP and to the top of the payload bay.

Figure 1.2. ADCP Mounted in Aft Payload Bay (top view)



The Short Aft Payload Dry Box is used when an ADCP is installed in the Wave Glider SV2 aft payload bay. The Short Aft Payload Dry Box can also contain other mission specific electronics. The lid for this payload dry box contains connectors to the ADCP electronics and to the Command and Control (C&C) Dry Box electronics.

Electronics

The Wave Glider SV2 short aft payload dry box contains the Sensor Management Computer (SMC), which hosts the LRI Workhorse ADCP Manager application (WHAM) that controls the ADCP, a Payload Interface Board (PIB), and a high voltage power board (HVB) that is

responsible for delivering 48 VDC power to the ADCP. The HVB is typically powered directly from the SMC, although other configurations are possible. Appropriate cables and cable harnesses are included with the product. Figure 1.3 shows the electrical connections to the dry box. Figure 1.4 shows the electronics mounted to the dry box lid. The electronics boards can be stacked in different arrangements depending on space requirements for other payload electronics.

Figure 1.3. Short Aft Payload Dry Box

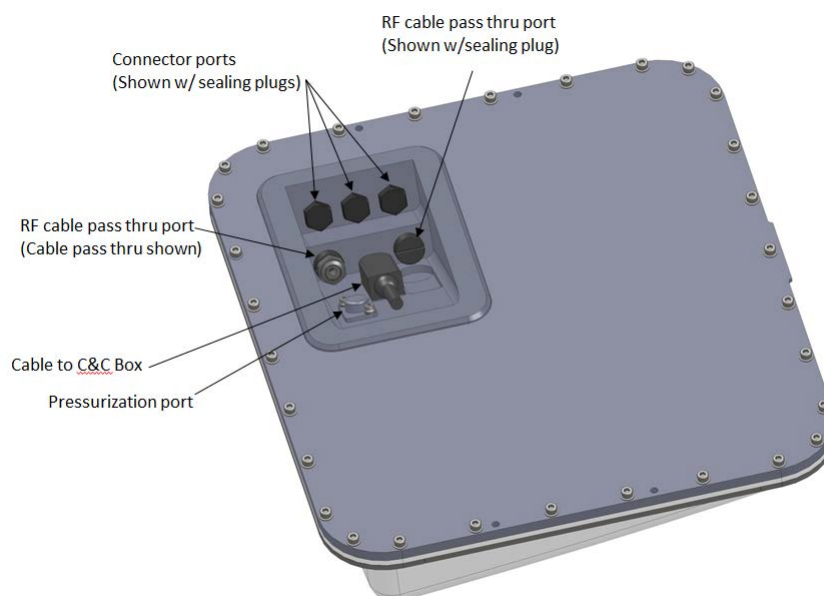
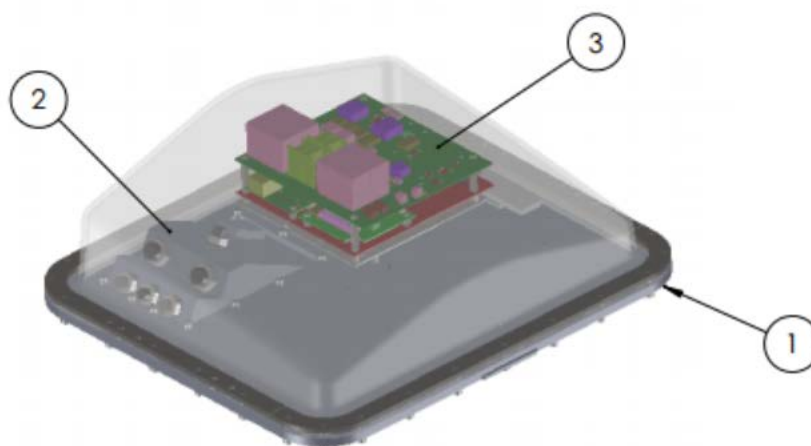


Figure 1.4. Short Aft Payload Dry Box Electronics Mounting



- 1 - Short Aft Payload Dry Box
- 2 - Electrical Connections
- 3 - SMC and HVB

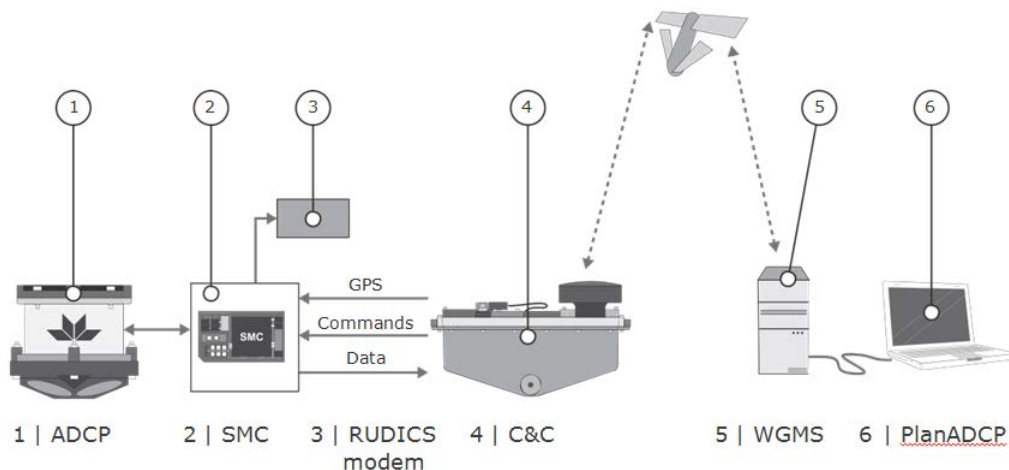
Software Components

The Wave Glider SV2 and the ADCP use the following firmware, software, and computing components:

- **Teledyne RDI Workhorse ADCP Monitor Firmware** - The Teledyne RDI Workhorse ADCP Monitor firmware located in the ADCP implements the ADCP functionality.
- **PlanADCP, WinADCP, VmDas** - These Teledyne RDI programs run on a PC. They are used to create ADCP configuration files and to analyze data generated by the ADCP.
- **Wave Glider Management System (WGMS)** - The LRI WGMS is a shore-based system used to pilot the Wave Glider. It typically uses an Iridium modem to communicate with the Wave Glider.
- **Sensor Management Computer (SMC)** - The SMC is a Linux compute module located on the Wave Glider. It hosts the software used to manage on-board sensors including the ADCP. Each sensor has a sensor-specific manager installed on the SMC.
- **Workhorse ADCP Manager (WHAM)** - WHAM is the LRI-developed ADCP-specific sensor manager installed on the SMC. WHAM supports LRI-developed "WHAM" commands that simplify configuration and management of the ADCP and ADCP data collection files. See [Appendix A: LRI "WHAM" Commands](#) for more information on LRI commands.

Software System Overview

Figure 1.5. ADCP Control and Data Flow



Starting from the right, PlanADCP (6) or similar tools from Teledyne RDI are used to create an ADCP configuration file that configures the ADCP (1). See the *Teledyne Workhorse Monitor ADCP User Guide* for more information about the Teledyne RDI tools. The ADCP configuration file sets parameters such as sampling rate, bin size, number of bins, data storage design, and reporting frequency. The ADCP configuration file is also developed to address power consumption, communications bandwidth, and data storage availability issues. See ["Data Collection Process Overview"](#) for more information.

WGMS (5) sends the ADCP configuration file to the C&C (4) and from there it is forwarded to the SMC (2) on-board the Wave Glider. It is stored in the file system on the SMC. Typically ADCP configuration files and other scripts used to configure and manage the ADCP are stored on the SMC before the Wave Glider is launched.

The Workhorse ADCP Manager (WHAM) installed on the SMC controls the ADCP. Commands are issued from WGMS to WHAM, then WHAM issues commands to the ADCP. When the Wave Glider is at sea, LRI-developed "WHAM" commands can instruct WHAM to run an ADCP configuration file or other script stored on the SMC, rather than transmitting the script over an Iridium communication channel. WHAM can also execute individual commands when they are sent from WGMS. LRI-developed "WHAM" commands simplify configuration and management of the ADCP.

The ADCP collects and processes data to create PD0 ensembles that it sends to WHAM. WHAM stores the ensembles in the SMC file system in the native PD0 format. Typically the SMC event manager is configured to deliver selected data from the ensembles to the SMC payload manager. The payload manager packages the PD0 ensembles into LRI data packets and sends them through the C&C communications infrastructure for delivery to WGMS.

It is also possible to send data to shore using payload-resident communications instead of the C&C communications infrastructure, for example, by using a payload-resident Iridium RUDICS modem (3). RUDICS can return the raw PD0 ensembles to shore as a single file. [Chapter 5: Using RUDICS to Manage ADCP Data Collection](#) provides more detail on the use of RUDICS for this purpose.

WHAM has the ability to select subsets of PD0 ensembles and use the SMC event manager to make them available to SMC-resident applications. For example, a custom SMC-resident program could filter and compress PD0 ensembles before delivering them to the SMC payload manager for forwarding to WGMS. This would reduce data transmission time, saving both power and bandwidth. This approach would also be useful for mid-mission data quality control checks.

[Appendix B: Configuration Files](#) provides WHAM configuration files for direct interface to the ADCP (default factory installation) and for interfacing with a Benthos modem.

Chapter 2. Collecting Data

This chapter describes how to configure ADCP data collection parameters using LRI and Teledyne RDI tools. The flexibility of the combined LRI and Teledyne RDI systems allows for a wide range of data collection options.

Data Collection Process Overview

Collecting data from an ADCP and returning it to shore involves five steps. This section provides an overview of each step in the process with links to other sections in this chapter where more detailed information is provided.

1. **Decide what kind of data you will collect and how you will process it.**

ADCPs are used for a wide range of tasks and have a correspondingly wide range of configuration options. WHAM can be configured to return raw data, filtered data or both. The principal constraints on your choices are environmental:

- Communications bandwidth
- Power Consumption
- Post-processing Requirements

See [“Planning for Data Collection” \(page 7\)](#) for more information.

2. **Develop an ADCP configuration file.**

Once you know what data you want to collect, you can develop an ADCP configuration file that implements your data collection plan. The most convenient way to develop an ADCP configuration file is to use the Teledyne RDI *PlanADCP* application. Using PlanADCP you can specify data collection parameters such as bin sizes and averaging policies. Once you develop a configuration in PlanADCP, export the ADCP configuration file (a .txt file) from PlanADCP and review it to make sure you avoid some common problems that can occur with the ADCP in the LRI environment. You may need to make some minor edits to tune the ADCP configuration file for operation on the Wave Glider, before downloading it to the SMC. See [“Configuring the ADCP” \(page 9\)](#) for more information on editing the ADCP configuration file.

3. **Develop the sequence of commands for WHAM.**

WHAM operations include:

- Executing LRI-developed "WHAM" commands to configure and manage the ADCP.
- Receiving PD0 ensembles from the ADCP.
- Processing PD0 ensembles according to ADCP operator instructions.
- Storing data on the SMC.

LRI-developed "WHAM" commands are described in [Appendix A: LRI "WHAM" Commands](#).

WHAM can execute commands individually, from a Linux shell script stored on the SMC, or from an ADCP configuration file stored on the SMC.

A typical sequence of operations for a script to perform would be:

- a. Send the ADCP configuration file to the ADCP, for example: **ADCP --run someConfigFile**
- b. Configure WHAM processing parameters such as the number of PD0 ensembles to process and the name of the file in which to store them, for example: **ADCP --output someOutputfile**
- c. Start pinging, for example: **ADCP --ping**
- d. Stop pinging, for example: **ADCP --stop**

See “[Sample WHAM Scripts](#)” (page 95) in [Appendix A: LRI “WHAM” Commands](#) for more examples. Typically, you will have multiple scripts stored on the SMC to support different data collection scenarios. These scripts can be downloaded using the methods described in “[Managing WHAM](#)” (page 11).

4. Collect data.

The ADCP starts streaming data to WHAM when WHAM executes the **ADCP --ping** command. WHAM automatically processes the stream based on the instructions it has received. See “[Collecting Data](#)” (page 11) for more information.



Note

Executing the **ADCP --ping** command when the Wave Glider is out of the water will not do any damage to the ADCP.

5. Retrieve the data from the SMC.

In most cases, your script will tell WHAM to store ADCP data in the SMC file system. The data can be retrieved from the SMC through a separate communications transport such as RUDICS (as described in “[Retrieving ADCP Data for Further Analysis](#)” (page 12)). Issuing the Linux **scp** (Secure Copy) command to the SMC over the RUDICS communications protocol is described in [Chapter 5: Using RUDICS to Manage ADCP Data Collection](#).

Planning for Data Collection

The integration of the highly configurable Workhorse Monitor ADCP with the Wave Glider SV2 sensor management system supports a wide range of possible applications, from near-shore bathymetry collection to long-duration offshore currents profiling. Your data collection plan must balance collection objectives with environmental constraints.

One of the key advantages of the LRI ADCP integration is that the ADCP configuration and the WHAM configuration can be easily changed after the Wave Glider SV2 is launched. For example, on a single mission you might want to first collect bathymetry data in an area and then study how the currents interact with the sea floor features you recorded. The principal mechanism for controlling WHAM and the ADCP is to execute scripts stored in the SMC file system. LRI recommends preparing for various mission objectives prior to launch so you

can test and pre-load the scripts on-shore. This approach is less expensive and faster than downloading scripts over the Iridium link.

Considerations for the ADCP

- **Power Budget**

The ADCP subsystem can be configured to consume more power than the solar power system of the Wave Glider SV2 can collect. As a general rule, the Workhorse Monitor Model WHM300 in combination with the SMC consumes approximately 9 watts when pinging at full rate. The Workhorse Monitor Model WHM600 in combination with the SMC consumes somewhat less - generally 5-6 watts. Depending on the Wave Glider mission and power consumption by other instruments and sensors on the Wave Glider, it may be advisable to change the ping rate and other ADCP configuration parameters to bring the total power consumption into balance with the power available from the Wave Glider SV2 solar powered electrical system. See "Communications Bandwidth" below for a discussion of how an Iridium receiver affects the power budget. Estimating Wave Glider solar power generation is described in the LRI User Manual. The Teledyne RDI manuals describe the power consumption characteristics of the Workhorse Monitor versions and options for reducing power usage.

- **Communications Bandwidth**

It is possible to configure the ADCP system to generate more raw data than the Iridium communications channel can transport to shore. Once a session is established, the underlying maximum data rate of the Iridium network is 2400 bps. The ADCP is capable of sending more than ten times as much data to WHAM. WHAM provides several options for collecting raw data at the full rate and then returning a subset of that data to shore. If those options are not appropriate for your application, custom code can be written for the SMC to reformat the data into a more useful format.



Note

Communications requirements should be included in the power budget - when transferring at its maximum data rate, an Iridium 9522B Satellite Transceiver can consume more than 2 watts.

- **On-board Storage**

WHAM stores the raw PD0 ensembles in the SMC file system. The SMC generally ships with a 16GB flash drive for its file system, of which approximately 12GB is available for user data. An ADCP can be configured to generate as much as 4KB per second, or approximately 400MB per day, although that is an extreme case. You should estimate how much data your application will generate and configure the system accordingly. Deleting unneeded files should be a priority. File deletion can be accomplished with LINUX commands and scripts executed on the SMC.

- **Sampling Rate, Bin Sizes and Number of Bins**

Bin size, number of bins, and the level of detail significantly affect the amount of data collected and potentially returned to shore. In good seas, a Wave Glider SV2 travels at about 0.5 meters per second. You can save power, bandwidth and storage by matching your data collection parameters (for example, frequency and bin size) to the level of accuracy required for your application. Note that the LRI **SELECT** command allows you to filter the data ensembles for transmission to WGMS.

- **Reporting Frequency**

Sample data can be reported:

- Immediately as individual readings.
- In a batch file after some amount of time.
- In a batch file after the completion of some task.

As a general rule, sending larger batches reduces the cost per byte, but delays the availability of the oldest data. On the other hand, using smaller batches reduces the amount of lost data if there are transmission issues.

- **Storing Data in WGMS or in a Separate File Server**

In most cases, data will be returned to shore in a file transfer from the SMC. This can be done using the WGMS file transfer mechanism through the C&C or more commonly, using a separate file server and an SMC-based IP communications path such as Iridium RUDICS. If you choose to use the SMC-based path, you will need to arrange for access to a server to receive the data.

Configuring the ADCP

The ADCP is configured by an ADCP configuration file. An ADCP configuration file is a sequence (script) of commands that are sent to the ADCP by WHAM to configure measurement parameters such as bottom tracking, bin sizes, and ping rates. You can use the Teledyne RDI PlanADCP tool to experiment with various configuration options. See the Teledyne RDI PlanADCP documentation for step by step instructions on creating and exporting ADCP configuration files. PlanADCP is available from the Teledyne RDI web site at http://www.rdiinstruments.com/Support/login/Login.aspx?ReturnUrl=%2fsupport%2fsoftwarefirmware%2fcc_software.aspx and also on a DVD included in the accessory kit for the LRI ADCP option.

After you have exported the ADCP configuration file from PlanADCP, we recommend that you review it and make edits, if necessary, to avoid some common problems that can occur with the ADCP in the LRI environment:

1. Avoid using the **CR1** command. **CR1** resets the ADCP to the factory defaults and may reset the RS232 communications settings, causing the SMC to lose contact with the ADCP. Instead, LRI recommends explicitly setting only the parameters that are important to your application.
2. The configuration script must contain the **EA+00000** command when Earth reference coordinates are used.
3. Use the **EB** command, to set the Heading Bias to the magnetic declination of the area of deployment.
4. Use the **CK** command at the end of the script to store the Heading Bias and other parameters as the user default, to be reused in the event of an ADCP microprocessor restart.
5. If your script includes a **CS** command (start pinging), it must be the last command in the file. Commands issued after the **CS** command will be ignored.

After you have modified the ADCP configuration file to run in the LRI environment, you must download it to the SMC on the Wave Glider. See [Chapter 5: Using RUDICS to Manage ADCP Data Collection](#) for instructions on using RUDICS to download files to the SMC file system.

Example: ADCP configuration file

This ADCP configuration file example for currents and bathymetry data collection averages sixty pings for currents profiles followed by one ping for bottom tracking. More examples can be found on the SMC in the directory /home/smc/roots/200_ADCP.

```
;-----\  
; ADCP Command File for Currents & Bathymetry 300/600Khz data collection  
;  
; ADCP type: 300/600 Khz Workhorse  
;  
; NOTE: Any line beginning with a semicolon in the first  
; column is treated as a comment and is ignored by  
; the WHAM software.  
;  
; Modified Last: 16May2011  
;-----/  
; Restore user default settings in the ADCP  
CR0  
; Turning off the recorder  
CF11110  
; set the data collection baud rate to 115200 bps,  
; no parity, one stop bit, 8 data bits  
;CB811  
; Set for reduced bandwidth (extended range) profile mode (WB),  
; 60-ping ensembles  
; (WP), twenty five (WN) 4 meter bins (WS), 1.5 meter blanking  
; distance (WF), 175 cm/s  
; ambiguity vel (WV)  
WB1  
WP00060  
WN025  
WS0400  
WF0150  
WV175  
; enable single-ping bottom track (BP),  
; Set maximum bottom search depth to 200 meters (BX)  
BP001  
BX2000  
; output velocity, correlation, echo intensity, percent good  
WD111100000  
; one second between pings  
TP000100  
; minimum one second between ensembles  
TE00000100  
; Set to calculate speed-of-sound, use internal depth sensor if  
; available), use internal  
; compass heading sensor, use internal pitch or roll being used, no  
; salinity sensor, use  
; internal transducer temperature sensor  
EZ1111101
```

```
;Heading Alignment, should be zero for Earth reference coord
; transform (see EX command below)
EA+00000
;Heading Bias (Set externally for specific deployment)
;EB00000
; Coord transform
EX11111
; Set transducer depth (decimeters) to 10 cm
ED00001
; Set Salinity (ppt)
ES35
; save this setup to non-volatile memory in the ADCP
CK
```

Managing WHAM

WHAM runs on the SMC and interacts directly with the ADCP.

WHAM operations include:

- Executing LRI commands.
- Receiving PD0 ensembles from the ADCP.
- Processing PD0 ensembles according to your instructions.
- Storing data on the SMC.

LRI commands are described in detail in [Appendix A: LRI "WHAM" Commands](#).

Collecting Data

WHAM begins recording PD0 ensembles as soon as the ADCP starts pinging.

The **ADCP --ping** command causes WHAM to send the **CS** command to the ADCP to start the ADCP pinging. WHAM detects that the **CS** command has been sent and automatically switches to receiving PD0 ensembles data recording mode.

When the **ADCP --stop** command is sent, WHAM sends a **<break>** to the ADCP, switching it to command mode and stopping the WHAM data recording mode. WHAM can receive commands from shore at the same time it is processing the data stream from the ADCP.

The **ADCP --start** command specifies an approximate latitude and longitude for the ADCP to start pinging, as well as the duration of the data collection period. See the command description in [Appendix A: LRI "WHAM" Commands](#) for details.

In practice, most users prefer to specify finer control of when pinging starts and when it ends. The **ADCP --ping** command has two optional parameters. The first parameter specifies a delay in seconds between the receipt of the **ADCP --ping** command by WHAM and when the **CS** command is sent to the ADCP. The second parameter specifies the data collection duration in seconds. For example, **ADCP --ping 300 3600** delays the start of pinging by five minutes (300 seconds) and collects data for an hour (3600 seconds).

WHAM processes PD0 ensembles into a LRI-specific variant of the Teledyne RDI ENS format. The processing step includes adding a NAV data block to the PD0 ensemble (see the

Teledyne RDI VmDas manual) and removing the vehicle velocity from the measured currents using the information in the NAV data block.. These PD0 ensembles are appended to the currently active ADCP output file.

Storage management must be configured. Typically, output data is stored in the user partition of the SMC file system. For example:

ADCP -o /mnt/XDATA/FirstRun/FirstBlock.ens

Naming schemes and file directory hierarchies in the user partition are user defined. Typically collected data is distributed across multiple files to make storage easier to manage and files easier to return to shore.

Retrieving ADCP Data for Further Analysis

After ADCP PD0 ensembles are stored in the file system of the SMC, data can be retrieved from a Wave Glider at sea, typically using the Iridium RUDICS protocol or, after the Wave Glider is recovered, using the SMC console or Ethernet interface. Compressed data samples such as C2, C4, & Bathymetry format data can be transmitted via the standard Iridium SBD path to WGMS. The value in this communications path is real-time feedback.

RUDICS (Router-based Unrestricted Digital Internetworking Connectivity Solution) implements a circuit-switched data call capability. The SMC supports the Point-to-Point Protocol (PPP), which allows TCP/IP applications to run on top of RUDICS. RUDICS requires a specially configured Iridium modem in the payload and appropriate software configuration on the SMC. It is not part of the ADCP kit and must be purchased separately. The use of RUDICS to transfer files is discussed more fully in [Chapter 5: Using RUDICS to Manage ADCP Data Collection](#).

The SMC also supports a wired Ethernet connection. When that connection is accessible, it is possible to log in to the SMC using conventional programs such as SSH and to transfer files using conventional tools such as **scp**. The SMC operating system supports DHCP, so no special configuration is required. However, to save power the Ethernet hardware is typically turned off while the Wave Glider is at sea, so you may need to enable the Ethernet hardware prior to use. See [“Enable Ethernet Access to the SMC” \(page 14\)](#) for more information.

ADCP Configuration and Ensembles Data Retrieval from the SMC

The ADCP is typically set up and configured by sending it a sequence of commands contained in an ASCII text script file referred to as an ADCP configuration file, as specified in Teledyne RDI's *Workhorse Commands and Output Data Format* manual. ADCP configuration files can be generated using Teledyne RDI tools such as PlanADCP or by modifying existing script files. Several sample ADCP configuration files are located in the default WHAM/ADCP directory on the SMC at:

`/home/smc/roots/200_ADCP/`

The sample ADCP configuration files are typically named `ADCP_XXXXX.TXT` where `XXXX` describes the particular configuration, such as `ADC_60PINGVEL_0PINGBT.TXT` for generating PD0 ensembles with an average of 60 currents profiling pings and no bottom track. The following Linux command will list all of the sample scripts installed on the SMC:

Is /home/smc/roots/200_ADCP/

Use the LRI ADCP command **ADCP --run <adcpconfigfilename>** to send the commands contained in the ADCP configuration file to the ADCP. The file name can be a fully qualified pathname or just the file name, if it is located in the WHAM/ADCP directory.

For example, the following commands send the same file to the ADCP:

ADCP --run /home/smc/roots/200_ADCP/ADCP_60PINGVEL_0PINGBT.TXT

ADCP --run ADCP_60PINGVEL_0PINGBT.TXT

The LRI command **WHAM --run <ScriptFile>** executes the specified script file containing a sequence of LRI commands. Several sample script files are located in the default WHAM/ADCP directory on the SMC at:

/home/smc/roots/200_ADCP/

The sample script files are named WHAM_XXXX.TXT where XXXX describes the desired action such as WHAM_STOP.TXT to stop the ADCP pinging and collecting data ensembles.

Using a Text Editor to Create Script Files on the SMC

Script files can be created on the SMC by logging into the LINUX system through the SMC debug console port. Use a text editor such as **vi** or **nano** to write the script files. Contact Liquid Robotics Support for the SMC Linux login credentials.

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

Issuing Commands to WHAM

Commands can be issued to WHAM either using Write Console Script specifying the Board address as decimal 8208 (hex 2010, assuming the SMC has been configured for its default board address of hex 20), or by issuing commands to the WHAM application using ServerExec such as:

ServerExec ADCPSensor "ADCP --run ADCP_60PINGVEL_0PINGBT.TXT"

ServerExec ADCPSensor "ADCP --ping"

ServerExec ADCPSensor "WHAM --run WHAM_STOP.TXT"

The **SELECT** and **EXPORT** commands described in [Appendix A: LRI "WHAM" Commands](#) can be used to send certain currents and Bathymetry data as telemetry reports to WGMS. This feature is only available in SMC software version 1.1.6 and later. You must ensure

that the selected frequency of exports (and the resulting data packet size) is within the telemetry transmission requirements. The various **EXPORT** data formats are detailed in “EXPORT” (page 84).

Example setup to send 100 C2 samples of currents data, once every 10 minutes (600 seconds), while logged into the SMC:

```
ServerExec ADCPSensor "ADCP --run ADCP_60PINGVEL_0PINGBT.TXT"
ServerExec ADCPSensor "ADCP --output PD0ensembles.ens"
ServerExec ADCPSensor "SELECT --time 600"
ServerExec ADCPSensor "EXPORT --output localCopyExportData.c2"
ServerExec ADCPSensor "EXPORT -c2 100"
ServerExec ADCPSensor "ADCP --ping"
```

Enable Ethernet Access to the SMC

If Ethernet access to the SMC is desired, then the Ethernet cable connector on the debug port must be attached to an active network and the EnableEthernet command must be issued, either locally on the SMC or from the Write Console Script command in WGMS.

Following this, the **ifconfig** command will display the SMC IP address on the network. SSH and **scp** can now be used for file access and command execution on the SMC.

To retrieve the ADCP PD0 ensembles file originally setup and specified by the **ADCP --output ensemblesFilename** command, file transfers such as **scp** can be used with an active Ethernet connection. If a full pathname is not specified for the output ensemblesFilename, it will be located in the default location:

/home/smc/roots/200_ADCP/



Note

When Ethernet is enabled on the SMC, such as with the utility EnableEthernet, the SMC must be re-started for normal operation which will, by default, disable Ethernet at startup.

Chapter 3. Data Formats

The Wave Glider supports the export of ADCP data as files in Teledyne RDI-compatible formats and LRI-specific formats. This chapter provides details on LRI-specific data formats. For information on Teledyne RDI-compatible formats, see the Teledyne RDI *Workhorse Commands and Output Data Format* manual.

Data Format Overview

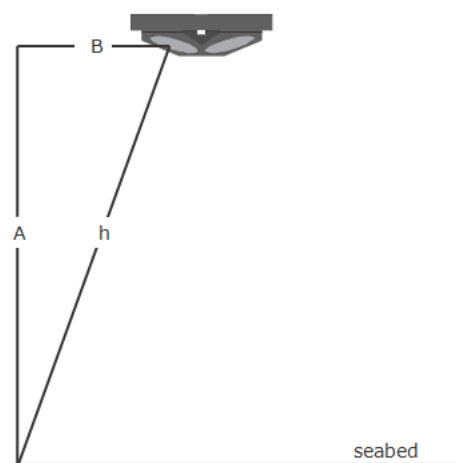
Published Teledyne RDI data formats frequently contain redundant values. This results in relatively large data structures, called PD0 ensembles in the Teledyne RDI literature. The Wave Glider stores ADCP data using Teledyne RDI-compatible file formats because that is how the data is delivered to the SMC from the ADCP. In addition, it is valuable to be able to post-process ADCP data using Teledyne RDI tools, such as WinADCP and VmDas. The Wave Glider supports the export of ADCP data in Teledyne RDI-compatible file formats. See the Teledyne RDI *Workhorse Commands and Output Data Format* manual for more information on data ensemble data structures.

There are many situations where it is useful to export a specific subset of the data. This not only conserves bandwidth but also conserves power, as the Iridium modem is a significant consumer of electricity. Alternatively, it allows more data points to be delivered to shore for the same expenditure of bandwidth and power. This section describes LRI-specific formats for returning currents profiles and bathymetry data to shore.

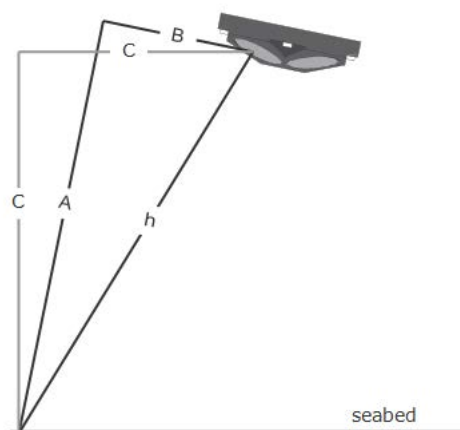
Compressed Bathymetry Data

The ADCP has four beam heads angled out at 20 degrees pointing in different directions. In bottom tracking mode, the ADCP reports the depth, as in line A in [Figure 3.1](#).

Figure 3.1. Simple Depth Reporting Model



ADCP operators generally want to know the exact latitude and longitude, and the exact depth of the Ah vertex. This must be computed using GPS data and tilt and roll measurements returned by the ADCP. As illustrated in [Figure 3.2](#), coordinate translations and trigonometry are required to generate the desired values.

Figure 3.2. Complex Depth Reporting Model**Note**

The current version of WHAM does not measure heave (the z-axis) and it does not correct for tidal effects.

Compressed Binary Bathymetry Sample Record Format

This record is exported per selected data ensemble. Note that Teledyne RDI numbers bytes from 1 and LRI policy is to number from 0. Use care when cross-referencing Teledyne RDI documentation to ensure that the correct numbering system is used.

Table 3.1. LRI Compressed Binary Bathymetry Sample Record Format

Field Name	Bytes Used	Byte #	Format
Latitude	4	0-3	Signed 32-bit integer
Longitude	4	4-7	Signed 32-bit integer
Unix Timestamp	4	8-11	Signed 32-bit integer
Heading	2	12-13	Unsigned 16-bit integer
Pitch	2	14-15	Unsigned 16-bit integer
Roll	2	16-17	Unsigned 16-bit integer
B1	2	18-19	Unsigned 16-bit integer
B2	2	20-21	Unsigned 16-bit integer
B3	2	22-23	Unsigned 16-bit integer
B4	2	24-25	Unsigned 16-bit integer

Notes

Latitude and Longitude - the latitude and longitude reported by the on-board GPS unit to the SMC. This is the location of the float at the time WHAM obtained latitude and longitude from the SMC operating system. Note that the GPS reading is not directly coordinated with the ADCP, but should be close enough given other errors in the system. Also note that in general the location of the individual depth readings will be offset from this value. Latitude and longitude counts are 1/10,000 of a minute.

Unix Timestamp - the standard Unix timestamp computed from the GPS reading.

Heading - The heading reported by the compass in the ADCP in the Variable Leader Data bytes 19-20, in hundredths of degrees, between 000.00 and 359.99.

Pitch - The pitch angle reported in the Variable Leader Data bytes 21-22, in hundredths of a degree, between -20.00 and +20.00.

Roll - The roll angle reported in the Variable Leader Data bytes 23-24, in hundredths of a degree, between -20.00 and +20.00.

B1 - B4 - The bottom track range reported in the Bottom-Track Data, bytes 17-24, in cm.

Compressed Currents Data

The primary application of ADCPs is the study of currents profiles. The water column is divided into uniform segments called bins or depth cells. The ADCP uses the Doppler shift of echoes off of particles in each depth cell to estimate the magnitude and direction of currents in that depth cell.

The Workhorse Monitor uses four beams that are set at an angle to each other. This results in three velocity vectors and one error estimate. Software within the ADCP performs coordinate transformations as directed by the ADCP configuration file (EX command). In most cases this is reported in Earth coordinates (north, east and up), but that is at the option of the user. The ADCP sends the data to WHAM in the Velocity Data Format segment of the PD0 data ensemble, in the selected coordinate system, as described in the Teledyne RDI *Workhorse Commands and Output Data Format* manual.

When data is reported in the Earth coordinate system, the values are corrected for pitch and roll (except the top bin - see the Teledyne RDI *Workhorse Commands and Output Data Format* manual for details). WHAM also adjusts the values to remove vehicle motion over ground, as reported by the Wave Glider's GPS. The velocities in each bin are reported in four 16-bit values representing East, North, up and error velocity. If reported in the other coordinate systems, such as the instrument coordinate system, it is the ADCP operator's responsibility to apply the required transformations into the desired coordinate system.

Much of the data in the PD0 data ensemble is redundant in the typical case where the data is reported in Earth coordinates. WHAM can report currents profiles in two compressed formats - East/North, and East/North/Up/Err (if the data sent by the ADCP is in Earth coordinates). The PD0 format is also valid for other coordinate systems. The compressed currents data will return the indicated data items from the raw PD0 ensemble, however, you may need additional information from the PD0 ensemble to interpret the data for other coordinate systems.

Compressed Binary Currents Sample Record Format C2

This record reports just the East/North components of the velocity data for each bin. The current values are extracted from the Velocity Data Format segment of the raw PD0 ensemble. Note that Teledyne RDI numbers bytes from 1 and LRI policy is to number from 0. Use care when referencing Teledyne RDI documentation to ensure that the correct numbering system is used.

Table 3.2. Compressed Binary Currents Sample Record Format C2

Field Name	Bytes Used	Byte #	Format
Latitude	4	0-3	Signed 32-bit integer

Field Name	Bytes Used	Byte #	Format
Longitude	4	4-7	Signed 32-bit integer
Unix Timestamp	4	8-11	Signed 32-bit integer
Bin Size	2	12-13	Unsigned 16-bit integer
Distance to Bin 1	2	14-15	Unsigned 16-bit integer
Bin 1, East	2	16-17	Signed 16-bit integer
Bin 1, North	2	18-19	Signed 16-bit integer
Bin 2, East	2	20-21	Signed 16-bit integer
Bin 2, North	2	22-23	Signed 16-bit integer
...	2	24-25	Signed 16-bit integer

Notes

Latitude and Longitude - the latitude and longitude reported by the on-board GPS unit to the SMC. This is the location of the float at the time WHAM obtained latitude and longitude from the SMC event handler. Note that the reading of the GPS is not directly coordinated with the ADCP, but should be close enough given other errors in the system. Latitude and longitude counts are 1/10,000 of a minute.

Unix Timestamp - the standard Unix timestamp computed from the GPS reading.

Bin Size - The Depth Cell Length from the PD0 Fixed Leader Data Format section, bytes 13 and 14. Its scale is 1 centimeter and its range is 1 to 6400 cm. This value is set in the ADCP configuration file using the WS command.

Distance to Bin1 – The distance to the middle of the first depth cell (Bin) from the PD0 Fixed Leader Data Format section, bytes 33 and 34. Its scale is 1 cm and its range is 0 to 65535 cm (2150 feet). This value is a function of the depth cell length (Bin size), the profiling mode, the blank after transmit distance, and the speed of sound. See the Teledyne RDI *Workhorse Commands and Output Data Format* manual for more information.

Bin n, East - The eastern component of the water velocity vector in the nth bin. A negative number means the direction is west. The units are in millimeters per second. Vehicle motion has been removed from the value. A value of -32768 indicates a bad value.

Bin n, North - The northern component of the water velocity vector in the nth bin. A negative number means the direction is south. The units are in millimeters per second. Vehicle motion has been removed from the value. A value of -32768 indicates a bad value.

The number of bins is specified in the ADCP configuration file, using the WN command. The number can be calculated from the size of the packet $((\text{size}-16)/4)$. Note that the maximum number of bins that can reasonably be fit into a single Iridium 9601 SBD message is about $(272 - 16)/4$, or 64 bins.

Compressed Binary Currents Sample Record Format C4

This record reports the East/North/Up/Error components of the velocity data for the bin. The Up and Error values are sometimes used for data QA/QC purposes. See the Teledyne RDI *Workhorse Commands and Output Data Format* manual for more information. The current values are extracted from the Velocity Data Format segment of the raw data ensemble. Note that Teledyne RDI numbers bytes from 1 and LRI policy is to number from 0. Use care when referencing Teledyne RDI documentation to ensure that the correct numbering system is used.

Table 3.3. Compressed Binary Currents Sample Record Format C4

Field Name	Bytes Used	Byte #	Format
Latitude	4	0-3	Signed 32-bit integer
Longitude	4	4-7	Signed 32-bit integer
Unix Timestamp	4	8-11	Signed 32-bit integer
Bin Size	2	12-13	Unsigned 16-bit integer
Distance to Bin 1	2	14-15	Unsigned 16-bit integer
Bin 1, East	2	16-17	Signed 16-bit integer
Bin 1, North	2	18-19	Signed 16-bit integer
Bin 1, Up	2	20-21	Signed 16-bit integer
Bin 1, Error	2	22-23	Signed 16-bit integer
...	2	24-25	Signed 16-bit integer

Notes

Latitude and Longitude - the latitude and longitude reported by the on-board GPS unit to the SMC. This is the location of the float at the time WHAM obtained latitude and longitude from the SMC event handler. Note that the reading of the GPS is not directly coordinated with the ADCP, but should be close enough given other errors in the system. Latitude and longitude counts are 1/10,000 of a minute.

Unix Timestamp - the standard Unix timestamp computed from the GPS reading.

Bin Size - The Depth Cell Length from the PD0 Fixed Leader Data Format section, bytes 13 and 14. Its scale is 1 centimeter and its range is 1 to 6400 cm. This value is set in the ADCP configuration file using the WS command.

Distance to Bin1 – The distance to the middle of the first depth cell (Bin) from the PD0 Fixed Leader Data Format section, bytes 33 and 34. Its scale is 1 cm and its range is 0 to 65535 cm (2150 feet). This value is a function of the depth cell length (Bin size), the profiling mode, the blank after transmit distance, and the speed of sound. See the Teledyne RDI *Workhorse Commands and Output Data Format* manual for more information.

Bin n, East - The eastern component of the water velocity vector in the nth bin. A negative number means the direction is west. The units are in millimeters per second. A value of -32768 indicates a bad value. Vehicle motion has been removed from the value.

Bin n, North - The northern component of the water velocity vector in the nth bin. A negative number means the direction is south. The units are in millimeters per second. Vehicle motion has been removed from the value. A value of -32768 indicates a bad value.

Bin n, Up - The up component of the water velocity vector in the nth bin. A negative number means the direction is down. The units are in millimeters per second. Vehicle motion has been removed from the value. A value of -32768 indicates a bad value.

Bin n, Error velocity - The error velocity component of the water velocity vector in the nth bin. The units are in millimeters per second. Vehicle motion has been removed from the value. A value of -32768 indicates a bad value.

The number of bins is specified in the ADCP configuration file, using the WN command. The number can be calculated from the size of the packet $((\text{size}-16)/8)$. Note that the maximum

number of bins that can reasonably be fit into a single Iridium 9601 SBD message is about $(272 - 16)/8$, or 32 bins.

Extended Sensor Report Record Parameters

ADCP PD0 ensembles that are exported through the LRI 0x91 message format (see the LRI *Interface Control Description* manual for more information), will set the message header fields as follows:

Sensor Data Format:

- 2 - Fixed and variable header (binary)
- 3 - Compressed Bathymetry sample (binary)
- 4 - C2 format Compressed Currents sample (binary)
- 5 - C4 format Compressed Currents sample (binary)

Repeat Count: set by payload interface formatter

Chapter 4. Using WGMS to Manage the ADCP

WGMS issues LRI-developed "WHAM" commands to the WHAM program running on the SMC, then WHAM executes these commands on the ADCP. Some LRI commands run scripts that are stored on the SMC.

For a complete LRI command reference, including an explanation of command syntax, see [Appendix A: LRI "WHAM" Commands](#).

Sending Commands to the SMC from WGMS

To send WHAM commands to the SMC:

1. Select the Wave Glider vehicle you want to issue a command to from the drop-down menu in the upper left-hand corner of the WGMS dashboard.
2. Click on **More Commands...** located just below the command buttons on the left side of the WGMS dashboard - a **Simple Command Form** will appear with the **Vehicle Command Info** tab open.
3. Confirm that the correct vehicle name appears in the **Vehicle** field.
4. Enter a reason for issuing the command in the **Command Reason** field.
5. Select **Write Console Script** in the **Command Type** drop-down menu.
6. Enter 0 in the **Function** field.
7. Enter the SMC board address in the **Board Address** field. The task ID for the ADCP is 0x10, so by convention the board address is 0x2010 (8208). If your configuration does not follow this convention, see ["Determining the Board Address" \(page 21\)](#).
8. Select the communication channel WGMS will use to send the command to the Wave Glider in the **Com Channel** drop-down menu. The default communications channel will be displayed. If any other communications channels available to the vehicle will be listed in the **Com Channel** drop-down menu.
9. Enter the command you want to issue in the **Script Buffer** field of the **Simple Command Form**.
10. Click **Send** at the bottom of the **Simple Command Form** to issue the command.

Determining the Board Address

To issue a command to the SMC, the decimal version of the combined Board ID and Task ID for the SMC that the ADCP is connected to must be entered into the **Board Address** field in the **Vehicle Command Info** tab of the **Simple Command Form**.

The combined Board ID and Task ID consists of two hexadecimal values:

- The first value is the Board ID for the SMC you want to issue a command to. The Board ID will be between 0x00 and 0xFF -exclusive.
- The second value is the Task ID. The Task ID for an ADCP is 0x10 hex (16 decimal).



Note

If you do not know the Board ID for the SMC, see [“Obtaining the Board ID” \(page 22\)](#).

Examples:

The combined Board ID/Task ID for a SMC with a Board ID of 0x20 would be 0x2010. To determine the decimal version, multiply the Board ID value by 256 and add the Task ID $\{(32)(256) + 16\}$. The result is 8208. This is the number you would enter into the Board Address field on the Vehicle Command tab.

If the Board ID for the SMC is 0x21, and the command is directed to the ADCP, the combined hexadecimal values would be 0x2110. To determine the decimal version, multiply the Board ID value by 256 and add the Task ID $\{(33)(256) + 16\}$. The result is 8464. This is the number you would enter into the **Board Address** field on the **Vehicle Command** tab.

Obtaining the Board ID

The Board ID for the SMC that the ADCP is associated with should be included in the Mission Plan (the Task ID for an ADCP is 0x10 hex (16 decimal)).

The Board ID for the SMC can also be obtained by issuing the **FCC -s** command to Board Address **0** provided:

- The payload is turned on (if the payload is not turned on, see [“Turning a Payload On or Off” \(page 23\)](#)).
- Float C&C Firmware version 2.0.995 (LRI Part Number 00655-09) or later is installed on the C&C.

The **FCC -s** command will return the power status of each payload port, and the Board ID and Task ID for each enumerated device on each payload port.

When the **FCC -s** command is "ACKed", double click on the **Command Reason** in the **Commands** list at the bottom of the WGMS dashboard - a **Simple Command Form** will appear.

Select **Command Form** in the drop-down menu at the top of the **Simple Command Form** to display the **Command Form**, then click on **Raw Outputs** and wait for the vehicle to respond.

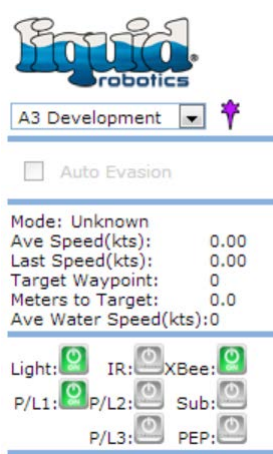
Click on the information displayed in the **Console Ack** column of the raw output to display the power on/off status of each payload port, and the Board ID and Task ID for each enumerated device on each payload port.

Using WGMS to Manage the ADCP



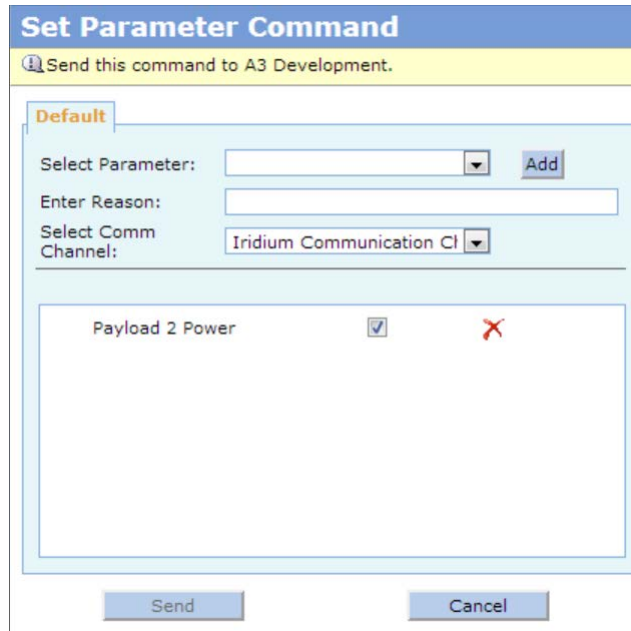
Turning a Payload On or Off

The P/L1, P/L2, and P/L3 payload buttons on the WGMS dashboard turn green when a payload power on command is issued, and they turn gray when a payload power off command is issued. In the following screen capture, Payload 1 is turned on and Payloads 2 and 3 are turned off.



Until telemetry is returned from the Wave Glider indicating that a payload actually is On or Off, the color of these buttons alone is not a reliable indicator of payload power status. See ["Payload On Command Sequence" \(page 25\)](#) for information on circumstances where the payload buttons on the WGMS dashboard may not accurately reflect the On/Off status of a payload.

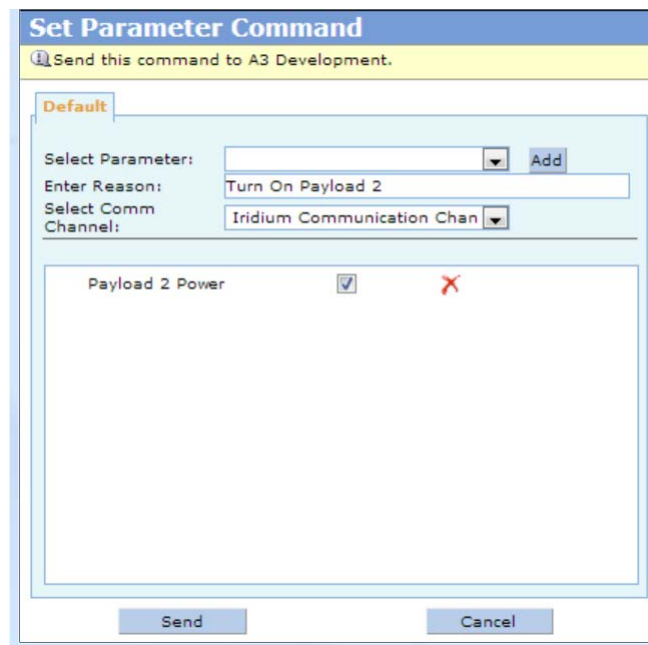
To turn a payload on, click the gray button associated with that payload and a **Set Parameter Command** dialog box will appear with the parameter field pre-populated.



The dialog box is titled "Set Parameter Command" and has a yellow banner at the top that says "Send this command to A3 Development." Below the banner is a "Default" tab. The form contains the following fields and controls:

- Select Parameter:** A dropdown menu with an "Add" button to its right.
- Enter Reason:** A text input field.
- Select Comm Channel:** A dropdown menu currently showing "Iridium Communication Cl".
- Payload 2 Power:** A section containing a checked checkbox and a red "X" icon.
- Buttons:** "Send" and "Cancel" buttons at the bottom.

Enter a reason in the **Enter Reason:** field, and select a different communications channel in the **Select Comm Channel:** field (if you are not using Iridium), then click the cursor in an unpopulated area of the parameter field to activate the **Send** button.



This is the same "Set Parameter Command" dialog box as above, but with the following changes:

- Enter Reason:** The text "Turn On Payload 2" has been entered.
- Select Comm Channel:** The dropdown menu now shows "Iridium Communication Chan".
- Payload 2 Power:** The checked checkbox is now green, and the red "X" icon is still present.

Click **Send** to turn the payload on - the button associated with that payload should turn green.

To turn a payload off, click the green payload button associated with that payload and a **Set Parameter Command** dialog box will appear with the parameter field pre-populated.

Set Parameter Command

Send this command to A3 Development.

Default

Select Parameter: Add

Enter Reason:

Select Comm Channel: Iridium Communication CI

Payload 2 Power ☐

Send Cancel

Enter a reason in the **Enter Reason:** field, and select a different communications channel in the **Select Comm Channel:** field (if you are not using Iridium), then click the cursor in an unpopulated area of the parameter field to activate the **Send** button.

Set Parameter Command

Send this command to A3 Development.

Default

Select Parameter: Add

Enter Reason: Turn Payload 2 Off

Select Comm Channel: Iridium Communication Chan

Payload 2 Power ☐

Send Cancel

Click **Send** to turn the payload off - the button associated with that payload should turn gray.

Payload On Command Sequence

When turning a payload on you must allow time for Iridium communications latency (telemetry intervals), and for the payload to boot, before issuing any other commands to the payload.

Figure 4.1 shows the sequence of events from the time that you click a **P/L** button on the WGMS dashboard to issue a payload power on command, to the time when telemetry is returned from the Wave Glider C&C indicating that the payload is actually powered on.

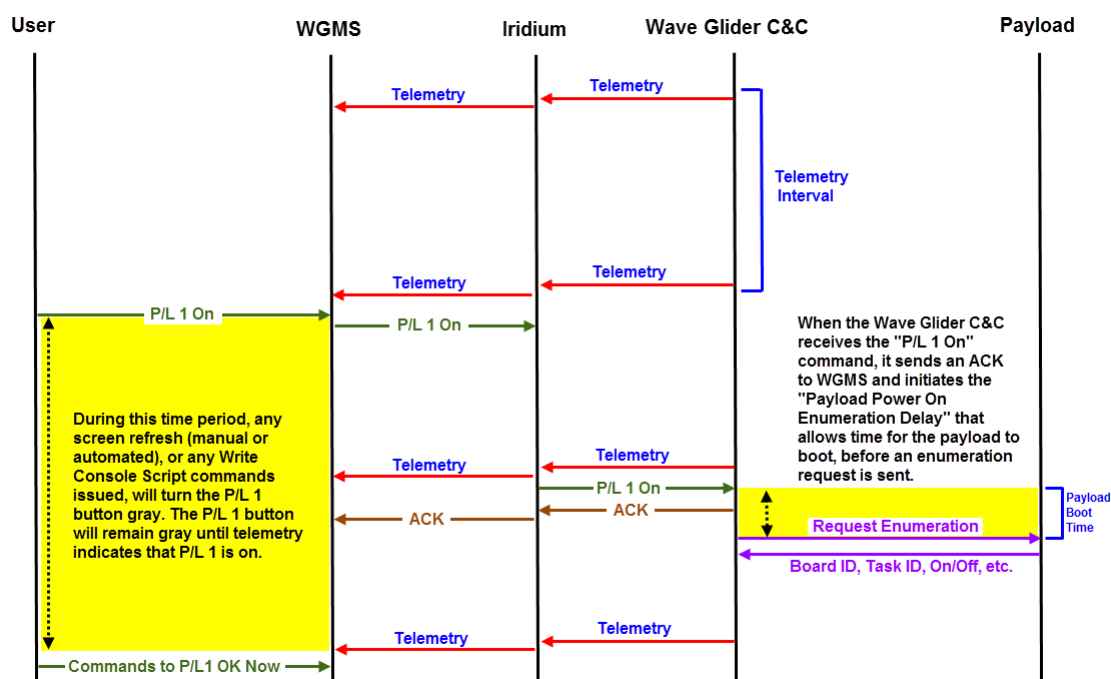
The time between when a payload on command is issued, and when a payload actually is on, depends on the length of the telemetry interval and on the WGMS "Payload Power On Enumeration Delay" setting.

- **Telemetry Interval** - The time between each telemetry broadcast from the Wave Glider C&C. The telemetry interval is determined by the WGMS **Set Status** command - it can range from 1 minute to 1440 minutes in 1 minute increments. When the Iridium communications channel is used, the telemetry interval is typically set to 5 minutes.
- **Payload Power On Enumeration Delay** - The time between when a payload is powered on and when the Wave Glider C&C issues an enumeration request to the payload. The purpose of this setting is to allow enough time for payloads to boot so they are able to respond to an enumeration request. The Payload Power On Enumeration Delay is determined by the WGMS **Set Parameters** command. The default setting is 15 seconds, but it can range from 1 to 32767 seconds. This setting applies to all of the payloads on a Wave Glider and should allow enough time for the payload with the longest boot sequence.

When a **P/L** button is clicked to turn a payload on, the **P/L** button instantly turns green. Until telemetry is returned indicating that the payload is actually powered on, a screen refresh will cause the **P/L** button color to revert to gray. Once the payload is actually powered on and the telemetry indicating the payload power on status has been received by WGMS, a green **P/L** button is a reliable indicator that the payload is powered on. Note, an ACK for the payload power on command confirms that the Wave Glider C&C received the command and issued it to the payload - it does not confirm that the payload has been powered on.

It is important to wait until telemetry confirms that a payload is powered on, before you attempt to issue any commands to that payload.

Figure 4.1. Payload Power On Command Sequence



Example: Starting and Stopping the ADCP

The executable shell script file `startADCP` is stored on the SMC. When you execute this script it will:

1. Configure ADCP profiling and data collection according to mission requirements.
2. Specify the file name for saving the PD0 ensembles on the SMC file system.
3. Send LRI compressed currents C2 samples to WGMS at the required frequency.
4. Immediately start ADCP pinging and data collection.

The executable shell script file `stopADCP` is stored on the SMC. When you execute this script it will:

1. Stop the ADCP pinging and data collection.
2. Stop sending C2 samples to WGMS.

Commonly Used ADCP Setup Commands

The **ADCP -o | --output** command is used to specify the output file for storing PD0 ensembles data received from the ADCP. For example:

ADCP --output PD0ensembles.ENS

ADCP -o /myDataDir/PD0ensembles.ENS

The **ADCP -r | --run** command is used to configure the ADCP by executing the sequence of commands contained in the specified script file (usually a .txt file). For example:

ADCP --run /myDir/ADCP_CONFIG.TXT

ADCP -r ADCP_CONFIG.TXT

Example: ADCP Configuration

The ADCP is configured using the Teledyne RDI specified commands and options described in the Teledyne RDI *Workhorse Commands and Output Data Format* manual. These commands can be sequenced and grouped into a .txt file, for example the script exported by the Teledyne RDI PlanADCP utility.

By issuing the **ADCP --run <somefilename>** command, WHAM will access a file based on `somefilename` and execute the sequence of Teledyne RDI configuration commands on the ADCP.

In the following example, the ADCP configuration script file `ADCP_CURRENTS1MIN.TXT` configures the ADCP for profiling currents over 30 bins of size 4m each, and generating a PD0 ensemble in earth coordinates averaged over 1 minute, using 60 water velocity pings at 1Hz.

When the **ADCP --run ADCP_CURRENTS1MIN.TXT** command is issued, WHAM executes the following script:

```
;-----\
; ADCP Command File for Currents averaged over 1 minute (60 pings at 1hz)
;
; ADCP type:      300/600 Khz Workhorse
;
; NOTE: Any line beginning with a semicolon in the first
;       column is treated as a comment and is ignored by
;       the WHAM software.
;
; Modified Last: 15May2012
;-----/
; Restore user default settings in the ADCP
CR0

; Turning off the recorder
CF11110

; Set for wide bandwidth (default) profile mode (WB), 60-ping ensembles
; (WP), thirty (WN) 4 meter bins (WS), 1.76 meter blanking distance (WF),
; 175 cm/s ambiguity vel (WV)
WB0
WP00060
WN030
WS0400
WF0176
WV175

; disable bottom track (BP),
; Set maximum bottom search depth to 200 meters (BX)
BP000
BX2000

; output velocity, correlation, echo intensity, percent good
WD111100000

; 1 second between pings
TP00:01.00

; one minute between ensembles
TE00:01:00.00

; Set to calculate speed-of-sound, use internal depth sensor (if available),
; use internal compass heading sensor, use internal pitch and roll sensor,
; no salinity sensor, use internal transducer temperature sensor
EZ1111101

;Heading Alignment, should be zero for Earth reference coord transform
;(see EX command below)
EA+00000

;Heading Bias (Set externally for specific deployment)
;EB00968

; Coord transform
```

EX11111

; Set transducer depth (decimeters) to 10 cm
ED00001

; Set Salinity (ppt)
ES35

; save this setup to non-volatile memory in the ADCP
CK

Commonly Used "WHAM" Commands

WHAM -r | --run <somefilename>

WHAM -s | --status

Example: WHAM Script to Configure the ADCP and Start Data Collection

By issuing the **WHAM --run WHAM_START_CURRENTS1MIN.TXT** command, WHAM runs the WHAM_START_CURRENTS1MIN.TXT script which runs a sequence of two LRI ADCP command scripts that execute the Teledyne RDI commands that configure the ADCP and start data collection:

```
-----\n-- WHAM script for starting 1 min currents average (WP60) data collection\n--\n--\n-- NOTE: Any line beginning with -- is treated as a comment and\n--       is ignored by the WHAM software.\n--\n-- Modified Last: 14June2012\n-----/\n-- Setup ADCP for 1 min currents averaging\nADCP --run /home/smc/roots/200_ADCP/ADCP_CURRENTS1MIN.TXT\nADCP --output /home/smc/roots/200_ADCP/data/CURRENTS1MIN.ENS\n-- Start pinging and collecting samples\nADCP --ping
```

Send (Export) Currents C2 Samples to WGMS

The following two commands configure the ADCP to select and export samples every 2 minutes (120 seconds)

SELECT --time 120

EXPORT --output EXPORT2MIN.C2

The following command will start exporting C2 samples, at the pre-selected frequency, for up to the specified count.

EXPORT -c2 65535

Example: WHAM Script for Exporting C2 Samples Every 2 Minutes

WHAM_EXPORT_C2_2MIN.TXT

```
-----\
-- WHAM script for exporting currents C2 sample every 2 minutes
--
--
-- NOTE: Any line beginning with -- is treated as a comment and
--       is ignored by the WHAM software.
--
-- Modified: 25Sept2012
-----/
-- Select to export every 2 mins (120 seconds)
SELECT --time 120
-- Save exported samples on the SMC filesystem
EXPORT --output /home/smc/roots/200_ADCP/data/EXPORT2MIN.C2
-- Export c2 samples (max count or until stopped)
EXPORT -c2 65535
```

Example: WHAM Script to Stop the ADCP Data Collection and Export

WHAM_STOP.TXT

```
-----\
-- WHAM script for stopping data collection
--
--
-- NOTE: Any line beginning with -- is treated as a comment and
--       is ignored by the WHAM software.
--
-- Modified Last: 30March2012
-----/
-- Stop exporting
EXPORT --stop
-- Stop ADCP pinging
ADCP --stop
```

Example: WHAM Script to Configure the ADCP, Start Data Collection, and Export C2 Samples Every 2 Minutes

startADCP

```
#!/bin/sh

# Setup to export C2 samples every 2 minutes

ServerExec ADCPSensor "WHAM --run /home/smc/roots/200_ADCP/WHAM_EXPORT_C2_2MIN.TXT"

sleep 10

# Config the ADCP for 1 min currents averaging, 60 pings at 1Hz,
# 30bins of size 4m,
# setup the PD0 ensembles output file, and start the ADCP pinging

ServerExec ADCPSensor "WHAM --run /home/smc/roots/200_ADCP/WHAM_START_CURRENTS1MIN.TXT"
```

Example: Shell Script to Stop ADCP Data Collection, and Export

stopADCP

```
#!/bin/sh
# Stop ADCP pinging and exporting
ServerExec ADCPSensor "WHAM --run /home/smc/roots/200_ADCP/WHAM_STOP.TXT"
```

Write Console Command Examples

This section provides examples of Write Console Script commands issued to the SMC and WHAM using the WGMS Simple Command Form.

Sending Commands to the SMC from WGMS

To send LINUX system commands to the SMC, or to execute scripts and programs on the SMC:

1. Select the Wave Glider vehicle you want to issue a command to from the drop-down menu in the upper left-hand corner of the WGMS dashboard.
2. Click on **More Commands...** located just below the command buttons on the left side of the WGMS dashboard - a **Vehicle Command Info** form will appear.
3. Confirm that the correct vehicle name appears in the **Vehicle** field.
4. Enter a reason for issuing the command in the **Command Reason** field.
5. Select **Write Console Script** in the **Command Type** drop-down menu.
6. Enter 0 in the **Function field**.
7. Enter the SMC board address (typically **8192**) in the **Board Address** field.
8. Select the communication channel WGMS will use to send the command to the Wave Glider in the **Com Channel** drop-down menu. The default communications channel will

be displayed. If any other communications channels available to the vehicle will be listed in the **Com Channel** drop-down menu.

9. Enter the RUNSHELL command prefix followed by the command you want to issue in the **Script Buffer** field.
10. Click **Send** at the bottom of the **Vehicle Command Info** form to issue the command.

Figure 4.2. Commanding the SMC from WGMS to run the startADCP script

The screenshot shows the 'Related Record' window with the 'Simple Command Form' selected. The 'Vehicle Command Info' form is displayed, containing the following fields and values:

- Command Reason:** Start ADCP 1min averaged data collection
- Vehicle:** SW_1732
- Command Type:** Write Console Script
- Command Status:** Created
- From Waypoint:** (empty)
- To Waypoint:** (empty)
- Heading (deg):** (empty)
- Status:** (empty)
- Course:** (empty)
- Vehicle Rudder Controls:** (empty)
- Function:** 0
- Board Address:** 8192
- File Type:** Unspecified
- Operation Type:** Current Image
- Com Channel:** Iridium Communication Channel
- Upload File:** (empty)
- Part:** (empty)
- Vehicle File:** (empty)
- Read File Name:** (empty)
- Security Manifest:** (empty)
- Disposition:** (empty)
- Time Field:** (empty)
- Script Buffer:** RUNSHELL startADCP

At the bottom of the form are three buttons: 'Copy ...', 'Send', and 'Cancel'.

The startADCP script starts ADCP data collection and export operations.

Figure 4.3. Commanding the SMC from WGMS to run the stopADCP script

The screenshot shows the 'Related Record' window with the 'Simple Command Form' selected. The 'Vehicle Command Info' form is displayed, containing the following fields and values:

- Command Reason:** Stop ADCP ping and data collection
- Vehicle:** SW_1732
- Command Type:** Write Console Script
- Command Status:** Created
- From Waypoint:** (empty)
- To Waypoint:** (empty)
- Heading (deg):** (empty)
- Status:** (empty)
- Course:** (empty)
- Vehicle Rudder Co...:** (empty)
- Function:** 0
- Board Address:** 8192
- File Type:** Unspecified
- Operation Type:** Current Image
- Com Channel:** Iridium Communication Channel
- Upload File:** (empty)
- Part:** (empty)
- Vehicle File:** (empty)
- Read File Name:** (empty)
- Security Manifest:** (empty)
- Disposition:** (empty)
- Time Field:** (empty)
- Script Buffer:** RUNSHELL stopADCP

At the bottom of the form are three buttons: 'Copy ...', 'Send', and 'Cancel'.

The stopADCP script stops ADCP data collection and export operations.

Sending Commands to WHAM from WGMS

To send commands listed in [Appendix A: LRI "WHAM" Commands](#) from WGMS to the Workhorse ADCP Manager (WHAM):

1. Select the Wave Glider vehicle you want to issue a command to from the drop-down menu in the upper left-hand corner of the WGMS dashboard.
2. Click on **More Commands...** located just below the command buttons on the left side of the WGMS dashboard - a **Vehicle Command Info** form will appear.
3. Confirm that the correct vehicle name appears in the **Vehicle** field.
4. Enter a reason for issuing the command in the **Command Reason** field.
5. Select **Write Console Script** in the **Command Type** drop-down menu.
6. Enter 0 in the **Function** field.
7. Enter **8208** in the **Board Address** field.
8. Select the communication channel WGMS will use to send the command to the Wave Glider in the **Com Channel** drop-down menu.
9. Enter the command you want to issue in the **Script Buffer** field.
10. Click **Send** at the bottom of the **Vehicle Command Info** form to issue the command.

Figure 4.4. Configure the ADCP for 1 Minute Averaged Currents Profiling and Start Pinging

The screenshot shows the 'Vehicle Command Info' form in the WGMS interface. The form is titled 'Vehicle Command Info' and has a 'Related Record' dropdown set to 'Simple Command Form'. The form contains several fields and sections:

- Command Reason:** A text field containing 'Config and Start ADCP 1min averaged currents data collection'.
- Vehicle:** A dropdown menu showing 'SW_1732'.
- Command Type:** A dropdown menu showing 'Write Console Script'.
- Command Status:** A dropdown menu showing 'Created'.
- Target Waypoint:** A text field.
- From Waypoint:** A text field.
- To Waypoint:** A text field.
- Heading (deg):** A text field.
- Status:** A text field.
- Course:** A text field.
- Vehicle Rudder Co.:** A text field.
- Function:** A text field containing '0'.
- Board Address:** A text field containing '8208'.
- File Type:** A dropdown menu showing 'Unspecified'.
- Operation Type:** A dropdown menu showing 'Current Image'.
- Com Channel:** A dropdown menu showing 'Indium Communication Ch'.
- Upload File:** A text field.
- Part:** A text field.
- Vehicle File:** A text field.
- Read File Name:** A text field.
- Security Manifest:** A text field.
- Disposition:** A text field.
- Time Field:** A text field.
- Script Buffer:** A text field containing 'WHAM --run WHAM_START_CURRENTS1MIN.TXT'.

At the bottom of the form, there are three buttons: 'Copy ...', 'Send', and 'Cancel'.

Figure 4.5. Configure the ADCP for 1 Minute Averaged Currents Profiling

The screenshot shows the 'Related Record' window with the 'Vehicle Command' tab selected. The 'Vehicle Command Info' section contains the following fields:

- Command Reason:** Config the ADCP to collect 1min averaged currents using 30 bins of size 4m
- Vehicle:** SW_1732
- Command Type:** Write Console Script
- Command Status:** Created
- Target Waypoint:** (empty)
- From Waypoint:** (empty)
- To Waypoint:** (empty)
- Heading (deg):** (empty)
- Status:** (empty)
- Course:** (empty)
- Vehicle Rudder Co.:** (empty)
- Function:** 0
- Board Address:** 8208
- File Type:** Unspecified
- Operation Type:** Current Image
- Com Channel:** Iridium Communication Ch...
- Upload File:** (empty)
- Part:** (empty)
- Vehicle File:** (empty)
- Read File Name:** (empty)
- Security Manifest:** (empty)
- Disposition:** (empty)
- Time Field:** (empty)
- Script Buffer:** ADCP --run ADCP_CURRENTS1MIN.TXT

At the bottom of the window are three buttons: 'Copy ...', 'Send', and 'Cancel'.

Figure 4.6. Setup and Start Exporting C2 Samples Every 2 Minutes

The screenshot shows the 'Related Record' window with the 'Vehicle Command' tab selected. The 'Vehicle Command Info' section contains the following fields:

- Command Reason:** Start exporting C2 samples every 2 minutes
- Vehicle:** SW_1732
- Command Type:** Write Console Script
- Command Status:** Created
- Target Waypoint:** (empty)
- From Waypoint:** (empty)
- To Waypoint:** (empty)
- Heading (deg):** (empty)
- Status:** (empty)
- Course:** (empty)
- Vehicle Rudder Co.:** (empty)
- Function:** 0
- Board Address:** 8208
- File Type:** Unspecified
- Operation Type:** Current Image
- Com Channel:** Iridium Communication Ch...
- Upload File:** (empty)
- Part:** (empty)
- Vehicle File:** (empty)
- Read File Name:** (empty)
- Security Manifest:** (empty)
- Disposition:** (empty)
- Time Field:** (empty)
- Script Buffer:** WHAM --run WHAM_EXPORT_C2_2MIN.TXT

At the bottom of the window are three buttons: 'Copy ...', 'Send', and 'Cancel'.

Figure 4.7. Sending the ADCP --ping Command to WHAM from WGMS

The screenshot shows the 'Related Record' window with the 'Vehicle Command' tab selected. The 'Command Reason' field is filled with 'Start the ADCP (pinging)'. The 'Vehicle' field is set to 'SW_1732'. The 'Command Type' is set to 'Write Console Script'. The 'Script Buffer' field contains the command 'ADCP --ping'. The 'Command Status' is 'Created'. The 'Board Address' is '8208'. The 'Operation Type' is 'Current Image'. The 'Com Channel' is 'Iridium Communication Channel'. The 'Upload File' field is empty. The 'Vehicle File' field is empty. The 'Security Manifest' field is empty. The 'Time Field' is empty. The 'Disposition' field is empty. The 'Read File Name' field is empty. The 'Part' field is empty. The 'Course' field is empty. The 'Heading (deg)' field is empty. The 'From Waypoint' field is empty. The 'To Waypoint' field is empty. The 'Status' field is empty. The 'Vehicle Rudder Co...' field is empty. The 'Copy ...', 'Send', and 'Cancel' buttons are at the bottom.

Figure 4.8. Sending the ADCP --stop Command

The screenshot shows the 'Related Record' window with the 'Vehicle Command' tab selected. The 'Command Reason' field is filled with 'Stop the ADCP'. The 'Vehicle' field is set to 'SW_1732'. The 'Command Type' is set to 'Write Console Script'. The 'Script Buffer' field contains the command 'ADCP --stop'. The 'Command Status' is 'Created'. The 'Board Address' is '8208'. The 'Operation Type' is 'Current Image'. The 'Com Channel' is 'Iridium Communication Channel'. The 'Upload File' field is empty. The 'Vehicle File' field is empty. The 'Security Manifest' field is empty. The 'Time Field' is empty. The 'Disposition' field is empty. The 'Read File Name' field is empty. The 'Part' field is empty. The 'Course' field is empty. The 'Heading (deg)' field is empty. The 'From Waypoint' field is empty. The 'To Waypoint' field is empty. The 'Status' field is empty. The 'Vehicle Rudder Co...' field is empty. The 'Copy ...', 'Send', and 'Cancel' buttons are at the bottom.

Figure 4.9. Sending the SELECT --time command to Set Up the ADCP to Export Data Every 2 Minutes

The screenshot shows the 'Related Record' window with the 'Vehicle Command' tab selected. The 'Command Reason' field contains the text 'Setup to export samples every 2 minutes'. The 'Script Buffer' field at the bottom contains the command 'SELECT --time 120'. Other fields include 'Vehicle' (SW_1732), 'Command Type' (Write Console Script), 'Command Status' (Created), 'Board Address' (8208), and 'Com Channel' (Iridium Communication Channel). The window has 'Copy ...', 'Send', and 'Cancel' buttons at the bottom.

Figure 4.10. Sending the EXPORT -c2 Command to Start Exporting C2 Samples

The screenshot shows the 'Related Record' window with the 'Vehicle Command' tab selected. The 'Command Reason' field contains the text 'Start exporting C2 samples'. The 'Script Buffer' field at the bottom contains the command 'EXPORT -c2 65535'. Other fields include 'Vehicle' (SW_1732), 'Command Type' (Write Console Script), 'Command Status' (Created), 'Board Address' (8208), and 'Com Channel' (Iridium Communication Channel). The window has 'Copy ...', 'Send', and 'Cancel' buttons at the bottom.

Chapter 5. Using RUDICS to Manage ADCP Data Collection

When an Iridium RUDICS modem is installed on the Wave Glider, the PPPHost application on the SMC can be configured to initiate RUDICS calls at a specified call-in time interval, establish a TCP/IP connection to a specified shore side server account, launch a SSH or dbclient session, and download a 'runme' script for execution on the SMC.

The 'runme' script can be used to run programs and other scripts on the SMC, for example:

- Sending commands to WHAM
- Data file management
- Using the TCP/IP connection to transfer files between the SMC and the shore-side server

Initiating a Session

A RUDICS/PPP session is initiated by a process called PPPHost. When Iridium RUDICS is used, the ADCP process relies on PPPHost to periodically make a connection and pull down a script to run from a shore-side server. Depending on ADCP operator requirements, this script may contain commands that transfer ADCP data to shore, as well as commands to change the pinging configuration and timing. Note that in this use case, the timing when the PPPHost makes the connection is not controlled at all by the ADCP process. The call-in interval is determined by the PPPHost XML configuration file and the shore-side script.

Example: PPPHost-Config XML Configuration File

```
<scpExecutorSettings class_id="8" tracking_level="0" version="0">
<callInInterval>3600</callInInterval>
<scpVerb>./runscp 0002</scpVerb>
<runVerb>cd workspace && ./runme</runVerb>
<queueCapacity>100</queueCapacity>
<nextCallIntervalVerb>if [ -f callinTime ] ; then cat callinTime ; fi</nextCallIntervalVerb>
<modemSerialNumberFilename>IMEI</modemSerialNumberFilename>
<modemSimCardFilename>SIMCARD</modemSimCardFilename>
<pppSettings class_id="1" tracking_level="0" version="0">
<dialupTimeout>60</dialupTimeout>
<modemRegistrationTimeout>180</modemRegistrationTimeout>
<modemResponseTimeout>5</modemResponseTimeout>
<phoneNumber></phoneNumber>
<powerOffDelay>10</powerOffDelay>
<powerOnDelay>3</powerOnDelay>
<powerOffVerb>sudo SetPowerSwitch 1 0</powerOffVerb>
<powerOnVerb>sudo SetPowerSwitch 1 1</powerOnVerb>
<protocolDaemonVerb>./runppp</protocolDaemonVerb>
<sendTries>5</sendTries>
<queueCapacity>100</queueCapacity>
<spSettings class_id="1" tracking_level="0" version="0">
<portName>/dev/ttyLX0</portName>
<baudRate>19200</baudRate>
<parity>NONE</parity>
<characterSize>8</characterSize>
<stopBits>1</stopBits>
<flowControl>HARDWARE</flowControl>
<rts>1</rts>
<dtr>1</dtr>
```

```
<breakTimeoutMultiplier>1</breakTimeoutMultiplier>  
</spSettings>  
</pppSettings>  
</scpExecutorSettings>
```

The `callInInterval` element is the default delay (in seconds) between RUDICS connection attempts.

The `nextCallIntervalVerb` element is a script that can override the `callInInterval` value. If the shore-side script creates a file called `callInTime` on the Wave Glider that contains a number of seconds, this value overrides the default call-in interval.

Example 1: scp over RUDICS

This section provides a general discussion of the use of Linux Secure Copy (**scp**) over RUDICS to receive ADCP configuration and management scripts and to transmit ADCP data.

RUDICS establishes a Point to Point Protocol (PPP) data link session with an Iridium provider as specified by the IMEI and SIM, allowing for network layer communication over the Internet. Once connected, any network layer protocol can be used. LRI has been using the RUDICS connection in the following way:

1. The Iridium 9522B RUDICS modem on the Wave Glider is kept powered off between sessions.
2. The connection sequence is initiated periodically from the Wave Glider, at a given time or on demand from one of the local processes on the SMC.
3. When a connection is established, a command is executed from the PPPHost configuration file on the modem. Typically, this is an **scp** command to pull down a script file from a pre-defined server (either an LRI maintained shore-side server, or a customer-provided server).
4. If the script is successfully read, it is executed on the SMC.
5. The connection is then closed.

The script file controls the action that occurs during the session. Typical actions are:

- Reporting the current status of the SMC, the location and the date/time (via SSH)
- Copying ADCP data files from where they have been accumulating on the SMC
- Executing commands on various applications that are running using CORBA and the ServerExec program
- Managing the file system (moving and archiving files, etc.)
- Upgrading software and scripts

Typically files are transferred in bzip2 format or in tar archives that have been compressed using bzip2.



Note

RUDICS sessions can be initiated from the SMC on-board the Wave Glider only
- the shore-side system has no way to send a message until the SMC connects.

This is in contrast to Iridium's SBD (Short Burst Data) service. The Iridium SBD service has a mailbox that the Wave Glider checks for messages, and it has the ability to call the Iridium SBD modem on the Wave Glider.

Example 2: RUDICS Multi-task "runme" Script

This script returns the PD0 ensembles data file to shore, sends a new ADCP configuration file to the vehicle, and restarts the ADCP data collection process using the new configuration.

```
#!/bin/sh

CALLINTERVALSECONDS=3600
SHOREACCT=user@1.2.3.4
SHOREPORT=10501
SHOREDIR=myDIR
SHOREIDENT=../myKEYFILE
ADCPDIR=/home/smc/roots/200_ADCP

echo $CALLINTERVALSECONDS > /home/smc/roots/200_PPPHost/callinTime

stopADCP

scp -i $SHOREIDENT -P $SHOREPORT "$ADCPDIR/PD0ensembles.ENS" "$SHOREACCT": "$SHOREDIR"

scp -i $SHOREIDENT -P $SHOREPORT "$SHOREACCT": "$SHOREDIR/ADCP_NEW_CONFIG.TXT" "$ADCPDIR"

startADCP
```

Example 3: RUDICS "runme" Script to Send Data to Shore

```
#!/bin/sh
# RUDICS communications variables
SHOREACCT=vehicle@12.15.66.48
SHOREPORT=10501
SHOREDIR=ex1
Collecting Data | Retrieving ADCP Data for Further Analysis 21
SHOREIDENT=../ex1
# Various folder names
STARTDIR=`pwd`
ADCPDIR=/home/smc/roots/200_ADCP
DATADIR="$ADCPDIR/data"
CMPLTDIR="$ADCPDIR/complete"
# Various file names
ENFILE="Pings60PD0.ENS"
BINFILE="Pings60C4.BIN"
CMDLOG=ADCPStatus.txt
CMDRPT=`date +%Y%m%d%H%M%S`Report.tar.bz2
# The ADCP configuration file
ADCPSCRIPT="ADCP_ex1_20110811.TXT"
ADCPCRONSCRIPT=ADCPcronScript
```

```
# GetWHAMStatus commands WHAM to report its current internal status to # $stdout.
function GetWHAMStatus()
{
    ls -l --dereference-command-line-symlink-to-dir $*
    ServerExec -ORBInitRef NameService=corbaname::localhost ADCPSensor
    "WHAM -s"
}

# StartSampling configures the ADCP and specifies the file on the SMC
# used to hold the ensembles.
# Note that ServerExec takes a string that is piped into the command
# as the argument.
function StartSampling()
{
    (
        echo "ADCP --run $ADCPSCRIPT"
        echo "ADCP --output $DATADIR/$SENSFILE"
    ) | ServerExec -ORBInitRef NameService=corbaname::localhost
    ADCPSensor
}
# Writes to an internal log file, gets a new ADCP configuration file
# if necessary and then starts the ensembles flowing to a new output
# file.
function ProduceReport()
{
    date
    echo Start60Ping10minCron
    GetWHAMStatus "$DATADIR" "$CMPLTDIR"
    if [ ! -f "$ADCPDIR/$ADCPSCRIPT" ]
    then
        scp -i $SHOREIDENT -P $SHOREPORT "$SHOREACCT":"$SHOREDIR/$ADCP
SCRIPT" "$ADCPDIR"
    fi
    if [ -f "$DATADIR/$SENSFILE" ]
    then
        mv "$DATADIR/$SENSFILE" "$CMPLTDIR/$SENSFILE"
    else
        StartSampling
        GetWHAMStatus "$ADCPDIR"
    fi
}

# set the report time to one hour
echo 3600 > ../callinTime

# dbclient is a version of SSH with a small memory footprint. This
# logs in to the shore-based system.
dbclient -i $SHOREIDENT -p $SHOREPORT $SHOREACCT "cd $SHOREDIR ; ./
response v-time=`date` IMEI=`cat ../IMEI` SIM=`cat ../SIMCARD`"

# create local directories if they don't exist
if [ ! -d "$DATADIR" ]
then
    mkdir "$DATADIR"
```

```
fi

if [ ! -d "$CMPLTDIR" ]
then
    mkdir "$CMPLTDIR"
fi

# start the next round of sampling
ProduceReport 2>&1 > "$CMPLTDIR/$CMDLOG"

# tar up new data files
if [ -f "$CMPLTDIR/$SENSFILE" ]
then
    ( cd "$CMPLTDIR" ; tar --remove-files -cvjf "$CMDRPT" "$CMDLOG"
"$SENSFILE" )
else
    ( cd "$CMPLTDIR" ; tar --remove-files -cvjf "$CMDRPT" "$CMDLOG" )
fi

# copy to shore any previously created data files
# deletes any data files that have been successfully copied to shore
for fileName in `find -L "$CMPLTDIR" -maxdepth 1 -type f -print`
do
    scp -i $SHOREIDENT -P $SHOREPORT "$fileName"
"$SHOREACCT": "$SHOREDIR"
    SCPRESULT="$?"
    if [ "$SCPRESULT" -eq 0 ]
    then
        rm "$fileName"
    else
        exit $SCPRESULT
    fi
done

exit 0
```

Chapter 6. ADCP Custom Data Reports

ADCP custom data reports can be generated and viewed from the Wave Glider Management System (WGMS) dashboard. WGMS Custom Reports are available for a wide range of Wave Glider integrated sensors.

Viewing Custom Reports

Use the **Custom Reports** screen to, view data from vehicle operations. A Custom Report displays data from a specific payload on a specific vehicle.

The following browsers are supported for viewing WGMS Custom Reports:

Browser	Version	Platform	Display
Internet Explorer	9, 10	Windows	Desktop
Firefox	20.0.1 (or later)	Windows	Desktop
Safari	6.0.4 (or later)	Mac	Desktop
Safari	(latest)	iPad (iOS 6.1 or later)	Mobile
Chrome	26.0.1410.64 m (or later)	Windows	Desktop
Chrome	(latest)	Android (4.0 or later)	Mobile

There are Custom Reports available for the following Wave Glider integrated payloads:

- **ADCP C2**
- **ADCP C4**
- **ADCP Bathymetry**
- **ADCP Header**
- **Aquatracka**
- **Benthos Modem**
- **C-Star**
- **Datawell MOSE**
- **Eco-Puck**
- **Fluorometer**
- **Fluorometer Header**
- **LISST Sensor**
- **pCO2 Sensor**
- **Seabird CTD**

- **VEMCO VR2C**
- **WHOI Micro Modem**

To view Custom Reports:

1. Click on **Show System Menus** to open the WGMS system menus.
2. Click on the **System** button to open the **System** screen.
3. Click on the **Custom Reports** side tab in the **Reports** menu on the side-bar.

Figure 6.1. Opening the Custom Reports Screen

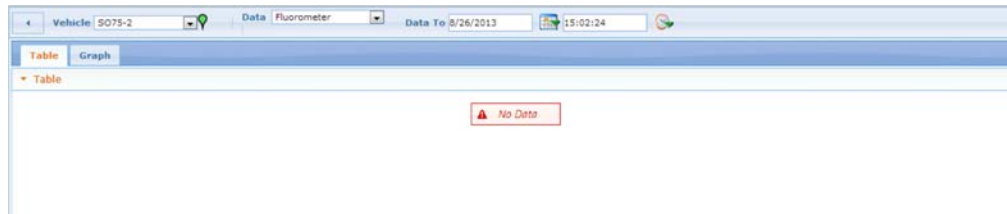


The Custom Reports screen for the selected vehicle will appear.

The toolbar at the top of the Custom Reports screen includes a drop down menu that displays the name of the vehicle that the data in the custom report comes from. If you want to view data from a different vehicle, you can select one from the drop down menu.

Data can be viewed in either of two formats, depending on which tab is selected:

- **Table** - This data format appears when the **Table** tab is selected. By default, the Custom Reports screen opens with the **Table** tab selected displaying data in a tabular format.
- **Graph** - This data format appears when the **Graph** tab is selected displaying data in a variety of graphs depending on the variables you select.

Figure 6.2. Custom Reports Screen - No Data Available

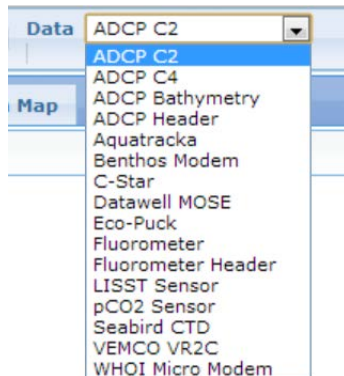
The data type in the **Data** drop-down menu will vary depending on what data type was last viewed in the Custom Reports screen. In [Figure 6.2](#), the Custom Reports screen opened with **Fluorometer** selected in the **Data** drop-down menu, but the No Data icon indicates that the selected vehicle in the **Vehicle** drop-down menu (**SO75-2**) is not generating Fluorometer data. This is the expected behavior for the Custom Reports screen. If the selected vehicle does not have a payload that generates the selected data type, the **No Data** icon will appear, instead of data.



Note

The Custom Reports screens for all of the supported data types have a similar format, except for the ADCP C2 and ADCP C4 data types. For information on viewing the ADCP C2 and C4 data types, see [“ADCP C2 and ADCP C4 Data Display”](#) (page 48).

If you know the type of data that you want to view, and you know the selected vehicle is capable of generating that data type, select it from the **Data** drop down menu.

Figure 6.3. Data Drop-Down Menu

If you do not know which data types the selected vehicle is capable of generating, you will need to work your way through the list in the **Data** drop-down menu to determine what data types are available from the selected vehicle.



Note

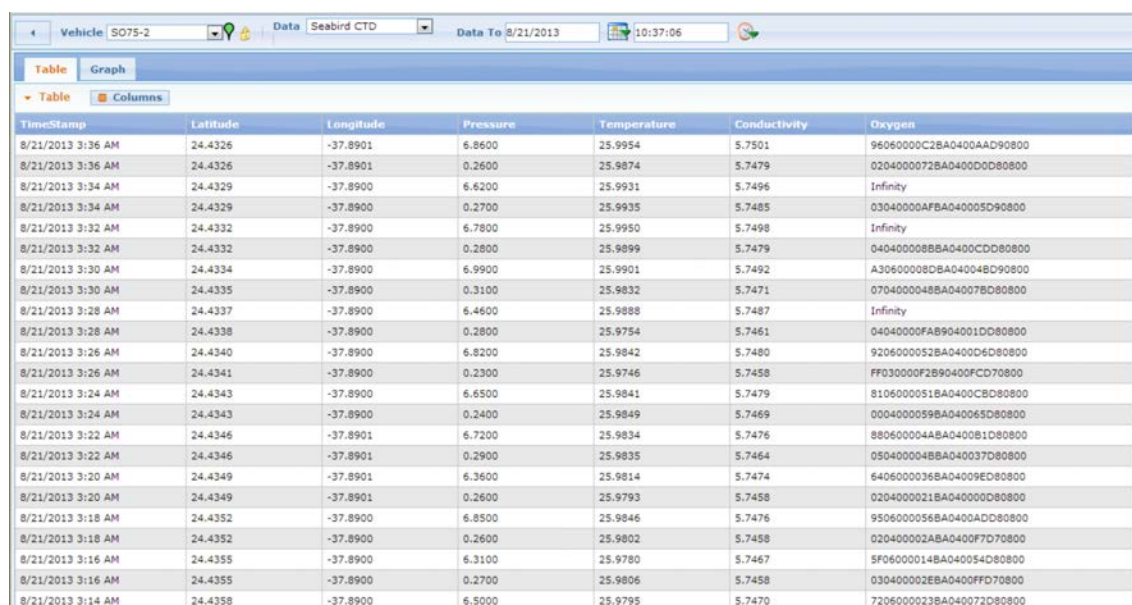
A future WGMS release will automatically populate the **Data** drop-down menu with only the data types that are available from the selected vehicle.

If a data type selected in the **Data** drop-down menu is available for the selected vehicle, an animated loading icon  will appear temporarily while the data loads, then the Custom Report screen will display data.

Custom Reports Table Format

By default, the Custom Reports screen opens to the **Table** tab and displays all of the columns available for a selected data type.

Figure 6.4. Custom Reports Screen With Data - Table Format



TimeStamp	Latitude	Longitude	Pressure	Temperature	Conductivity	Oxygen
8/21/2013 3:36 AM	24.4326	-37.8901	6.8600	25.9954	5.7501	96060000C2BA0400AAD90800
8/21/2013 3:36 AM	24.4326	-37.8901	0.2600	25.9874	5.7479	0204000072BA0400D0D80800
8/21/2013 3:34 AM	24.4329	-37.8900	6.6200	25.9931	5.7496	Infinity
8/21/2013 3:34 AM	24.4329	-37.8900	0.2700	25.9935	5.7485	03040000AFBA040005D90800
8/21/2013 3:32 AM	24.4332	-37.8900	6.7800	25.9950	5.7498	Infinity
8/21/2013 3:32 AM	24.4332	-37.8900	0.2800	25.9899	5.7479	0404000088BA0400CDD80800
8/21/2013 3:30 AM	24.4334	-37.8900	6.9900	25.9901	5.7492	A30600008DBA040048D90800
8/21/2013 3:30 AM	24.4335	-37.8900	0.3100	25.9832	5.7471	0704000048BA04007BD80800
8/21/2013 3:28 AM	24.4337	-37.8900	6.4600	25.9888	5.7487	Infinity
8/21/2013 3:28 AM	24.4338	-37.8900	0.2800	25.9754	5.7461	04040000FAB904001DD80800
8/21/2013 3:26 AM	24.4340	-37.8900	6.8200	25.9842	5.7480	9206000052BA0400D6D80800
8/21/2013 3:26 AM	24.4341	-37.8900	0.2300	25.9746	5.7458	FF030000F2B90400FCD70800
8/21/2013 3:24 AM	24.4343	-37.8900	6.6500	25.9841	5.7479	8106000051BA0400C8D80800
8/21/2013 3:24 AM	24.4343	-37.8900	0.2400	25.9849	5.7469	0004000059BA040065D80800
8/21/2013 3:22 AM	24.4346	-37.8901	6.7200	25.9834	5.7476	880600004ABA0400B1D80800
8/21/2013 3:22 AM	24.4346	-37.8901	0.2900	25.9835	5.7464	0504000048BA040037D80800
8/21/2013 3:20 AM	24.4349	-37.8901	6.3600	25.9814	5.7474	6406000036BA04009ED80800
8/21/2013 3:20 AM	24.4349	-37.8901	0.2600	25.9793	5.7458	0204000021BA040000D80800
8/21/2013 3:18 AM	24.4352	-37.8900	6.8500	25.9846	5.7476	9506000056BA0400ADD80800
8/21/2013 3:18 AM	24.4352	-37.8900	0.2600	25.9802	5.7458	020400002ABA0400F7D70800
8/21/2013 3:16 AM	24.4355	-37.8900	6.3100	25.9780	5.7467	5F06000014BA040054D80800
8/21/2013 3:16 AM	24.4355	-37.8900	0.2700	25.9806	5.7458	030400002EBA0400FFD70800
8/21/2013 3:14 AM	24.4358	-37.8900	6.5000	25.9795	5.7470	7206000023BA040072D80800

For some data types you will need to scroll to the right to see all of the columns. To limit the number of columns displayed:

1. Click on **Columns** button. A drop-down menu listing the column names will appear.
2. Un-check the check box next to each column name that you do not want displayed and that column will instantly be removed from the Custom Report.
3. To restore all columns, click the **Reset** button.

Figure 6.5. Changing the Columns that are Displayed

TimeStamp	Latitude	Longitude	Pressure	Temperature	Conductivity
8/21/2013 5:50 AM	24.4133	-37.8900	6.9700	25.9806	5.7505
8/21/2013 5:51 AM		-37.8900	0.2700	26.0617	5.7590
8/21/2013 5:52 AM		-37.8901	6.4300	25.9908	5.7517
8/21/2013 5:53 AM		-37.8900	0.2400	26.0746	5.7603
8/21/2013 5:54 AM		-37.8901	6.5000	25.9884	5.7515
8/21/2013 5:55 AM		-37.8901	0.2400	26.0624	5.7588
8/21/2013 5:56 AM		-37.8901	6.6400	25.9849	5.7511
8/21/2013 5:57 AM		-37.8900	0.2700	26.0716	5.7597
8/21/2013 5:58 AM		-37.8900	6.8200	25.9801	5.7506

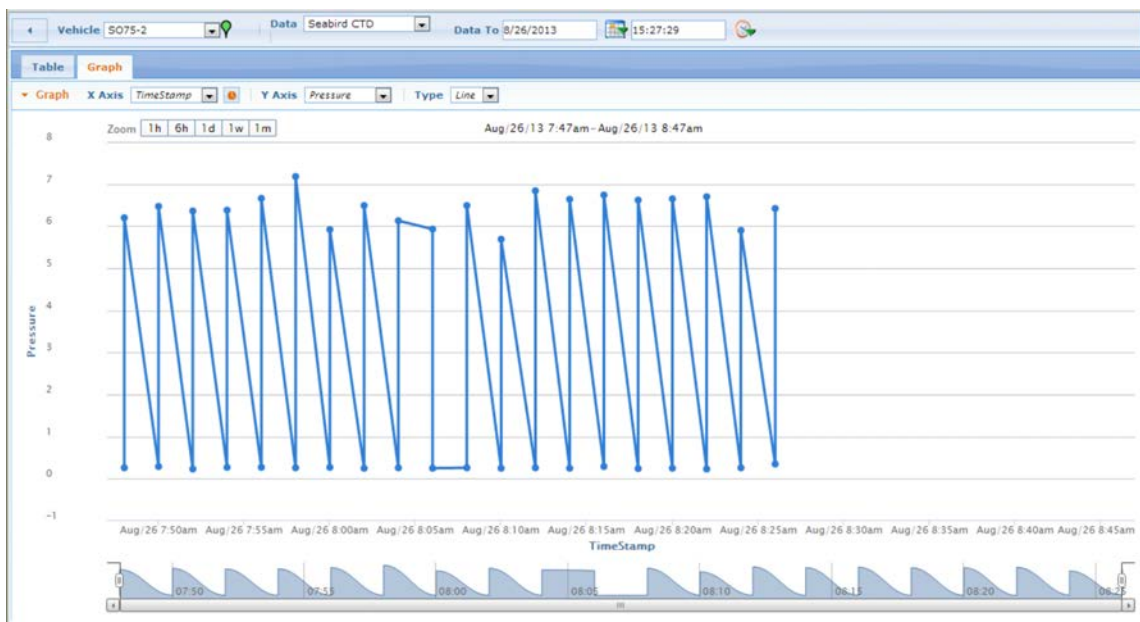
**Note**

The Custom Report screen provides similar functionality on a tablet, but the navigation is slightly different. When using a tablet, allow extra time for Custom Report screens to generate.

By default, the custom report for a selected data type will display all available data. You can limit the amount of historical data that is displayed by changing the **Data To:** date and time settings. Changing the date and time settings will update the custom report screen that you are viewing.

Custom Reports Graph Format

Click on the **Graph** tab to view the graphical data display for the selected vehicle and data type.

Figure 6.6. Custom Reports Screen - Graph Format

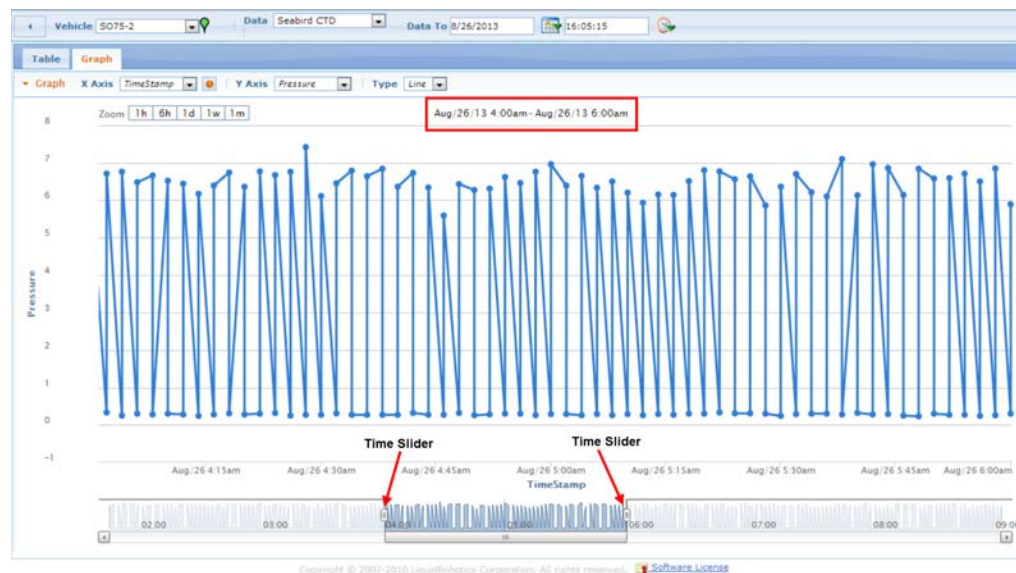
The selections made in the **X Axis** and **Y Axis** drop-down menus determine how the data is displayed. Displaying the **Time Stamp** on the X Axis with one of the other variables displayed on the Y Axis graphs the Y Axis data over time. This is the most widely used combination of X and Y Axis variables. The **Time Stamp** button adjacent to the **X Axis** drop-down menu can also be used to set the X Axis to **Time Stamp**. The **Type** drop-down menu is used to add or remove the line that connects the data points on the graph. Click on one of the selections in the **Zoom** menu to display data for the last hour, 6 hours, 1 day, 1 week, or 1 month. The Time Range indicates when the data display begins and ends.

Figure 6.7. Custom Reports Screen - Graph Format Time Settings



The **Time Slider** buttons in the time line at the bottom of the **Graph** display can also be used to adjust the time range for the data display.

Figure 6.8. Custom Reports Screen - Graph Format Time Slider



Note

The options available in the **X Axis** and **Y Axis** drop-down menus may not always result in a useful or meaningful graph. Knowledge of the data being measured is necessary to choose X and Y Axis variables that make sense.

ADCP C2 and ADCP C4 Data Display

The WGMS Custom Report for the Wave Glider integrated Teledyne RD Instruments Workhorse Monitor ADCP displays C2 data in a Table format, a Graph format, and a Bin Map format. C4 data is displayed in Table and Graph formats only. The WGMS Custom Report display for all other data types, including ADCP Bathymetry and ADCP Header data, is described in “[Viewing Custom Reports](#) ” (page 42)

The following browsers are supported:

Browser	Version	Platform	Display
Internet Explorer	9, 10	Windows	Desktop
Firefox	20.0.1 (or later)	Windows	Desktop
Safari	6.0.4 (or later)	Mac	Desktop
Safari	(latest)	iPad (iOS 6.1 or later)	Mobile
Chrome	26.0.1410.64 m (or later)	Windows	Desktop
Chrome	(latest)	Android (4.0 or later)	Mobile

To view the Custom Report for ADCP data from a specific Wave Glider vehicle:

1. Click on **Show System Menus** to open the WGMS system menus.
2. Click on the **System** button to open the **System** screen.
3. Click on the **Custom Reports** side tab in the **Reports** menu on the side-bar.

Figure 6.9. Opening the Custom Reports Screen

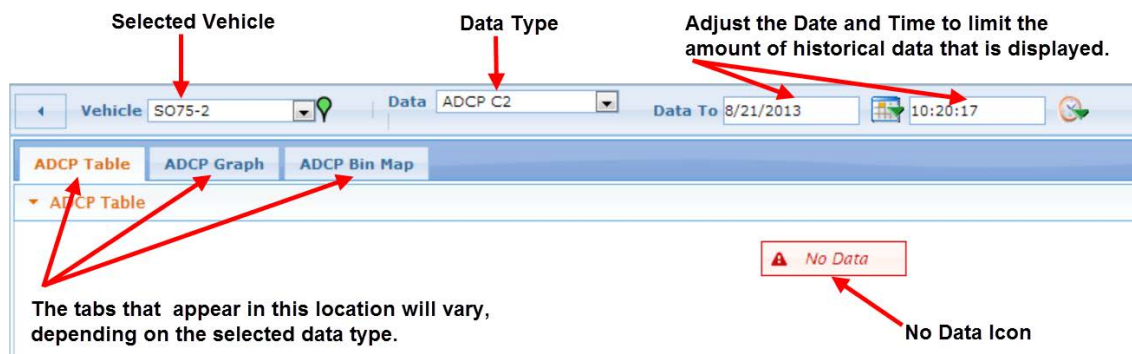
The Custom Reports screen for the selected vehicle will appear.



Note

You can also select vehicles from a menu in the tool bar on the ADCP Custom Report screen.

If there is no data available, the screen will be empty.

Figure 6.10. Custom Reports Screen No ADCP C2 Data

If data is available for the selected vehicle (changed to **S075-3**), an animated loading icon

■■■ will appear temporarily while the data loads, then the Custom Report screen will display data as illustrated in Figure 6.11.

ADCP C2 and C4 Table Format

The Custom Report for ADCP C2 and C4 data displays data in the **Table** format by default, as illustrated in Figure 6.11



Note

The Custom Report screen provides similar functionality on a tablet, but the navigation is slightly different. When using a tablet, allow extra time for Custom Report screens to generate.

Figure 6.11. ADCP Custom Reports Screen - Table Format

TimeStamp	11/27/2012 12:41 PM	11/16/2012 7:44 PM	9/27/2012 4:15 AM	9/27/2012 1:15 AM	9/26/2012 10:15 PM	9/26/2012 7:15 PM	9/26/2012 4:15 PM	9/26/2012 1:15 PM	9/26/2012 12:41 PM
Latitude	25.9958	20.0379	20.0382	20.0382	20.0382	20.0382	20.0383	20.0382	19.966
Longitude	-79.8791	-155.8310	-155.8308	-155.8308	-155.8308	-155.8308	-155.8308	-155.8308	-155.8
Bin Size (m)	4	4	4	4	4	4	4	4	4
Bin 1 Depth (m)	6.2400	6.2400	6.2400	6.2400	6.2400	6.2500	6.2400	6.2300	6.2400
Bin 1 Mag (mm/s)	20.6155	NA	NA	NA	NA	NA	NA	NA	168.41
Bin 1 Dir (Degrees True)	129.0939	NA	NA	NA	NA	NA	NA	NA	330.06
Bin 2 Depth	10.2400	10.2400	10.2400	10.2400	10.2400	10.2500	10.2400	10.2300	10.240
Bin 2 Mag	284.3132	NA	NA	NA	NA	NA	NA	NA	438.95
Bin 2 Dir	316.1401	NA	NA	NA	NA	NA	NA	NA	273.78
Bin 3 Depth	14.2400	14.2400	14.2400	14.2400	14.2400	14.2500	14.2400	14.2300	14.240
Bin 3 Mag	212.6029	NA	NA	NA	NA	NA	NA	NA	487.85
Bin 3 Dir	318.8141	NA	NA	NA	NA	NA	NA	NA	277.18
Bin 4 Depth	18.2400	18.2400	18.2400	18.2400	18.2400	18.2500	18.2400	18.2300	18.240
Bin 4 Mag	277.2724	NA	NA	NA	NA	NA	NA	NA	575.04
Bin 4 Dir	296.5651	NA	NA	NA	NA	NA	NA	NA	277.55
Bin 5 Depth	22.2400	22.2400	22.2400	22.2400	22.2400	22.2500	22.2400	22.2300	22.240
Bin 5 Mag	277.6058	NA	NA	NA	NA	NA	NA	NA	497.00
Bin 5 Dir	307.2414	NA	NA	NA	NA	NA	NA	NA	269.76
Bin 6 Depth	26.2400	26.2400	26.2400	26.2400	26.2400	26.2500	26.2400	26.2300	26.240
Bin 6 Mag	279.6140	NA	NA	NA	NA	NA	NA	NA	380.42
Bin 6 Dir	307.4437	NA	NA	NA	NA	NA	NA	NA	263.51
Bin 7 Depth	30.2400	30.2400	30.2400	30.2400	30.2400	30.2500	30.2400	30.2300	30.240
Bin 7 Mag	264.5921	NA	NA	NA	NA	NA	NA	NA	529.84
Bin 7 Dir	307.7501	NA	NA	NA	NA	NA	NA	NA	744.00

The ADCP Table format is a rotated table. The table header is the left column. Data is displayed in descending chronological order, from left-to-right. Scrolling to the right will automatically load more data. The table body also scrolls vertically to reveal all rows.

The toolbar at the top of the Custom Reports screen includes a drop down menu that displays the name of the vehicle that the data in the custom report comes from. If you want to view data from a different vehicle, you can select one from the drop down menu.

Figure 6.12. Custom Reports Tool Bar



By default, a custom data screen will display all available data. To see it all you must scroll to the right, until you reach the end. You can limit the amount of historical data that is displayed by changing the **Data To:** date and time settings. Changing the date and time settings will update the custom report screen that you are viewing.

The ADCP Table format tool bar located at the top of the table includes **Rows**, **Bins**, and **Magnitude** menus that allow you to modify the data that will be displayed in the table.

Figure 6.13. ADCP C2 and C4 Table Format Tool Bar

ADCP Table ADCP Graph ADCP Bin Map			
▼ ADCP Table Rows Bins 20 Magnitude mm/s			
TimeStamp	11/27/2012 12:41 PM	11/16/2012 7:44 PM	9/27/2012 4:1
Latitude	25.9958	20.0379	20.0382
Longitude	-79.8791	-155.8310	-155.8308
Bin Size (m)	4	4	4
Bin 1 Depth (m)	6.2400	6.2400	6.2400

- Click on the **Rows** button to display a drop-down menu listing every row in the ADCP Table. Un-checking a row removes it from the display. Re-checking a row restores it to the display. Clicking on **Reset** at the bottom of the drop-down menu will restore all of the rows in the ADCP Table. Clicking anywhere outside of the drop-down menu will collapse it.

Figure 6.14. Rows Drop-Down Menu



- Use the **Bins** 20 dropdown menu to limit the number of Bins that are displayed in the ADCP Table.
- Use the **Magnitude** mm/s dropdown menu to set the units for the **Bin Mag** rows in the ADCP Table. The options are **mm/s** or **Knots**. When you change the **Magnitude** setting, the ADCP Table regenerates with the selected units of magnitude.

The compass icons  in the Bin Mag rows of the ADCP Table are accurate to within 10 degrees of the direction the red end of the icon is pointing toward.

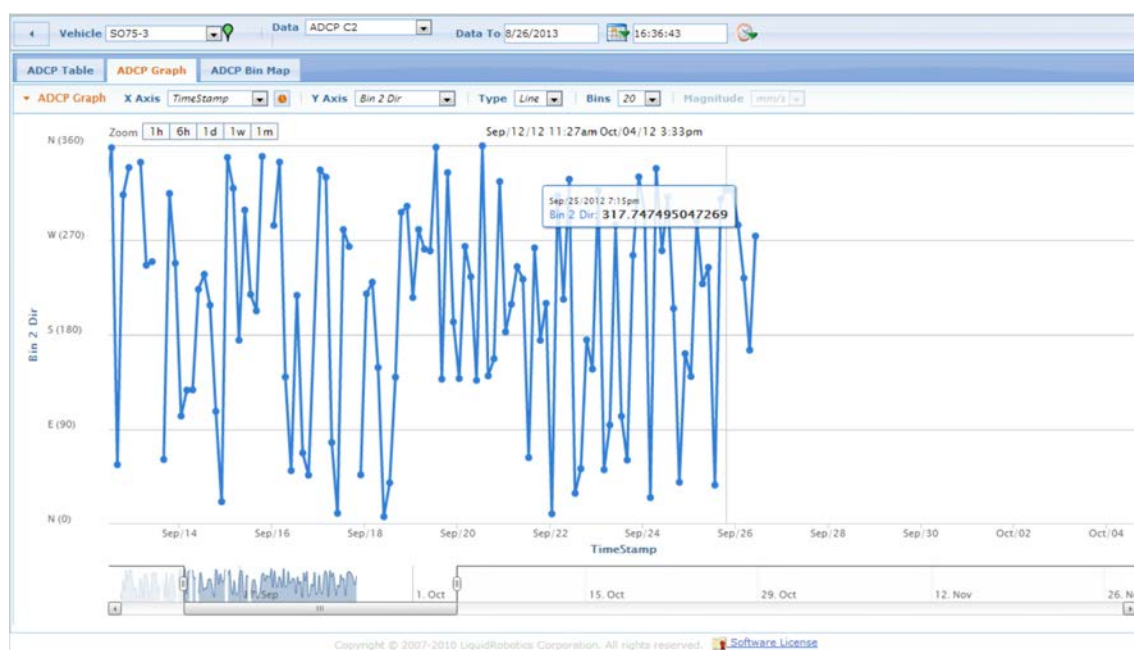
Figure 6.15. Compass Icons

Bin 1 Mag (mm/s)	21.0950		35.3553		36.0555		58.2151		12.0416	
Bin 1 Dir (Degrees True)	148.5704		81.8699		199.4400		355.0729		228.3665	
Bin 2 Depth	10.2400		10.2400		10.2400		10.2400		10.2400	
Bin 2 Mag	217.5132		50.4777		135.2072		270.9336		374.9587	

ADCP C2 and C4 Graph Format

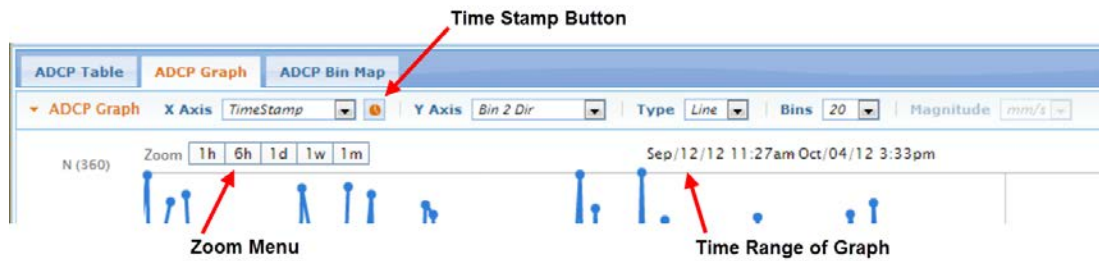
The Custom Report for ADCP C2 and C4 data includes an **ADCP Graph** option. Click on the **ADCP Graph** tab to view a graphical display of C2 or C4 data for the selected vehicle.

Figure 6.16. Custom Reports Screen - ADCP C2 Graph Format



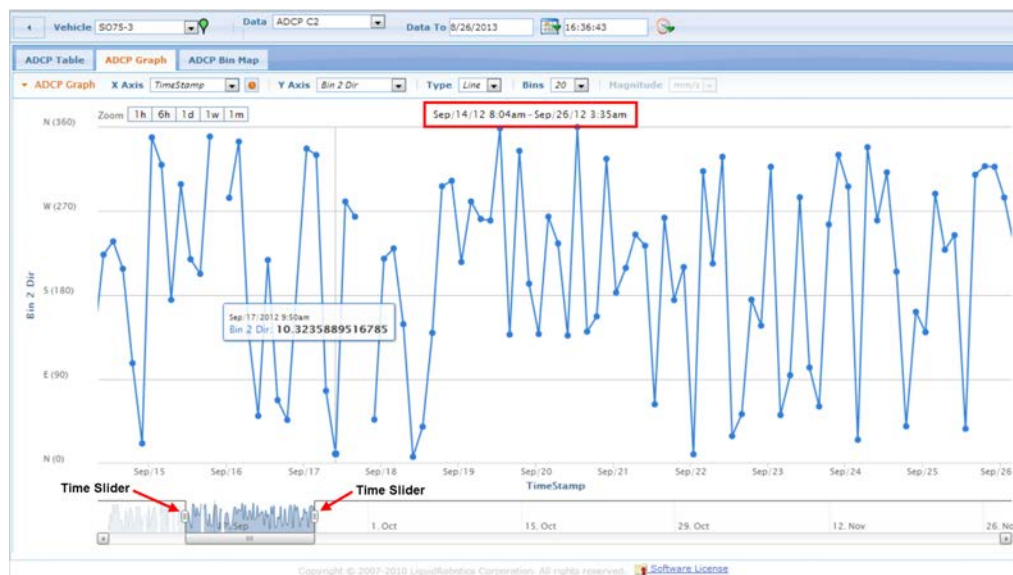
The selections made in the **X Axis** and **Y Axis** drop-down menus determine how the data is displayed. Displaying the **Time Stamp** on the X Axis with one of the other variables displayed on the Y Axis graphs the Y Axis data over time. This is the most widely used combination of X and Y Axis variables. The **Time Stamp** button adjacent to the **X Axis** drop-down menu can also be used to set the X Axis to **Time Stamp**. The **Type** drop-down menu is used to add or remove the line that connects the data points on the graph. Click on one of the selections in the **Zoom** menu to display data for the last hour, 6 hours, 1 day, 1 week, or 1 month. The Time Range indicates when the data display begins and ends.

Figure 6.17. ADCP Graph Format - Time Settings



The **Time Slider** buttons in the time line at the bottom of the graph can also be used to adjust the time range for the data display.

Figure 6.18. ADCP Graph Format - Time Slider

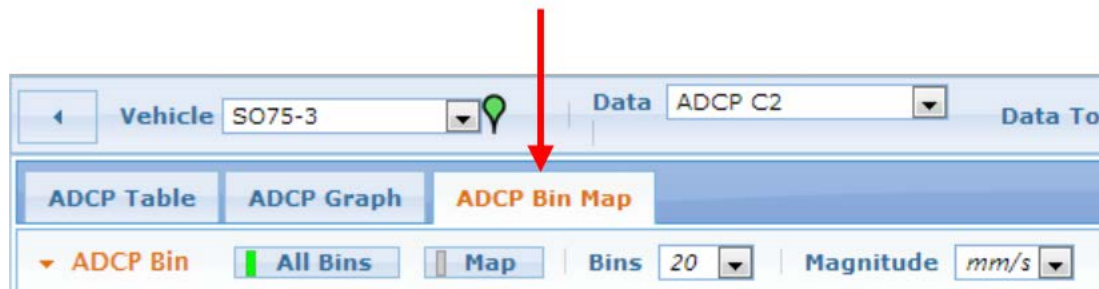


Note

The options available in the **X Axis** and **Y Axis** drop-down menus may not always result in a useful or meaningful graph. Knowledge of the data being measured is necessary to choose X and Y Axis variables that make sense.

ADCP C2 Bin Map Format

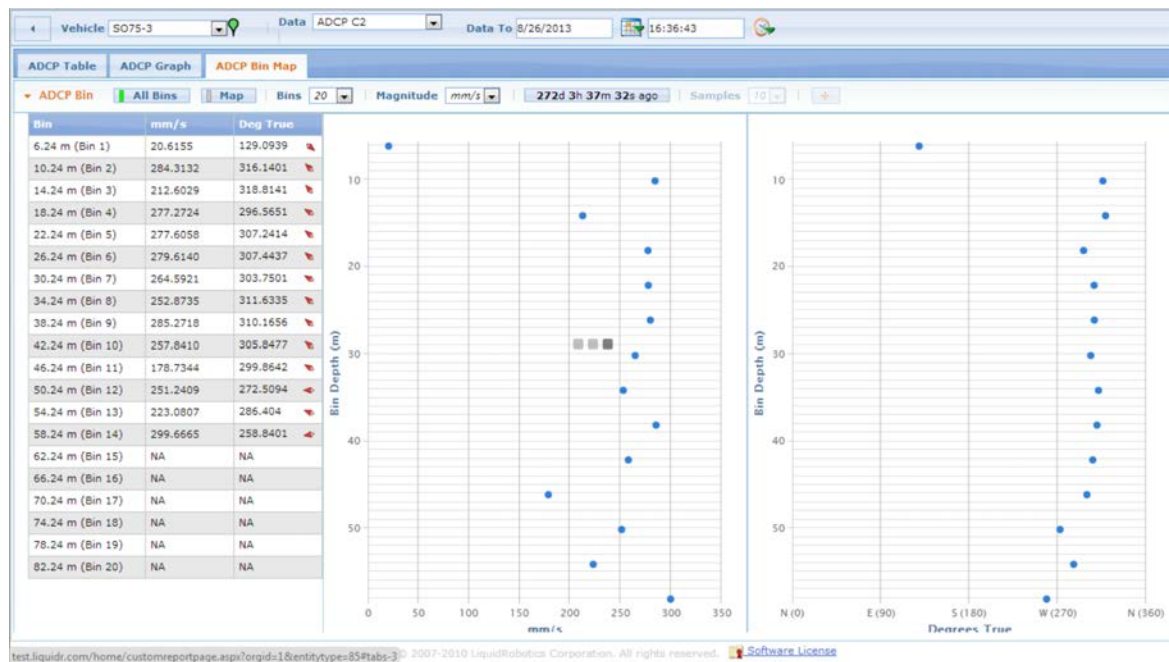
The Custom Report for ADCP C2 data includes a tab for a **Bin Map** data display. To view the ADCP C2 Bin Map format, click on the **Bin Map** tab.

Figure 6.19. Select ADCP Bin Map Display

The ADCP Bin Map format displays the most recent ADCP data. It is automatically updated every 120 seconds and will redraw itself only if new data is found. The time when the ADCP Bin Map data was last updated, and the time that has passed since then are displayed in the time window: **168d 19h 49m 9s ago**

The ADCP Bin Map format displays data in two modes: **All Bins** and **Map**. All Bins is the default mode when you select the ADCP Bin Map data format.

All Bins mode displays a Bin Depth table with two charts to the right of it. One chart displays bin depth relative to speed (in mm/s or Knots). The other chart displays bin depth relative to compass degrees true.

Figure 6.20. ADCP Bin Map in All Bins Mode

Click on the **Map** button to display the Map mode.



Map mode displays the same Bin Depth table that appears in All Bins mode. When you click on a row in the Bin Depth table, a compass icon locating that ADCP data point on a world map is displayed on the adjacent Map panel.

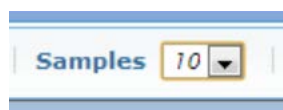
Figure 6.21. ADCP Bin Map in Map Mode



The time when the ADCP Bin Map data was last updated, and the time that has passed since then are displayed in the time window. **272d 3h 37m 32s ago**

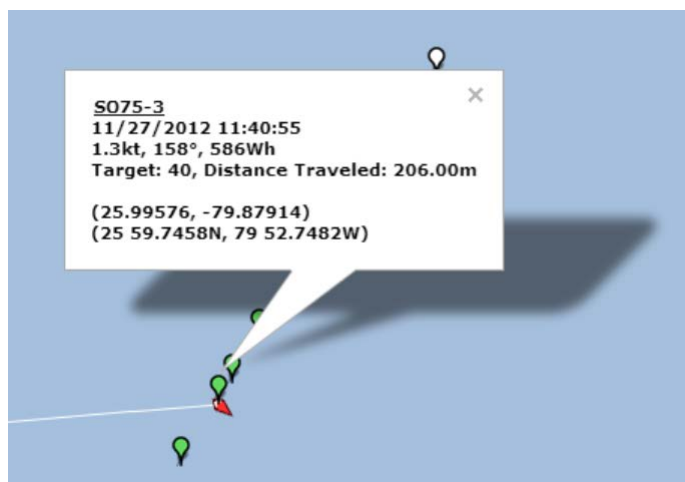
Use the **Magnitude** **mm/s** drop-down menu to set the units for rows in the Bin Depth table. The options are **mm/s** or **Knots**. When you change the **Magnitude** setting, the ADCP Table regenerates with the selected unit of magnitude.

When you click on a Bin Depth row in the Bin Depth table, the text in the row changes color and the associated data points are displayed in the Map panel. You have the option to display the most recent data sample, or the 5, 10, 15, or 20 most recent data samples for this Bin Depth. You can adjust the number of samples displayed by changing the setting in the **Samples** drop-down menu. The default setting is 10.



Clicking on the  button will re-center the map display.

The compass icons  in the Bin Mag rows of the ADCP Table are accurate to within 10 degrees of the direction the red end of the icon is pointing toward. Clicking on a compass icon will display all of the information associated with that data sample.



Chapter 7. Launch, Recovery, and Storage

This chapter provides specific instructions and considerations for Wave Glider SV2 launch, recovery and storage when an ADCP is installed.

Launch, Recovery, and Storage Overview

ADCP Accessories Kit

A Wave Glider SV2 with an integrated ADCP ships with an ADCP accessory kit. It's important that you store the ADCP accessory kit where it will be easy to access if you need to troubleshoot the ADCP, or return the ADCP to Teledyne RDI.

ADCP Accessories Kit
I/O Cable
AC Power Adaptor
Power Cord
Teledyne RDI Manuals and Software
Custom Foam (save for shipping)

ADCP Precautions

The four transducer faces on the ADCP monitor are very fragile. Follow the precautions below during unpacking, pre-launch checkout, launch, recovery, packing, storage, and shipment to prevent damage to the transducer faces:

- Ensure that the transducer faces do not come into contact with any other surface. Do not touch the transducer faces.
- Do not expose the transducer faces to prolonged sunlight. Keep the transducer faces covered.

See the Teledyne RDI *Workhorse Monitor Technical Manual* for more information on protecting the ADCP transducer faces.

Do not apply any upward, downward, or side-to-side force on the end-cap connector of the ADCP cable. Stressing the end-cap connector may cause damage to the ADCP.

In order to accommodate and protect the ADCP when the Wave Glider SV2 is not in the water, the float must be installed on an ADCP compatible float-glider saddle (LRI P/N 00231). The ADCP float-glider saddle ships with the Wave Glider SV2. Note that there are some older saddles which are not compatible. See ["Placing the Float on the ADCP Compatible Float-Glider Saddle"](#) (page 63) for more information on using the ADCP float-glider saddle.

Pre-Launch Checkout

The ADCP should undergo a final pre-launch test, as part of the overall test of the Wave Glider. Add the following to the checklist to confirm ADCP functionality:

Status Checks

Calibrate the ADCP compass, if necessary. Confirm that you have the correct magnetic declination for the area of operations. This information must be entered in your ADCP configuration file.



Important

The ADCP compass is calibrated and matched to the Wave Glider vehicle it is installed in before the vehicle is shipped from the Liquid Robotics facility. If any changes are made to the Wave Glider Float that could impact its magnetic signature, the ADCP compass must be recalibrated while it is installed in the Float. For example, installing additional hardware or sensors on the Float, or in the Payload Dry Boxes, would impact the magnetic signature of the vehicle. If the ADCP compass is not properly calibrated, the current magnitudes and directions the ADCP reports will be invalid.

For information on verifying the ADCP compass calibration, or for instructions on recalibrating the ADCP compass, contact the Liquid Robotics Customer Support organization.

Liquid Robotics Customer Support is available 24/7.

Telephone:

(US) 888-574-4574

(International) 1-408-636-4205

Email: support@liquidr.com

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.

Final Assembly Checks

Visually inspect cable connections to ensure that they are completely seated. See [“Installing the ADCP” \(page 63\)](#).

Visually inspect the mounting of the ADCP to ensure that it is secure. See [“Installing the ADCP” \(page 63\)](#).

Functionality Checks

With the system configured and ready to launch, run through the data acquisition steps described in [Chapter 2: Collecting Data](#). Include the step where you start the ADCP pinging and the step where you retrieve PD0 ensembles from the Wave Glider. This will confirm that you have electrical and communications connectivity throughout the system.

Chapter 8. Troubleshooting

Testing and troubleshooting of the standalone Workhorse Monitor ADCP must be completed according to the Teledyne RDI *Workhorse Monitor ADCP Technical Manual* before installing the ADCP in the Wave Glider SV2. This chapter provides instructions for troubleshooting the ADCP *after* it is installed in the Wave Glider SV2.

Troubleshooting Overview

There are three situations where you may become aware that the ADCP is not operating properly:

- During on-shore checkout
- During pre-launch checkout
- During normal operations at sea

If you become aware of a possible problem with the ADCP, follow the steps below to isolate the problem.



Note

The Wave Glider SV2 with ADCP ships with an ADCP accessory kit. The kit contains items needed for troubleshooting. You can find more information on the ADCP accessory kit in [“Launch, Recovery, and Storage Overview” \(page 57\)](#).

1. Confirm that WHAM is running by sending it the **WHAM --status** command. Check that the status of WHAM is returned. Start the ADCP pinging by sending the **ADCP --ping** command. Listen for audible "chirping" or "pinging" from the ADCP transducers.
2. If the **WHAM --status** or **ADCP --ping** do not work correctly, consult the Troubleshooting chapter of the LRI *Wave Glider User Manual* to ensure that there are no problems with the Wave Glider power or communications systems.
3. If there are no problems with the Wave Glider power or communications systems, disconnect the Wave Glider SV2 I/O cable from the ADCP following the procedures below:

- See [“Removing the Turtle Deck” \(page 64\)](#)
- See [“Removing the Aft Solar Panel” \(page 65\)](#)
- See [“Disconnecting the ADCP Payload” \(page 68\)](#)

Use the Teledyne RDI I/O cable from the ADCP accessory kit to connect the ADCP to a PC. Follow the testing and troubleshooting instructions in the Teledyne RDI *Workhorse Monitor Technical Manual*. If the ADCP operates properly following the Teledyne RDI troubleshooting instructions, reconnect the ADCP to the Wave Glider SV2 I/O cable following the procedure in [“Connecting the ADCP Payload” \(page 74\)](#).

4. If the ADCP monitor continues to fail, see the following [“LRI Customer Support” \(page 59\)](#) section for instructions on contacting LRI.

LRI Customer Support

LRI Customer Support 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.

Chapter 9. Maintenance

Maintenance instructions for the ADCP are provided in the Teledyne RDI *Workhorse Monitor Technical Manual*. This chapter provides additional instructions for maintenance of the ADCP when installed in a Wave Glider SV2.

Maintenance Overview

There are no special maintenance procedures for the ADCP integrated into the Wave Glider SV2.

Below are special considerations to be followed when performing maintenance on the ADCP integrated into the Wave Glider SV2:

- The Wave Glider SV2 with ADCP ships with an ADCP accessory kit. The kit contains items that may be needed for troubleshooting. You can find more information on the ADCP accessory kit in [“Launch, Recovery, and Storage Overview” \(page 57\)](#).
- To protect the ADCP when the Wave Glider SV2 is not in the water, the float must be stored resting on an ADCP compatible float-glider saddle. See [“Placing the Float on the ADCP Compatible Float-Glider Saddle” \(page 63\)](#) for instructions.
- The ADCP monitor is fragile. See [“ADCP Precautions” \(page 57\)](#) for information on protecting the ADCP during maintenance procedures.

If the ADCP needs to be removed from the Wave Glider SV2 for maintenance, follow the instructions in [Chapter 10: Replacement](#).

If the ADCP is being installed following maintenance, be sure to do a complete checkout of the ADCP before installation. Follow the testing and troubleshooting instructions in the Teledyne RDI *Workhorse Monitor Technical Manual*.

Chapter 10. Replacement

The ADCP may need to be disconnected or removed from the Wave Glider SV2 for troubleshooting. This chapter provides detailed instructions for disconnecting, removing, or installing the ADCP in the Wave Glider SV2.

Replacement Overview

To accommodate and protect the ADCP when the Wave Glider SV2 is not in the water the float must be installed on an ADCP compatible float-glider saddle (Liquid Robotic P/N 00231). The ADCP float-glider saddle ships with the Wave Glider SV2. Note that there are some older saddles which are not compatible. See [“Placing the Float on the ADCP Compatible Float-Glider Saddle” \(page 63\)](#) for more information.

The ADCP monitor is fragile. See [“ADCP Precautions” \(page 57\)](#) for information on protecting the ADCP during replacement.

Before installing the ADCP in a Wave Glider SV2, be sure to perform the testing procedures described in the *Testing the Workhorse* chapter of the Teledyne RDI *Workhorse Monitor Technical Manual*. If any issues come to your attention during testing, see the *Troubleshooting* chapter in the Teledyne RDI *Workhorse Monitor Technical Manual*.

Installing or removing an ADCP in a Wave Glider SV2 requires the tools and equipment listed in [Table 10.1](#). Have the necessary tools and equipment ready before disconnecting the ADCP or beginning the removal or installation procedure.

Table 10.1. Tools and Equipment for Removal and Installation

Tool or Part	Quantity	Part Number
ADCP float-glider saddle	1	00231
#2 Phillips head screwdriver	1	N/A
6mm hex head wrench	1	N/A
4mm hex head wrench	1	N/A
Silicone spray lubricant	1	N/A
Loctite 242 (blue)	1	N/A
Cable ties	1	N/A
Cable cutter (for cable ties)	1	N/A

The Wave Glider SV2 is a complex instrument with many components integrated onto it.

To safely remove the ADCP, follow the sequence in [“Removing the ADCP” \(page 62\)](#).

To safely install the ADCP, follow the sequence in [“Installing the ADCP” \(page 63\)](#)

Removing the ADCP

1. [“Removing the Turtle Deck” \(page 64\)](#)
2. [“Removing the Aft Solar Panel” \(page 65\)](#)

3. “Disconnecting the ADCP Payload” (page 68)
4. “Removing the ADCP Payload Dry Box” (page 69)
5. “Removing the ADCP Assembly” (page 70)

Installing the ADCP

1. “Removing the Turtle Deck” (page 64)
2. “Preparing the ADCP Assembly” (page 71)
3. “Installing the ADCP Assembly” (page 72)
4. “Installing the ADCP Payload Dry Box” (page 73)
5. “Connecting the ADCP Payload” (page 74)
6. “Installing the Aft Solar Panel” (page 75)
7. “Installing the Turtle Deck” (page 77)
8. “Checking the Operation of the ADCP in a Wave Glider SV2” (page 78)

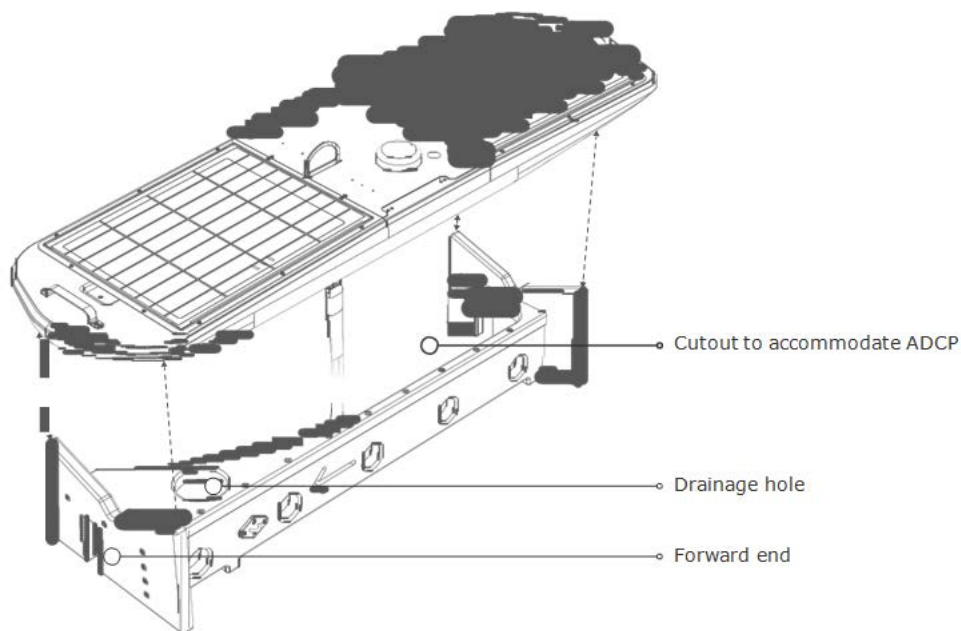
Placing the Float on the ADCP Compatible Float-Glider Saddle

Before You Begin

In order to accommodate and protect the ADCP when the Wave Glider SV2 is not in the water the float must be installed on an ADCP compatible float-glider saddle (Liquid Robotic P/N 00231). The ADCP float-glider saddle ships with the Wave Glider SV2. Note that there are some older saddles which are not compatible.

Description of Work

1. Place the Glider on the support stand as instructed in the LRI *Wave Glider SV2 Unpacking and Assembly Guide*.
2. Place the ADCP float-glider saddle on the glider, following the instructions in the LRI *Wave Glider SV2 Unpacking and Assembly Guide*.
3. Place the Float on the ADCP float-glider saddle as instructed in the LRI *Wave Glider SV2 Unpacking and Assembly Guide*.

Figure 10.1. ADCP Float-Glider Saddle

This completes the procedure for using the ADCP compatible float-glider saddle.

Removing the Turtle Deck

Before You Begin

Ensure that the float is installed on an ADCP compatible float-glider saddle.



Note

For detailed instructions, see [“Placing the Float on the ADCP Compatible Float-Glider Saddle”](#) (page 63).



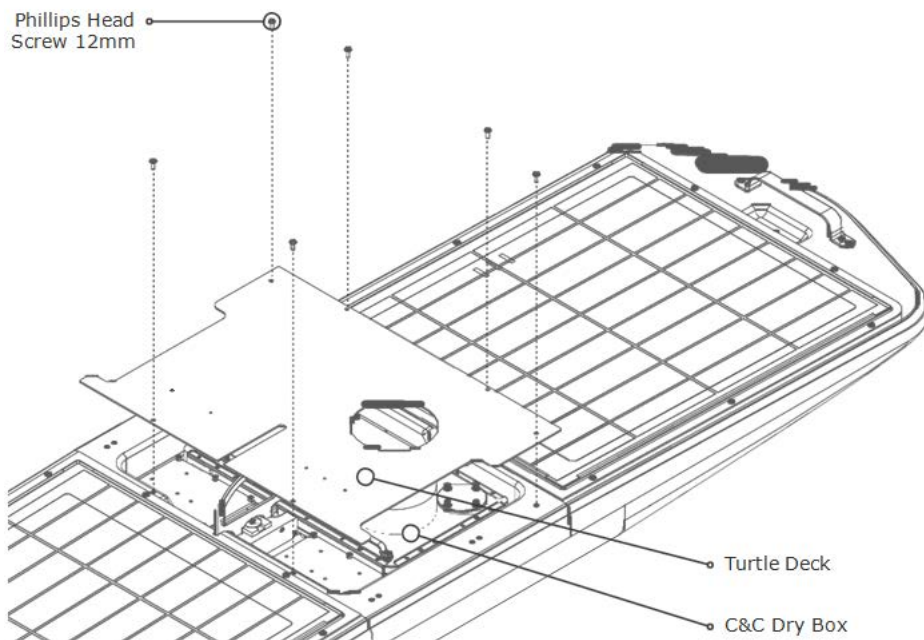
Warning

Before working on the Wave Glider SV2, make sure that you have powered off the vehicle by disconnecting the shorting plug from the battery switch on the C&C dry box.

Description of Work

1. Remove the six (6) screws securing the turtle deck.

Figure 10.2. Removing the Turtle Deck Screws



2. Remove the turtle deck to expose the C&C dry box.

This completes the procedure for removing the turtle deck.

Removing the Aft Solar Panel

Before You Begin

To remove the aft solar panel, the turtle deck must be removed so that you can access the C&C dry box.



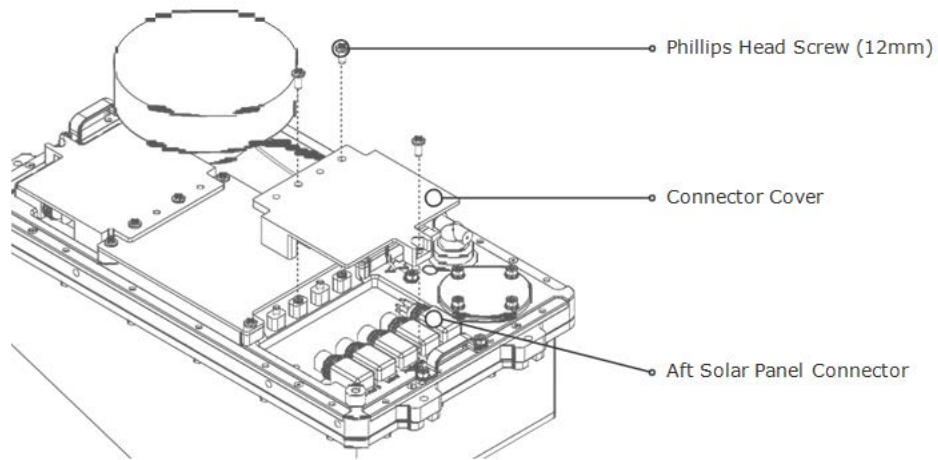
Note

For detailed instructions, see [“Removing the Turtle Deck” \(page 64\)](#)

Description of Work

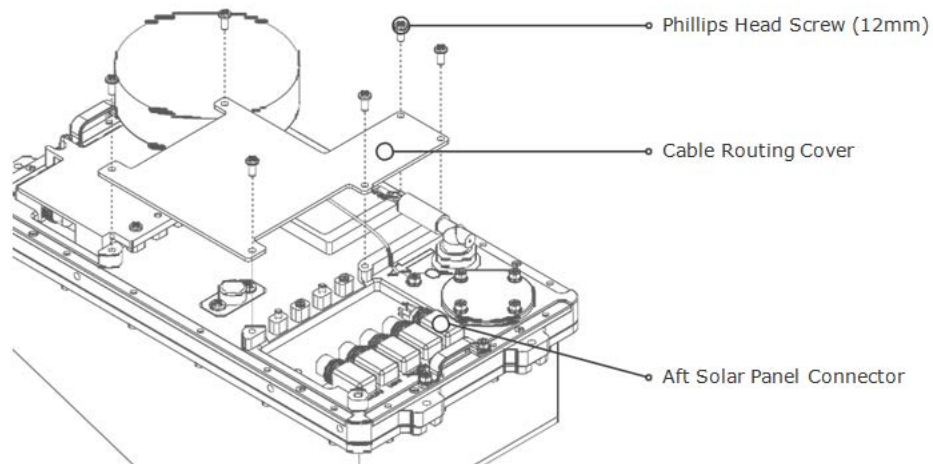
1. Remove the three (3) screws securing the left side connector cover to the C&C dry box, and remove the cover to access the solar panel cable connector.

Figure 10.3. Removing the Connector Cover from the C&C Dry Box



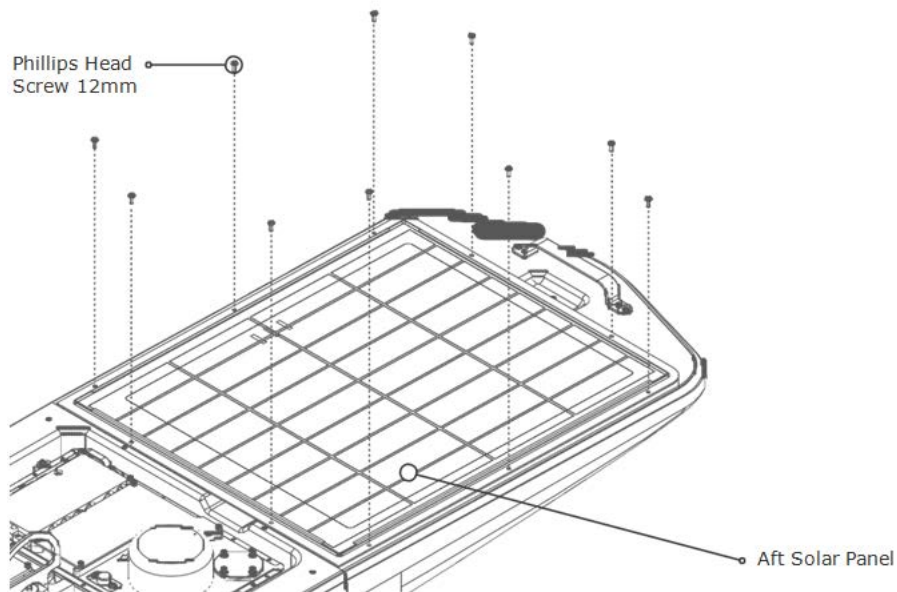
2. Remove the six (6) screws securing the center cable routing cover to the dry box, and remove the cover. Phillips Head Screw (12mm) Cable Routing Cover Aft Solar Panel Connector

Figure 10.4. Removing the Cable Routing Cover from the C&C Dry Box



3. Disconnect the aft solar panel cable from the SOLAR 1 AFT connector on the C&C dry box.
4. Remove the eight (8) screws securing the aft solar panel.

Figure 10.5. ADCP Mounted in Aft Payload Bay (top view)



Warning

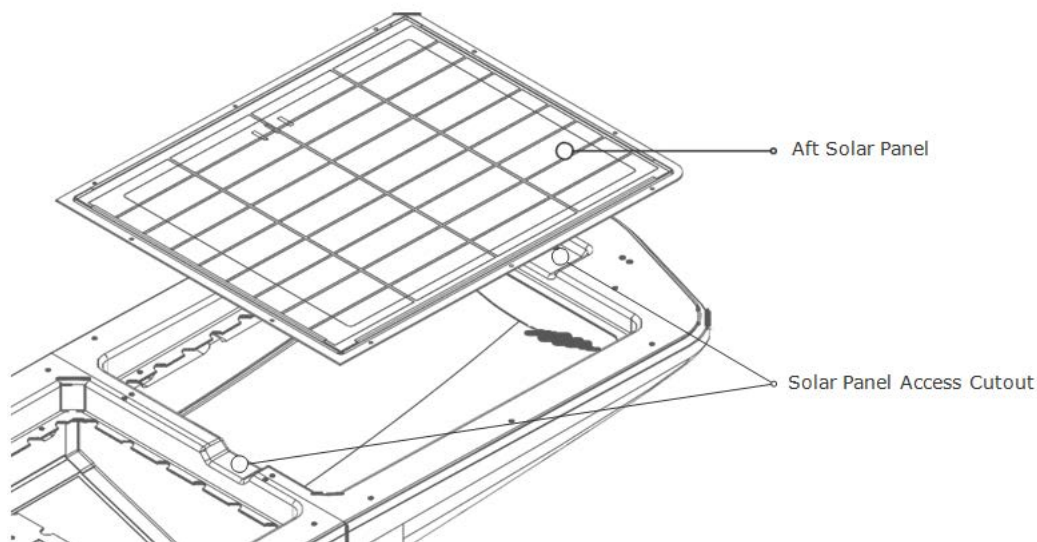
Handle the solar panel with care. Bending a solar panel during removal or installation can cause damage.

5. Grasping the assembly from both ends, gently lift the solar panel off of the float and place it on a smooth, level surface where it will not get damaged.



Note

There are cutouts in the float at the front and back of the solar panel which allow you to access the panel for easy removal.

Figure 10.6. ADCP Mounted in Aft Payload Bay (top view)

This completes the procedure for removing the aft solar panel.

Disconnecting the ADCP Payload

Before You Begin

To remove the ADCP payload, the turtle deck must be removed so you can access the C&C dry box and the aft solar panel must be removed so you can access the aft payload bay.



Note

For detailed instructions, see [“Removing the Turtle Deck” \(page 64\)](#) and [“Removing the Aft Solar Panel” \(page 65\)](#).

The ADCP is connected to the C&C by two cables. The cables must be disconnected prior to ADCP troubleshooting or removal.

- **ADCP cable:** - connects the ADCP End Cap to the Payload Dry Box.
- **ADCP comms cable:** - connects the Payload Dry Box to the C&C Dry Box.

Description of Work

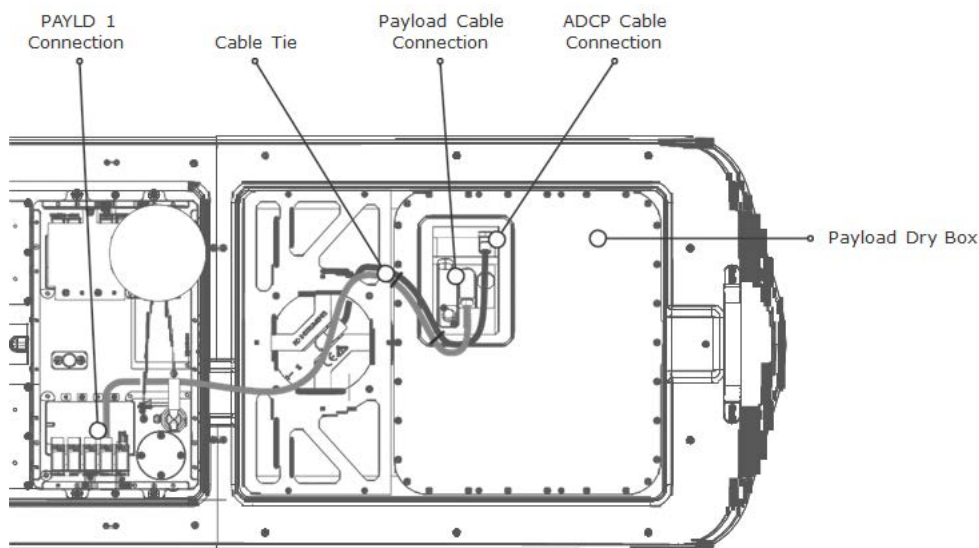
1. Disconnect any cable ties.
2. Disconnect the C&C dry box end of the ADCP comms cable from the PAYLD1 connector on the C&C dry box.
3. Disconnect the payload end of the ADCP cable from the connector on the payload dry box.



Warning

Do not apply any upward, downward, or side-to-side force on the end-cap connector as the cable is being disconnected. Stressing the end-cap connector may cause damage to the ADCP.

Figure 10.7. ADCP Payload and Assembly Cable Routing



Removing the ADCP Payload Dry Box

Before You Begin

To remove the ADCP payload dry box, the ADCP payload must be disconnected.



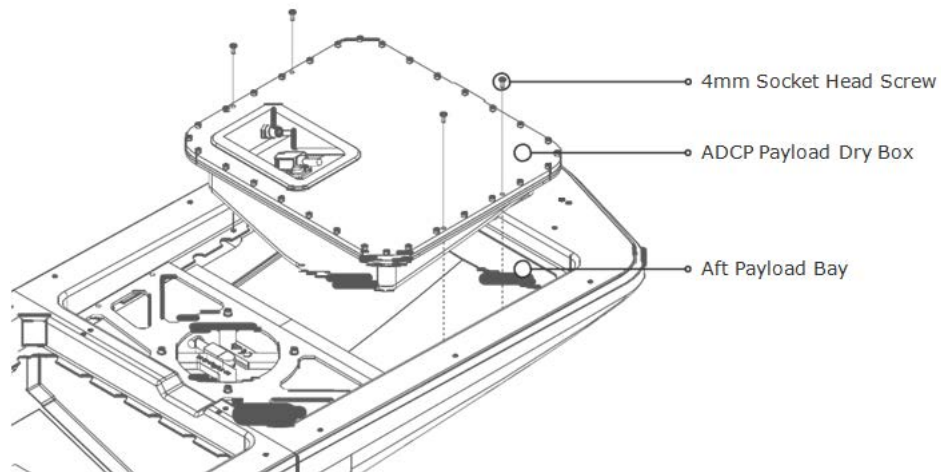
Note

For detailed instructions, see [“Disconnecting the ADCP Payload” \(page 68\)](#).

Description of Work

1. Loosen and remove the four (4) screws attaching the payload dry box to the mounting rail.
2. Gently lift the payload dry box from the aft payload bay.

Figure 10.8. Lowering the ADCP Assembly into the Aft Payload Bay



The ADCP payload dry box is now removed.

Removing the ADCP Assembly

Before You Begin

To remove the ADCP assembly, the ADCP payload dry box must be removed.

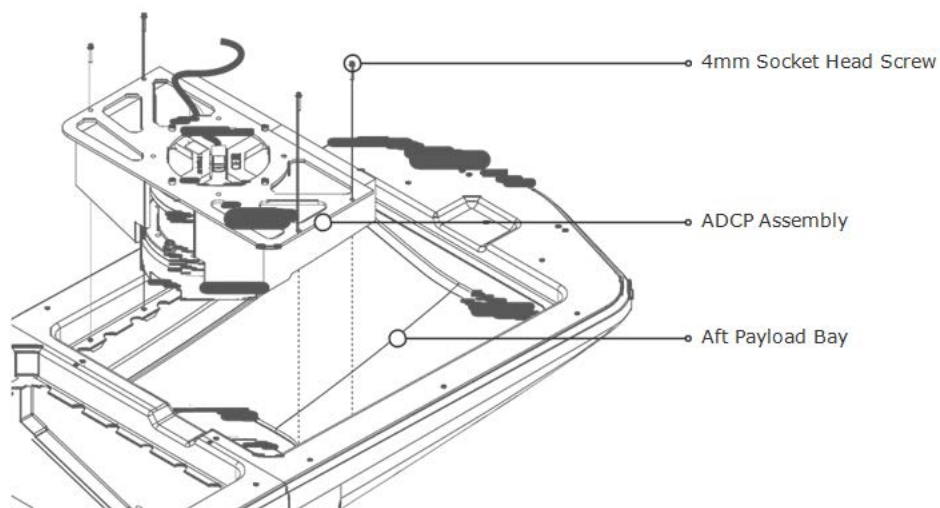


Note

For detailed instructions, see [“Removing the ADCP Payload Dry Box”](#) (page 69).

Description of Work

1. Loosen and remove the four screws attaching the ADCP assembly to the mounting rail.

Figure 10.9. Lifting the ADCP Assembly out of the Aft Payload Bay

2. Lift the ADCP assembly out of the aft payload bay.

The ADCP assembly is now removed from the aft payload bay.

Preparing the ADCP Assembly

Before You Begin

The ADCP assembly consists of the Workhorse ADCP, a foam insert, and a mounting bracket. This procedure describes how these pieces are assembled prior to installation.



Note

For information about installing the ADCP assembly, see [“Installing the ADCP Assembly” \(page 72\)](#).

Make sure you have a clean, smooth work surface, and always protect the ADCP from scratching or other damage.

Description of Work

1. Place the ADCP face down on a soft clean surface, making sure that the face of the ADCP is protected from scratching.



Warning

Do not apply any upward, downward, or side-to-side force on the end-cap connector as the cable is being connected. Stressing the end-cap connector may cause damage to the ADCP.

2. Connect the ADCP cable to the connector on the ADCP. To connect the cable, lightly lubricate the connectors with silicone spray lubricant, and push the cable end connector onto the end-cap connector. When the cable is fully connected, loop the retaining strap around the connector to secure the connection.

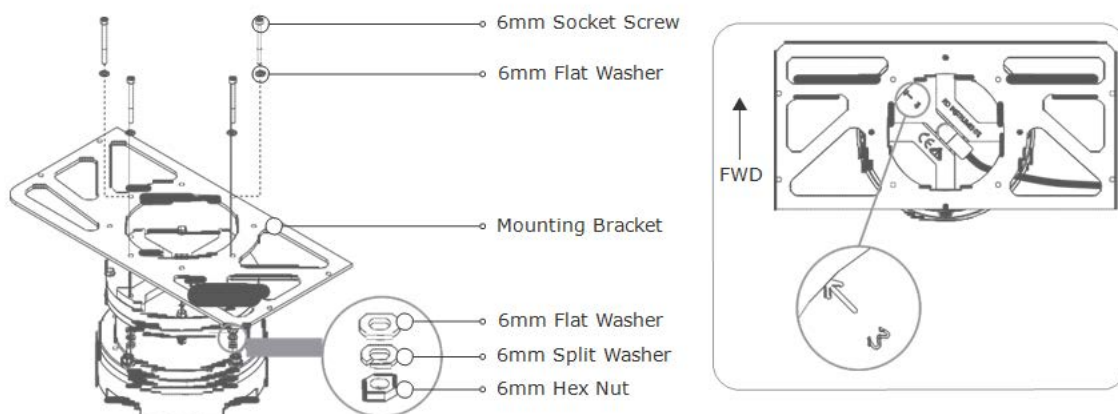
- Place the mounting bracket on top of the ADCP and fasten it using the four (4) 6mm socket screws, washers, and hex nuts as shown in the figure below.



Note

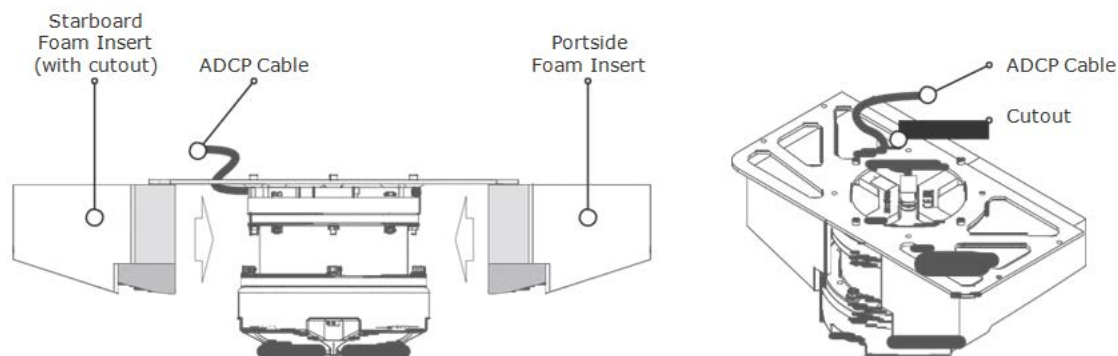
The ADCP must be installed in the correct orientation. The “3” mark must be pointing to a position -45° from the vertical (as viewed from above), and the rounded corners of the mounting bracket must be facing forward, as shown in the figure below.

Figure 10.10. Attaching the ADCP Mounting Bracket



- Slide the foam inserts under the bracket on either side of the ADCP, making sure that the ADCP cable is routed through the cutout in the foam and up through the bracket as shown below.

Figure 10.11. Installing Foam Insert on ADCP



The ADCP assembly is now ready to be installed in the aft payload bay.

Installing the ADCP Assembly

Before You Begin

Ensure that the ADCP assembly is properly prepared for installation.



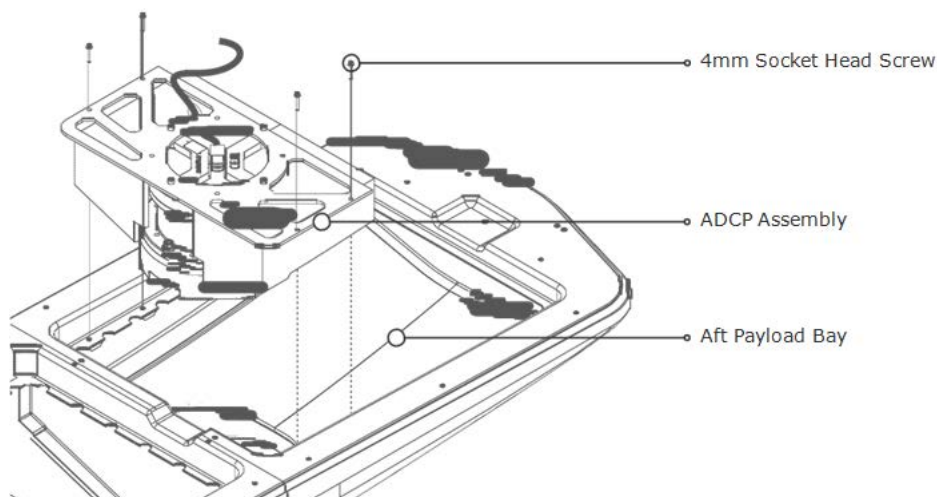
Note

For detailed information about preparing the ADCP assembly, see [“Preparing the ADCP Assembly” \(page 71\)](#).

Description of Work

1. Gently lower the ADCP assembly into the front of the aft payload bay, taking care not to damage the ADCP head. The assembly is correctly in place when the outside edges of the mounting bracket rest on the mounting rail in the payload bay.

Figure 10.12. Lowering the ADCP Assembly into the Aft Payload Bay



2. Align the four screw holes in the mounting bracket with the holes in the mounting rail.
3. Secure the assembly with four (4) screws. LRI recommend using a light coating of Loctite 242 (blue) on the screw heads.

The ADCP assembly is now installed.

Installing the ADCP Payload Dry Box

Before You Begin

The ADCP payload dry box is installed partially on top of the ADCP assembly. Thus the ADCP assembly must be properly installed prior to performing this procedure.



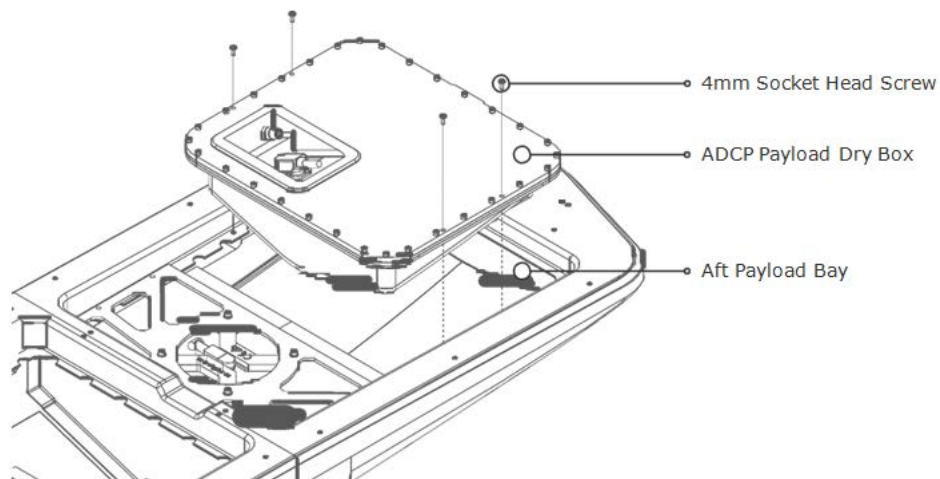
Note

For detailed information about installing the ADCP assembly, see [“Installing the ADCP Assembly” \(page 72\)](#).

Description of Work

1. Gently lower the payload dry box into the aft payload bay, behind the ADCP assembly. The dry box is correctly in place when the outside edges of the lid rest on the mounting rail in the payload bay, and the forward edge overlaps the foam insert in the ADCP assembly.

Figure 10.13. Lowering the ADCP Payload Dry Box into the Aft Payload Bay



2. Make sure that the screw holes in the dry box lid are aligned with the holes in the mounting rail.
3. Secure the assembly with the four (4) screws. LRI recommends using a light coating of Loctite 242 (blue) on the screw threads.

The ADCP payload dry box is now installed.

Connecting the ADCP Payload

Before You Begin

The ADCP connections are as follows:

- **ADCP cable:** - connects the ADCP End Cap to Payload Dry Box.
- **ADCP comms cable:** - connects the Payload Dry Box to the C&C Dry Box.

Description of Work

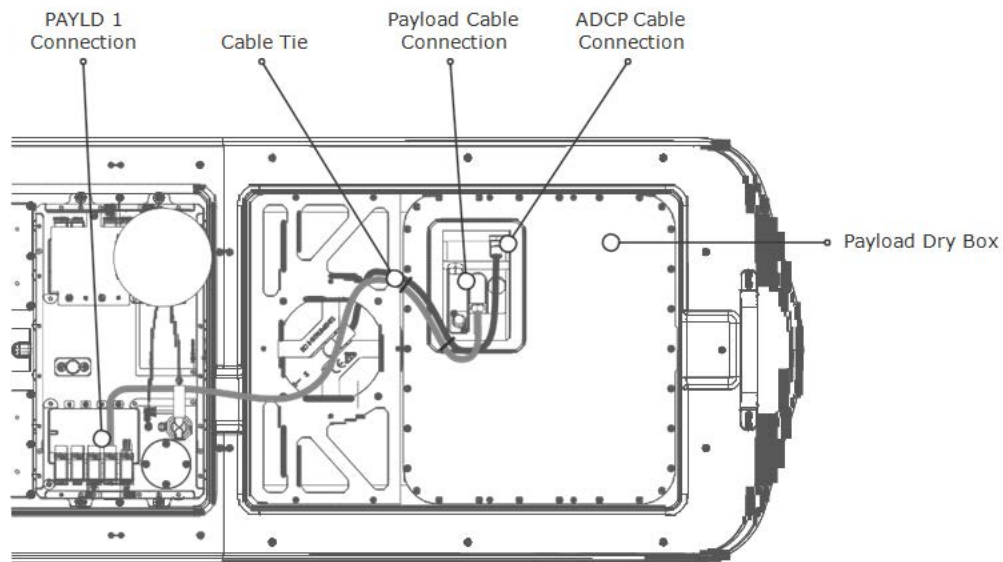
1. Connect the payload end of the ADCP cable to the connector on the payload dry box. To connect the cable, lightly lubricate both connectors with silicone spray lubricant, and push the cable end connector onto the dry box connector. Secure the cable by turning the locking collar clockwise finger-tight.
2. Connect the C&C dry box end of the ADCP comms cable to the PAYLD 1 connector on the C&C dry box. To connect the cable, lightly lubricate both connectors with silicone spray lubricant, and push the cable end connector onto the dry box connector. Secure the cable by turning the locking collar clockwise finger-tight.
3. Route the cables as shown in the figure below, taking care to keep the cables as flat to the lid of the dry box and the ADCP mounting bracket as possible to avoid interference with the solar panel and solar panel cable. Also make sure to route the cables around any protruding screws or bolts, and away from sharp edges.

4. Secure the cables to each other using two cable ties.

**Note**

When you attach the cable ties, make sure that the locking end of the tie is neither on top nor under the cables, to avoid interference with the solar panel.

Figure 10.14. ADCP Payload and Assembly Cable Routing



The ADCP payload is now connected.

Installing the Aft Solar Panel

Before You Begin

To install the aft solar panel, the turtle deck must be removed so that you can access the C&C dry box.

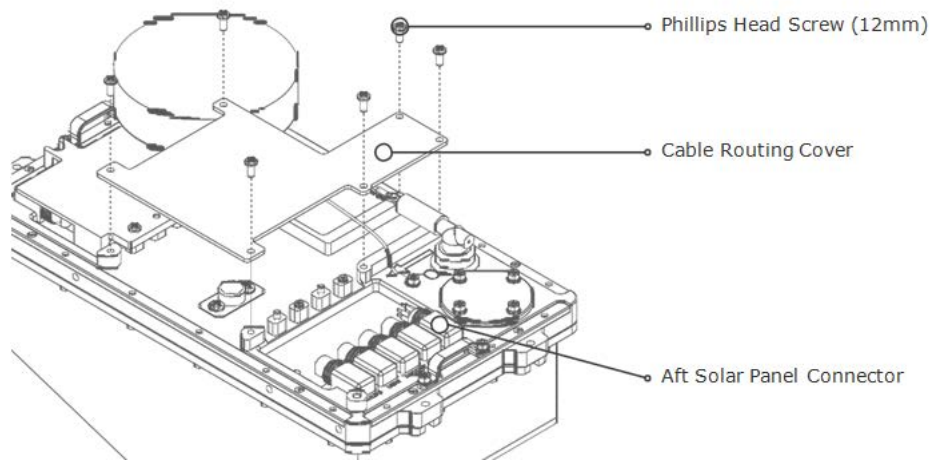
**Note**

For detailed instructions, see [“Removing the Turtle Deck”](#) (page 64).

Description of Work

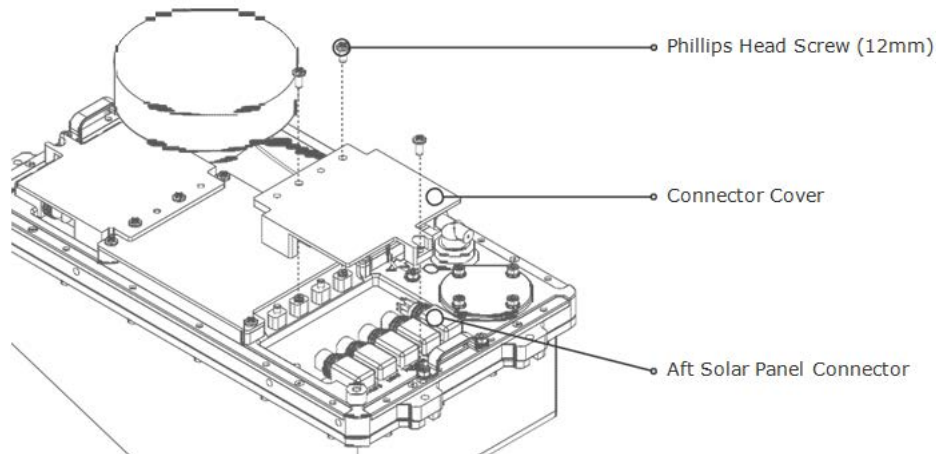
1. Connect the aft solar panel cable to the SOLAR 1 AFT connector on the C&C dry box.
2. Install the center cable routing cover and secure it with the six 12mm phillips head screws.

Figure 10.15. Installing the Cable Routing Cover on the C&C Dry Box



3. Install the left side connector cover on the C&C dry box and secure it with three 12mm phillips head screws.

Figure 10.16. Installing the Connector Cover on the C&C Dry Box

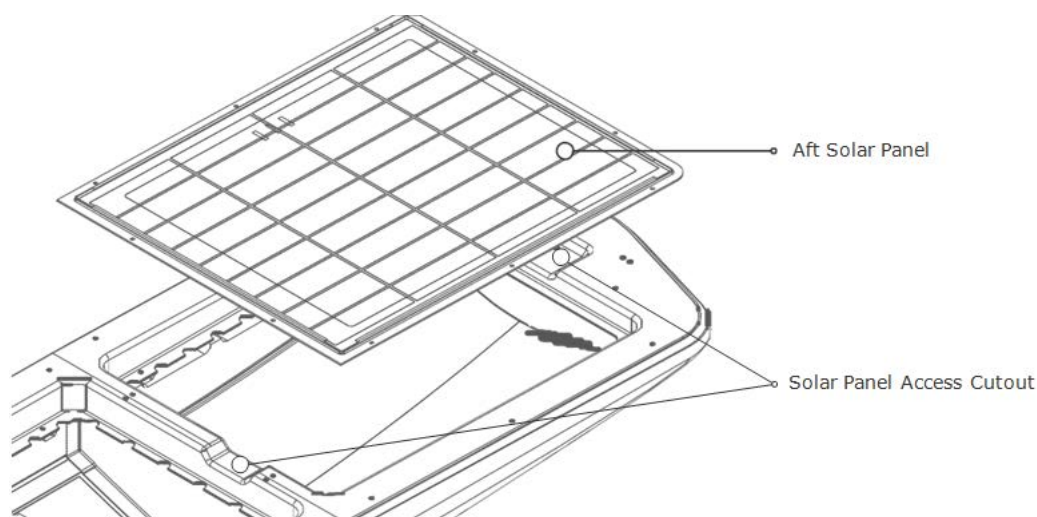


Warning

Handle the solar panel with care. Bending a solar panel during removal or installation can cause damage.

4. Gently lower the solar panel in place, making sure not to pinch the solar panel cable in the process. The cable must be routed through the cutout at the forward end of the aft payload bay.

Figure 10.17. Installing the Aft Solar Panel



5. Secure the solar panel with eight 12mm phillips head screws.

This completes the procedure for installing the aft solar panel.

Installing the Turtle Deck

Before You Begin



Warning

Before working on the Wave Glider SV2 system, make sure that you have powered off the vehicle by disconnecting the shorting plug from the battery switch on the C&C dry box.

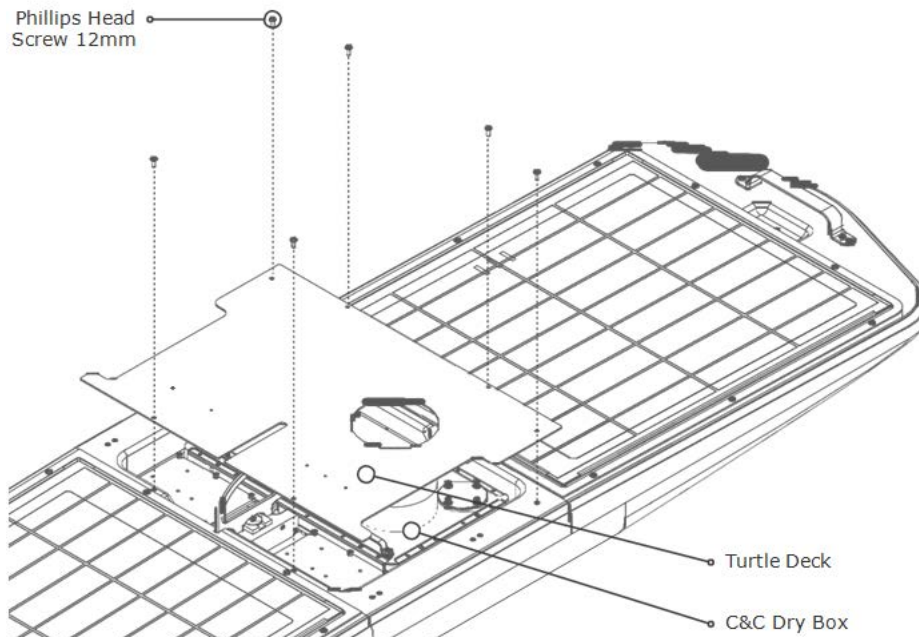
Description of Work

1. Install the turtle deck and secure it with six 12 mm phillips head screws.



Note

Depending upon your vehicle configuration, you may have to uninstall antennas or other components in order to install the turtle deck.

Figure 10.18. Installing the Turtle Deck Screws

This completes the procedure for installing the turtle deck.

Checking the Operation of the ADCP in a Wave Glider SV2

Before You Begin

You must perform the testing procedures described in the *Testing the Workhorse* chapter of the Teledyne RDI *Workhorse Monitor Technical Manual* on the ADCP, before the ADCP is installed and tested in a Wave Glider SV2. If any issues come to your attention during this testing, see the *Troubleshooting* chapter in the Teledyne RDI *Workhorse Monitor Technical Manual*.

Description of Work

1. Follow the instructions in the LRI *Wave Glider User Manual* to power up the Wave Glider.
2. Start the ADCP pinging by sending it the **ADCP --ping** command. Listen for audible "chirping" or "pinging".
3. Confirm that WHAM is running by sending it the **WHAM --Status** command. The WHAM will return the current state of the ADCP.
4. If the ADCP does not ping or return the ADCP status, follow the instructions in [Chapter 8: Troubleshooting](#).

Appendix A. LRI "WHAM" Commands

This appendix references the "WHAM" commands developed by LRI for configuring and managing a Wave Glider integrated Teledyne RDI Workhorse Monitor ADCP.

Commands are listed in alphabetical order.

Commands and parameters are not case sensitive, except where noted as file names or path names.

Table A.1. Command Syntax

Bold	Bold items in the command syntax must entered.
<i>Italic</i>	Italic items in the syntax are place holders for information that you must include when you enter the command. Italic items are not to be taken literally - do not include them when you enter a command.
Vertical Bar " "	Vertical bars (also known as "pipes") are used to separate the short form and the long form of commands, or to separate various command options. Vertical bars are not to be taken literally - do not include them when you enter a command.
[Text inside Brackets]	Any items inside brackets are optional. Brackets are not to be taken literally - do not include them when you enter a command.
Nested Brackets [x[y]]	A bracketed item within a set of brackets [y] is optional, but cannot be executed unless the optional item in the outer set of brackets [x] is executed.
S p a c e s	All spaces should be taken literally. If a command's syntax has a space, use that space when entering the command.
EXAMPLES:	
The syntax for the WHAM exit command is: WHAM -x --exit	
The short form of the command is: WHAM -x The long form is: WHAM --exit	
The syntax for the ADCP correction command is: ADCP -c --correction <i>MotionCorrectionType</i>	
One of six single digit motion correction type codes (0,1,2,3,4,5) must be entered. The short form of the ADCP correction command for motion correction type 3 is: ADCP -c 3	
The syntax for the ADCP ping command is: ADCP -p --ping [<i>time</i> [<i>duration</i>]]	
The <i>time</i> option can be executed independent of the <i>duration</i> option, but the <i>duration</i> option cannot be executed unless the <i>time</i> option is also executed. The long form of the ADCP ping command with the <u>option</u> to delay start time by 8 seconds and continue pinging for 30 seconds is: ADCP --ping 8 30	

The syntax for the EXPORT command is:

EXPORT -b | --bathymetry | -e | --ensemble | -h | --header | -s | --stop

Only one of the four short or long form command options can be used.

The long form of the EXPORT command to export ensembles is: **EXPORT --ensemble** The short form of the EXPORT command to export bathymetry is: **EXPORT -b**

Upon receiving any command, WHAM responds with a text message indicating the operation it was performing when it received the new command. This primarily serves as an acknowledgment that the command was received. **WHAM --status** will return the current state of the ADCP without changing that state. ADCP state was ADCP_STANDBY and ADCP state was ADCP_PING-AND_READ_ENSEMBLES are the most common responses.

ADCP --cmd

Syntax

ADCP --cmd *adcp_command_string* | BREAK

Summary

Sends the *adcp_command_string* or a BREAK directly to the ADCP.

Semantics

The *adcp_command_string*, terminated with a <CR>, is sent to the ADCP.

Notes

The **CS** command initiates the actions noted above for ADCP -p | --ping.

Presently, the set baud rate command (CBnnn), is not sent to the ADCP to prevent serial communications failure with the SMC.

ADCP --correction

Syntax

ADCP -c | --correction *MotionCorrectionType*

Summary

Selects the type of vehicle motion correction (reference velocity adjustment) to be performed on the currents data for each bin in the ensemble.

Semantics

The different motion correction type options are:

- 0 : None
- 1 : Delta Position (GPS_GGA_1STLAST)
- 2 : Average Speed/Dir (GPS_VTG)

3 : Speed/Dir Made Good (GPS_GGA)
4 : Bottom Track
5 : Water Track

The default motion correction type set by WHAM at startup is 0 : None - it is specified by the xml key **<i>EnsMotionCorrectionType</i>** in the configuration xml file. See [Appendix B: Configuration Files](#) for more information.

ADCP --off

Syntax

ADCP --off

Summary

Sets the ADCP's power supply switch on the SMC board to the OFF state.

Semantics

Implement the ADCP stop sequence as described in "[ADCP --stop](#)" (page 84).

The power *off* verb, specified in the configuration xml file, is executed via a system call.

Notes

Issuing this command results in the ADCP aborting any pinging in progress.

An **ADCP --on** command must be sent prior to any subsequent ADCP actions.

WHAM performs this ADCP *off* sequence upon program exit/shutdown.

ADCP --on

Syntax

ADCP --on

Summary

Sets the ADCP's power supply switch on the SMC board to the ON state.

Semantics

The *on* verb, specified in the configuration xml file, is executed via a system call.

Notes

WHAM performs this ADCP *on* sequence at program startup.

ADCP --output

Syntax

ADCP -o | --output pathname**Summary**

Directs WHAM to append processed PD0 ensembles received from the ADCP to the file located at *pathname*.

Semantics

The currently active output file, if any, is closed.

If *pathname* already exists, ensembles will be appended. If the output file does not exist, it will be created.

Notes

pathname may be relative or fully qualified. *pathname* is case sensitive. *pathname* is a required parameter. By convention, PD0 ensembles are stored in a user partition at /mnt/XDATA/<user selected directory>. The user is responsible for ensuring that the specified directory exists – WHAM cannot create it for you.

ADCP --ping

Syntax

ADCP -p | --ping [*time* [*duration*]]

Summary

Starts the ADCP ping and generating PD0 ensembles, per its currently loaded configuration. The start will be delayed by *time* (seconds), if specified, and the ping will continue for *duration* (seconds), if specified.

Semantics

Send the start ping (CS) command to the ADCP. The ADCP will use its currently specified configuration.

Start receiving PD0 format ensembles and storing processed ensembles into the currently active ADCP output file.

Notes

PING is different from RUN. RUN specifies the ADCP configuration file to execute, whereas PING simply sends the CS command, to start the ADCP ping and generating data as per the configuration specified by the last **ADCP --run configFile**.

time specifies the time in seconds, between 0 and 2147483647, prior to implementing this command. *time* is an optional parameter.

duration specifies the time in seconds, between 0 and 2147483647, to continue ping and then stop. The duration is measured after the ping has started. *duration* is an optional parameter, but it must be specified *after* the time parameter. For example, **ADCP -p 0 300** will start ping immediately and stop after 300 seconds duration, whereas **ADCP -p 300** will start ping after 300 seconds and continue ping until stopped by some other command or action..

ADCP --run

Syntax

ADCP -r | --run [*pathname*]

Summary

Directs WHAM to run an ADCP configuration file. If *pathname* is not provided, WHAM uses the one that was most recently specified.

Semantics

Send an RS232 Break to wake up or abort pinging and data collection on the ADCP.

If *pathname* is specified, the command sets it as the most recently specified ADCP configuration file.

Attempt to open the most recently specified ADCP configuration file and go into Standby mode if this attempt fails.

Run the script file until either a **CS** (start pinging) command is sent or the end-of-file (EOF) is reached. Note that script files have the effect of configuring the ADCP. If a CK command is specified, that configuration is preserved in the ADCP until it is overwritten, even through power cycles on the ADCP.

If EOF on the ADCP configuration file is reached, close the script file and go into Standby mode.

If a **CS** command (start pinging) is sent, the ADCP configuration file is closed (ignoring any additional commands) and the ADCP starts receiving and processing PD0 ensembles.

Notes

pathname may be relative or fully qualified within the SMC file system. *pathname* is case sensitive. If *pathname* is not specified, then the most recently specified file is used. By convention, configuration files are stored in /home/smc/roots/200_ADCP/.

ADCP --start

Syntax

ADCP --start *latitude longitude* [*duration*]

Summary

Starts the ADCP pinging and generating ensembles, as per its currently loaded configuration, when the vehicle reaches the location specified by *latitude* and *longitude*. The pinging will continue for *duration* seconds, if specified.

Semantics

Iteratively check the Wave Glider GPS until the Wave Glider is within 5m of the location specified by *latitude* and *longitude*.

Send the start pinging (**CS**) command to the ADCP. This will use the currently loaded ADCP configuration.

Start receiving PD0 ensembles and storing processed ensembles into the currently active ADCP output file.

Notes

latitude is specified in decimal degrees, between -90.0 and 90.0.

longitude is specified in decimal degrees, between -180.0 and 180.0.

duration specifies the time in seconds, between 0 and 2147483647, to continue pinging and then stop. The duration is measured after the pinging has started. *duration* is an optional parameter.

The **ADCP --start** command parameters cannot be maintained after the SMC and/or WHAM application is powered off, or restarted. After the SMC and/or WHAM application is powered off, the **ADCP --start** command must be re-issued.

ADCP --stop

Syntax

ADCP -s | --stop [*duration*]

Summary

Abort ADCP pinging and data collection and put the ADCP into standby mode, after *duration* seconds, or immediately if *duration* = 0 or if *duration* is not specified.

Semantics

Send an RS232 Break to abort pinging and data collection on the ADCP.

Put the ADCP into command mode to ensure that it does not re-awaken in Ping mode.

Send the Power down / sleep command (CZ) to the ADCP.

Go into Standby mode.

Notes

duration specifies the time in seconds, between 0 and 2147483647, prior to implementing this command. *duration* is an optional parameter.

EXPORT

Syntax

EXPORT -b | --bathymetry | -e | --ensemble | -h | --header | -s | --stop [*m*]

EXPORT -c2 | -c4 [*m*][*v*]]

Summary

Sets the export type, initializes counters and starts the export of selected data from WHAM.

Semantics

Data in the indicated format is sent to the SMC event manager. Note that this data is the export sample data only - it does not include the extended sensor report record parameters that are added by the `PayloadInterface` when it constructs the shore-bound message.

`-b --bathymetry` Directs WHAM to export data in the compressed binary bathymetry format as described in ["Compressed Bathymetry Data" \(page 15\)](#).

`-e --ensemble` Directs WHAM to export the entire PD0 ensemble exactly as it was written to the ADCP Output file.

`-h --header` Directs WHAM to export the fixed and variable header segments of the selected data ensemble. The data is exported in Teledyne RDI format, starting with the Fixed Leader Data Format ID bytes and ending with the last byte of the Variable Leader Data bytes (RTC Hundredth).

`-s --stop` Stops the export of the currently specified data samples. A new **EXPORT** command must be issued to restart the export of any data sample type.

m is an optional parameter that specifies a count of the number of data samples to export. *m* defaults to 1.

`-c2` Directs WHAM to export the currents data from the PD0 ensemble in the compressed binary currents format that reports just East and North components per bin, as described in ["Compressed Currents Data" \(page 17\)](#).

`-c4` Directs WHAM to export the currents data from the PD0 ensemble in the compressed binary currents format that reports East, North, Up and error components per bin, as described in ["Compressed Currents Data" \(page 17\)](#).

v is an optional parameter that specifies the type of vehicle motion correction (reference velocity adjustment) to be performed on the north and east components of the currents data being exported in the *c2* and *c4* samples. The different types of vehicle motion correction are:

- 0 : None
- 1 : Delta Position (GPS_GGA_1STLAST)
- 2 : Average Speed/Dir (GPS_VTG)
- 3 : Speed/Dir Made Good (GPS_GGA)
- 4 : Bottom Track
- 5 : Water Track

The default, if you do not specify a value for the *v* option, is 1 : Delta Position (GPS_GGA_1STLAST) - it is specified by the xml key **<iC2MotionCorrectionType>** in the configuration xml file.

`-o --output pathname` Directs WHAM to append the exported samples, in the compressed samples format specified, to the file located at *pathname*. If *pathname* already exists, samples will be appended. If it does not exist, it will be created. *pathname* may be relative or fully qualified. *pathname* is case sensitive. *pathname* is a required parameter for the `-o | --output`. The ADCP operator is responsible for ensuring that the directory exists – WHAM cannot create it for you.

Notes

The export types are mutually exclusive - only one can be active at any time. By convention, output files are stored in a user partition at /mnt/XDATA/<user selected directory>.

SELECT

Syntax

SELECT [-t | --time | -s | --samples | -d | --distance] [n]

Summary

The SELECT command directs WHAM to select samples from the ADCP's data stream for further processing. It is used together with the EXPORT command to subsample the data stream from the ADCP. In effect, the SELECT command creates a filter and the EXPORT command executes it.

Semantics

WHAM, like other sensor managers, tags ensembles sent by the ADCP with GPS-derived latitude, longitude and timestamp. It stores those ensembles in the local file system in the file specified by the ADCP output command. The SELECT command directs WHAM to also filter that data stream for further processing.

The *time*, *sample* counts and *distance* settings are initialized to the first sample received after the EXPORT command is executed.

n is an integer which is interpreted in the context of the type option. The default type option is -s (samples) and the default value for *n* is 1. Consequently, the default value of the select variable is to select every sample.

-t, --time - The parameter, *n*, sets a "tick" rate for a clock measured in seconds. The clock is initialized to zero by WHAM on receipt of the EXPORT command. The selected sample is the first one after the tick. For example, if *n* is 5, there will be ticks at zero, 5, 10, 15, 20 and so forth. If PD0 ensembles are generated every second and *n* is 5, every fifth sample will be selected. If PD0 ensembles are generated every three seconds and *n* is 5, the sample selected will be the one at the 6th second, the one at the 12th second, the one at the 15th second, the one at the 21st second and so forth. If one ensemble is generated every sixty seconds and *n* is 1, every ensemble will be selected as a sample to be exported. In that case, only one ensemble will be selected even though sixty seconds passed. No ensemble is selected more than once even if multiple ticks intervene.

-s, --samples - This parameter specifies that the selected ensemble is the one that is *n* ensembles after the previously selected sample. For example, if *n* is 2, every second data ensemble from the ADCP will be selected for further processing.

-d, --distance - Analogous to the time parameter, the parameter *n* sets a "tick" rate for an odometer measured in meters. The odometer is initialized to zero by WHAM on receipt of the EXPORT command. The selected ensemble is the first one after the odometer passes a tick. For example, if *n* is 100, the selected data ensemble will be the first one after the odometer passes 100, 200, 300 and so forth. The distance travelled is calculated using the GPS data that WHAM uses to generate the NAV data block in the PD0 ensemble.

Examples

SELECT selects the next ensemble after the EXPORT command is processed.

SELECT -t 10 selects the next ensemble after the EXPORT command is processed and uses its timestamp as the zero reference. It then selects the next ensemble after every 10 seconds.

SELECT -d 50 selects the next ensemble after the EXPORT command is processed and uses its latitude and longitude as the zero reference point. It then selects the next ensemble after every 50 meters.

START

Syntax

START

Summary

For executing a pre-defined system script/application for configuring the ADCP, specifying any SELECT/EXPORT and starting the data collection. The script/application name is specified by the xml key <StartScript> in the configuration xml file.

STOP

Syntax

STOP

Summary

For executing a pre-defined system script/application to stop the ADCP, data collection and EXPORTs. The script/application name is specified by the xml key <StopScript> in the configuration xml file.

TEST

Syntax

TEST

Summary

For executing a pre-defined system script/application for testing the ADCP. The script/application name is specified by the xml key <TestScript> in the configuration xml file.

WHAM --exit

Syntax

WHAM -x | --exit

Summary

Puts ADCP into quiescent mode and terminates the WHAM application.

Semantics

WHAM executes an ADCP `--stop`, which stops the ADCP from pinging and puts it into standby mode, where it will go into low power sleep mode.

Once the ADCP has stopped, WHAM closes all open files, unregisters any events it has set with the event manager, closes the ADCP serial port and exits.

Notes

WHAM variables, such as the report rate, are persistent only through a session and thus must be re-specified when a new WHAM instance is launched.

WHAM --run

Syntax

WHAM -r | --run *pathname*

Summary

Directs WHAM to execute the commands in the script file *pathname*.

Semantics

pathname is a script to be executed by WHAM's command interpreter.

WHAM immediately opens the script file (*pathname*) and executes commands in it until it either reaches end-of-file (EOF) or encounters a command it cannot parse. *pathname* not being readable (i.e., permissions problem or doesn't exist) is an error and will be treated as an immediate EOF.

Notes

pathname may be relative or fully qualified. *pathname* is case sensitive. *pathname* is a required parameter. By convention, script files are stored in `/home/smc/roots/200_ADCP`.

WHAM --status

Syntax

WHAM -s | --status

Summary

Directs WHAM to return the current state of the WHAM state machine.

Semantics

WHAM returns the state of the ADCP.

Appendix B. Configuration Files

This appendix provides typical configuration files for the ADCP.

Communications Options

WHAM can communicate with ADCPs that are directly connected via an RS-232 serial port, as well as ADCPs that are indirectly connected via a Benthos modem. Many low-level configuration parameters are configured via an XML file stored on the SMC at /home/smc/roots/200_ADCP/ADCPSensor-config.xml. This file also contains several default values which generally are overridden by specific commands.

Frequently Modified XML Keys

XML Keys for Controlling the Power Supply to the ADCP:

<powerOnVerb> — Set to default power switch 3, blank for legacy H/W with no ADCP power switching. The factory standard port for the ADCP (i.e., the High Voltage Board which services the ADCP) is switch 3 on the SMC. If you use a different port or power the ADCP through some other means, you must change this value.

<powerOffVerb> — Set to default power switch 3, blank for legacy H/W with no ADCP power switching.

XML Keys for RS232 Communications with the ADCP:

<ADCPserialPort> — Set to default /dev/ttyLX2. This corresponds to a particular connector on the SMC. If you choose to use a different connector, you must change this value accordingly.

<ADCPserialPortMode> — Set to default 811, as per Teledyne Teledyne RDI's ADCP CB command (CB=811 is 115200 baud, 8 bits, 1 stop bit, no parity).

<ModemBreakCommand> — Set to blank.

<ModemConnectCommand> — Set to blank.

<ModemServerName> — Set to blank.

XML Keys for Benthos Modem Communications with the ADCP:

<ADCPserialPort> — Set to the pseudotty for communicating with the modem.

<ADCPserialPortMode> — Unused.

<ModemBreakCommand> — Set to default modem RS232 Break command.

<ModemConnectCommand> — Set to the default modem connection command.

<ModemServerName> — Set to the modem process server name.

XML Keys for Vehicle Motion Correction

<iC2MotionCorrectionType> — Set to default 1 to perform delta position based vehicle motion correction on all C2 or C4 samples being exported.

<iEnsMotionCorrectionType> — Specifies the ensemble motion correction type. The default set by WHAM at startup is 0 (None).

XML Keys for Testing, Starting and Stopping ADCP Data Collection

<StartScript> — For executing a pre-defined system script/application for configuring the ADCP, specifying any SELECT/EXPORT, and starting the data collection.

<StopScript> — For executing a pre-defined system script/application to stop the ADCP, data collection and EXPORTs.

<TestScript> — For executing a pre-defined system script/application for testing the ADCP.

XML Keys for Non-Standard ADCP Installations

For non-standard ADCP installations, including multiple units, the following XML file keys must be modified:

```
serverName
payloadDescription -> boardID
payloadDescription -> taskID
payloadDescription -> readableName
```

LRI recommends consulting with Customer Support to confirm that your intended configuration will work.

Configuration file for direct interface to the ADCP

```
<?xml version="1.0" encoding="UTF-8" standalone="true"?>
<!DOCTYPE boost_serialization>
<boost_serialization version="7" signature="serialization::archive">
  <rootlevel version="0" tracking_level="0" class_id="0">
    <serverName>ADCPSensor</serverName>
    <loggerSettings version="0" tracking_level="0" class_id="3">
      <logLevel>LT_INFO</logLevel>
      <processName>unknown</processName>
      <isFileDes>1</isFileDes>
      <fileDes>1</fileDes>
      <fileName/>
      <pipeName/>
    </loggerSettings>
    <commandCompleteEventSettings version="0" tracking_level="0" class_id="1">
      <eventName>CommandComplete</eventName>
      <eventType version="0" tracking_level="0" class_id="2">
        <typeName>SendCommandCompleteEvent</typeName>
        <domainName>LiquidR-SMC</domainName>
      </eventType>
    </commandCompleteEventSettings>
    <gpsEventSettings>
      <eventName>GPSSample</eventName>
```

```

    <eventType>
      <typeName>GPSSample</typeName>
      <domainName>LiquidR-SMC</domainName>
    </eventType>
  </gpsEventSettings>
  <eventTransceiverSettings version="0" tracking_level="0" class_id="3">
    <eventServiceName>EventManager</eventServiceName>
    <eventServiceKind/>
    <receiveEnable>1</receiveEnable>
    <aliasToEvent version="0" tracking_level="0" class_id="4">
      <count>1</count>
      <item_version>0</item_version>
      <item version="0" tracking_level="0" class_id="5">
        <first>alias</first>
        <second>event</second>
      </item>
    </aliasToEvent>
    <eventFilterEnabled>1</eventFilterEnabled>
    <eventNameFilter version="0" tracking_level="0" class_id="6">
      <count>1</count>
      <item_version>0</item_version>
      <item>GPSSample</item>
    </eventNameFilter>
    <eventTypeFilter version="0" tracking_level="0" class_id="7">
      <count>0</count>
      <item_version>0</item_version>
    </eventTypeFilter>
  </eventTransceiverSettings>
  <payloadManagerClientSettings version="0" tracking_level="0" class_id="8">
    <serviceName>PayloadManager</serviceName>
    <serviceKind/>
    <deviceAddedEventName>PayloadDeviceAdded</deviceAddedEventName>
    <deviceChangedEventName>PayloadDeviceChanged</deviceChangedEventName>
    <deviceRemovedEventName>PayloadDeviceRemoved</deviceRemovedEventName>
    <commonEventType>PayloadRegistrationEvent</commonEventType>
    <commonEventDomain>LiquidR-SMC</commonEventDomain>
    <payloadDescription version="0" tracking_level="0" class_id="9">
      <boardID>255</boardID>
      <taskID>16</taskID>
      <description>ADCP sensor implementation</description>
      <ior>(This will be overwritten)</ior>
      <readableName>ADCPSensor</readableName>
    </payloadDescription>
  </payloadManagerClientSettings>
  <powerOnVerb>sudo SetPowerSwitch 3 1</powerOnVerb>
  <powerOffVerb>sudo SetPowerSwitch 3 0</powerOffVerb>
  <ADCPserialPort>/dev/ttyLX2</ADCPserialPort>
  <ADCPserialPortMode>811</ADCPserialPortMode>
  <ADCPcommTimeoutMs>2000</ADCPcommTimeoutMs>
  <ADCPwakeupTimeoutMs>7000</ADCPwakeupTimeoutMs>
  <ADCPensembleTimeoutMs>75000</ADCPensembleTimeoutMs>
  <ADCPdataTimeoutMs>50</ADCPdataTimeoutMs>
  <ADCPbreakLengthMs>500</ADCPbreakLengthMs>
  <ADCPbreakRetries>5</ADCPbreakRetries>

```

```
<ADCPstartupBreakRetries>14</ADCPstartupBreakRetries>
<BreakTimeoutMultiplier>5</BreakTimeoutMultiplier>
<ModemBreakCommand/>
<ModemConnectCommand/>
<ModemServerName/>
<ModemRetryDelayMs>3000</ModemRetryDelayMs>
<ADCPstartupScriptFilename>STARTUP_ADCP_SCRIPT.TXT</ADCPstartupScriptFilename>
<GPSlogFilename>GPSLOG.CSV</GPSlogFilename>
<ADCPscriptFilename>DEFAULT_ADCP_SCRIPT.TXT</ADCPscriptFilename>
<WHAMscriptFilename>DEFAULT_WHAM_SCRIPT.TXT</WHAMscriptFilename>
<ADCPoutputFilename>PD0.ENS</ADCPoutputFilename>
<ExportOutputFilename>EXPORTSAMPLES.BIN</ExportOutputFilename>
<TestScript>testADCP</TestScript>
<StartScript>startADCP</StartScript>
<StopScript>stopADCP</StopScript>
<iEnsMotionCorrectionType>0</iEnsMotionCorrectionType>
<iC2MotionCorrectionType>1</iC2MotionCorrectionType>
<C4EventSettings>
  <eventName>ADCPSampleC4</eventName>
  <eventType>
    <typeName>ADCPEvent</typeName>
    <domainName>LiquidR-SMC</domainName>
  </eventType>
</C4EventSettings>
<C2EventSettings>
  <eventName>ADCPSampleC2</eventName>
  <eventType>
    <typeName>ADCPEvent</typeName>
    <domainName>LiquidR-SMC</domainName>
  </eventType>
</C2EventSettings>
<BEventSettings>
  <eventName>ADCPSampleB</eventName>
  <eventType>
    <typeName>ADCPEvent</typeName>
    <domainName>LiquidR-SMC</domainName>
  </eventType>
</BEventSettings>
<HeadersEventSettings>
  <eventName>ADCPSampleHeaders</eventName>
  <eventType>
    <typeName>ADCPEvent</typeName>
    <domainName>LiquidR-SMC</domainName>
  </eventType>
</HeadersEventSettings>
</rootlevel>
</boost_serialization>
```

Configuration file for interfacing via Benthos modem

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<!DOCTYPE boost_serialization>
<boost_serialization signature="serialization::archive" version="7">
  <rootlevel class_id="0" tracking_level="0" version="0">
    <serverName>ADCPSensor</serverName>
    <loggerSettings class_id="3" tracking_level="0" version="0">
      <logLevel>LT_INFO</logLevel>
      <processName>unknown</processName>
      <isFileDes>1</isFileDes>
      <fileDes>1</fileDes>
      <fileName></fileName>
      <pipeName></pipeName>
    </loggerSettings>
    <commandCompleteEventSettings class_id="1" tracking_level="0" version="0">
      <eventName>CommandComplete</eventName>
      <eventType class_id="2" tracking_level="0" version="0">
        <typeName>SendCommandCompleteEvent</typeName>
        <domainName>LiquidR-SMC</domainName>
      </eventType>
    </commandCompleteEventSettings>
    <gpsEventSettings>
      <eventName>GPSSample</eventName>
      <eventType>
        <typeName>GPSSample</typeName>
        <domainName>LiquidR-SMC</domainName>
      </eventType>
    </gpsEventSettings>
    <eventTransceiverSettings class_id="3" tracking_level="0" version="0">
      <eventServiceName>EventManager</eventServiceName>
      <eventServiceKind></eventServiceKind>
      <receiveEnable>1</receiveEnable>
      <aliasToEvent class_id="4" tracking_level="0" version="0">
        <count>1</count>
        <item_version>0</item_version>
        <item class_id="5" tracking_level="0" version="0">
          <first>alias</first>
          <second>event</second>
        </item>
      </aliasToEvent>
      <eventFilterEnabled>1</eventFilterEnabled>
      <eventNameFilter class_id="6" tracking_level="0" version="0">
        <count>1</count>
        <item_version>0</item_version>
        <item>GPSSample</item>
      </eventNameFilter>
      <eventTypeFilter class_id="7" tracking_level="0" version="0">
        <count>0</count>
        <item_version>0</item_version>
      </eventTypeFilter>
    </eventTransceiverSettings>
    <payloadManagerClientSettings class_id="8" tracking_level="0" version="0">
      <serviceName>PayloadManager</serviceName>
      <serviceKind></serviceKind>
```

```

<deviceAddedEventName>PayloadDeviceAdded</deviceAddedEventName>

<deviceChangedEventName>PayloadDeviceChanged</deviceChangedEventName>

<deviceRemovedEventName>PayloadDeviceRemoved</deviceRemovedEventName>
  <commonEventType>PayloadRegistrationEvent</commonEventType>
  <commonEventDomain>LiquidR-SMC</commonEventDomain>
  <payloadDescription class_id="9" tracking_level="0" version="0">
    <boardID>255</boardID>
    <taskID>16</taskID>
    <description>ADCP sensor implementation</description>
    <ior>(This will be overwritten)</ior>
    <readableName>ADCPSensor</readableName>
  </payloadDescription>
</payloadManagerClientSettings>
<powerOnVerb></powerOnVerb>
<powerOffVerb></powerOffVerb>

<ADCPserialPort>/home/smc/roots/190_BenthosModem/pseudotty</ADCPserialPort>
<ADCPserialPortMode>811</ADCPserialPortMode>
<ADCPcommTimeoutMs>10000</ADCPcommTimeoutMs>
<ADCPwakeupTimeoutMs>20000</ADCPwakeupTimeoutMs>
<ADCPensembleTimeoutMs>120000</ADCPensembleTimeoutMs>
<ADCPdataTimeoutMs>100</ADCPdataTimeoutMs>
<ADCPbreakLengthMs>500</ADCPbreakLengthMs>
<ADCPbreakRetries>5</ADCPbreakRetries>
<ADCPstartupBreakRetries>14</ADCPstartupBreakRetries>
<BreakTimeoutMultiplier>5</BreakTimeoutMultiplier>
<ModemBreakCommand>BAM --priv=0 BREAK</ModemBreakCommand>
<ModemConnectCommand>BAM --priv=0 CONNECTON 100</ModemConnectCommand>
<ModemServerName>BenthosModem</ModemServerName>
<ModemRetryDelayMs>3000</ModemRetryDelayMs>

<ADCPstartupScriptFilename>STARTUP_ADCP_SCRIPT.TXT</ADCPstartupScriptFilename>
<GPSlogFilename>GPSLOG.CSV</GPSlogFilename>
<ADCPscriptFilename>DEFAULT_ADCP_SCRIPT.TXT</ADCPscriptFilename>
<WHAMscriptFilename>DEFAULT_WHAM_SCRIPT.TXT</WHAMscriptFilename>
<ADCPoutputFilename>PD0.ENS</ADCPoutputFilename>
<ExportOutputFilename>EXPORTSAMPLES.BIN</ExportOutputFilename>
<TestScript>testADCP</TestScript>
<StartScript>startADCP</StartScript>
<StopScript>stopADCP</StopScript>
<iEnsMotionCorrectionType>0</iEnsMotionCorrectionType>
<iC2MotionCorrectionType>1</iC2MotionCorrectionType>
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  <eventName>ADCPSampleC4</eventName>
  <eventType>
    <typeName>ADCPEvent</typeName>
    <domainName>LiquidR-SMC</domainName>
  </eventType>
</C4EventSettings>
<C2EventSettings>
  <eventName>ADCPSampleC2</eventName>
  <eventType>

```

```
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<domainName>LiquidR-SMC</domainName>
</eventType>
</C2EventSettings>
<BEventSettings>
  <eventName>ADCPSampleB</eventName>
  <eventType>
    <typeName>ADCPEvent</typeName>
    <domainName>LiquidR-SMC</domainName>
  </eventType>
</BEventSettings>
<HeadersEventSettings>
  <eventName>ADCPSampleHeaders</eventName>
  <eventType>
    <typeName>ADCPEvent</typeName>
    <domainName>LiquidR-SMC</domainName>
  </eventType>
</HeadersEventSettings>
</rootlevel>
</boost_serialization>
```

Sample WHAM Scripts

Assume the application has a local working directory. Pathnames will be relative to that working directory.

Sample 1: Export bathymetry every fifty meters for a kilometer

Assume the file ADCPscripts/BathySetup is an ADCP configuration file that configures the ADCP for collecting bottom track data at the fastest ping rate, with an averaged data ensemble returned every five seconds. In this example, the script has a concluding **CS** command (start pinging).

This example also assumes that the user has configured another external task to listen for events from WHAM. For example, it might simply store the bathymetry samples in a file for later delivery to shore.

Specify where the raw PD0 ensembles should be stored:

```
ADCP -o rawData/bathy110115
```

Initialize and start the ADCP - this sets the ADCP configuration and starts it pinging:

```
ADCP -r ADCPscripts/BathySetup
```

Set the selection variables to distance, with a separation of about 50m:

```
SELECT -d 50
```

Start exporting bathymetry, for a kilometer (20*50):

```
EXPORT -b 20
```

Sample 2: Export one Currents sample every 15 minutes for 24 hours

This example directs WHAM to turn the ADCP on every fifteen minutes for a minute to get a snapshot. That snapshot is returned to shore. Key to the implementation is a shell script that implements the control loop, sending commands to WHAM. There are several ways to implement this example - this is just one of them. This one turns off the ADCP between exported samples, to minimize power consumption.

Assume the file ADCPscripts/CurrentsSetup is an ADCP configuration file that configures the ADCP to average a minute's worth of currents data and return a single data ensemble. Also assume that it does not contain a **CS** command (start pinging).

Shell script:

```
#!/bin/bash
# initialize the ADCP and WHAM
DATE='date +%Y%m%d%H%M'
mv RawData/current RawData/raw"$DATE"
ServerExec -ORBInitRef NameService=corbaname::localhost ADCPSensor "WHAM -r
WHAMscripts/CurrentsSetup" i = 0
while [ $i -lt 96]
do
ServerExec -ORBInitRef NameService=corbaname::localhost
ADCPsensor "WHAM -r WHAMscripts/GetCurrentsEnsemble"
sleep 60
ServerExec -ORBInitRef NameService=corbaname::localhost
ADCPsensor "ADCP --stop"
sleep 840
i = [$i + 1]
done
```

script CurrentsSetup:

```
ADCP -r ADCPscripts/CurrentsAverageMinutes
ADCP -o RawData/current
EXPORT -c211
```

script GetCurrentsEnsemble:

```
SELECT -s1
ADCP -p
```

Sample 3: Export one Currents sample every 15 minutes for 24 hours

This example turns the ADCP on every fifteen minutes for a minute to get a snapshot wherever the Wave Glider is located. That snapshot is returned to shore. In this example WHAM is terminated at the end - it might just as easily do an **ADCP --stop**. There are other ways to implement this example - this is just one of them. This one leaves the ADCP on between exported samples.

Assume the file ADCPscripts/CurrentsSetup is an ADCP configuration file that configures the ADCP to average a minute's worth of currents data and return a single data ensemble. Also assume that it does not contain a **CS** command (start pinging).

Shell script:

```
#!/bin/bash
# initialize the ADCP and WHAM
DATE='date +%Y%m%d%H%M'
mv RawData/current RawData/raw"$DATE"
ServerExec -ORBInitRef NameService=corbaname::localhost ADCPSensor "WHAM -r
WHAMscripts/CurrentsSetup"
ServerExec -ORBInitRef NameService=corbaname::localhost ADCPSensor "WHAM -r
WHAMscripts/GetManyEnsembles"
sleep 86400
ServerExec -ORBInitRef NameService=corbaname::localhost ADCPSensor "WHAM -x"
```

script CurrentsSetup:

```
ADCP --run ADCPscripts/CurrentsAverageMinutes
ADCP --output RawData/current
EXPORT -c211
```

script GetManyEnsembles:

```
SELECT --time 900
EXPORT -c2 961
ADCP --ping
```

Appendix C. Wave Glider Integrated ADCP Best Practices

Summary

This document outlines best practices for Wave Glider integrated ADCP setup and configuration for optimal data collection in an SV2 using a 600KHz ADCP for shallow profiling (< 40m) or a 300KHz ADCP for deeper profiling (up to 100 meters).

ADCP data quality is impacted by:

- Glider depth as a function of Umbilical length
- ADCP compass calibration & Magnetic declination setting
- Turns in the Wave Glider course

Umbilical Length and Depths of Interest

Reflections from the Glider, and its first harmonic, contaminate the data in the ADCP bins at the corresponding depths. This is particularly noticeable during shallow profiling with the 600KHz ADCP. Based on the bin size and ADCP configuration, neighboring bins may also be contaminated. No discernible contamination has been observed at the second and third harmonic depths. The length of the Umbilical determines the location of the contaminated bins:

Umbilical length	Contaminated bins at depths
4 meters	4 meters, 8 meters
6 meters	6 meters, 12 meters

Umbilical lengths, and resultant Glider depth, should be selected to ensure that the reflection and first harmonic contamination are not at the depths of interest for the ADCP data.

ADCP Compass Calibration

Proper calibration of the ADCP's compass within its operating environment is required to overcome the influences of any hard and soft iron effects and magnetic fields. This is essential for the ADCP to correctly transform the profiled currents data to Earth coordinates based magnitude and direction (East and North components).

ADCPs are individually factory calibrated when mounted in the fully assembled Wave Glider as a matched pair with the Wave Glider and its payloads, including the Float C&C and its internal battery units, as configured.

Any replacements or modifications to the following will require an in-vehicle ADCP compass verification and full recalibration using the Teledyne RDI commands and steps:

- Payload configurations
- C&C internal batteries

- The ADCP

This is because we use the ADCP's internal compass, which is influenced by nearby magnetic fields. These fields differ between Wave Gliders, requiring recalibration if magnetic influences such as batteries are modified.

Some Wave Gliders are shipped with both a 300 KHz and a 600 KHz ADCP. Both are factory calibrated in that Wave Glider. If the Wave Glider's ADCPs are exchanged, it is important to use the ADCPs that were calibrated for that specific Wave Glider.

Performing an in-vehicle ADCP compass calibration is a complicated and time consuming procedure requiring non-ferrous stands and fixtures for rotating and tilting the Wave Glider. Contact LRI for further details.

Magnetic Declination for Areas of Deployment and ADCP Data Collection

For proper configuration of the ADCP, the Magnetic Declination of the areas where ADCP data collection will be performed must be specified in the mission plan. This is required for accurate currents measurements in true earth coordinates.

Magnetic Declination can be obtained from the following site using the primary Latitude and Longitude of the area of deployment: <http://www.ngdc.noaa.gov/geomag-web/#declination>

Wave Glider Course While Collecting ADCP Data

The Wave Glider integrated ADCP is normally configured to use its internal compass and sensors to perform transformations of the individual pings to Earth coordinates, and return an ensemble of pings averaged over a period of two minutes (recommended) using the ADCP's internal software. Vehicle motion correction is then performed on these ensembles by the software on the Wave Glider's Sensor Management Computer (SMC) using the onboard GPS to determine the vehicle's position before and after the ensemble's profiling and averaging period. This can lead to noisy or inaccurate motion correction if the Wave Glider is turning during the ensemble profiling and averaging period.

To reduce the number of noisy and invalid data points, try to minimize turns in the Wave Glider course relative to the total distance travelled when the ADCP is collecting data.

The recommended course should be a straight line with minimal turns, where each segment is a minimum of 500 meters in length.

The recommended station keeping course, for profiling a particular location, is a rectangle 500m x 50m.

ADCP Configuration

As described in the *Wave Glider ADCP Sensor Integration Guide*, there are a large number of configuration parameters available for the ADCP.

LRI recommends using default values for all of the parameters except as follows:

- Bin size (WS)
- Number of bins (WN)
- Averaging interval - time per ensemble (TE)
- Number of Water currents pings to average (WP)
- Ping frequency - time per ping (TP)

Default values are used for all other parameters except:

- Wave Glider mount Transducer depth at 10cm (ED01)
- Use Earth coordinates (EX11111)
- Use internal sensors (EZ1111101)
- Ping at 1Hz (TP 00:01.00)
- Disable reference layer averaging (WL0,1)

The following two configuration scripts are pre-loaded on the Wave Glider, and will be used to configure the ADCP as specified in the mission plan. Another example configuration for generating 1 minute averaged ensembles is also shown.

Parameter	Config 1 600KHz ADCP	Config 2 300KHz ADCP	1 minute averaging 600KHz ADCP
Bin Size (WS)	1 meter	4 meters	1 meter
Number of Bins (WN)	40	25	40
Averaging interval (ensemble time) (TE)	2 minutes	2 minutes	1 minute
Number of pings to average (WP)	120	120	60
Time per ping (TP)	1 sec	1 sec	1 sec
Blanking Distance (WF)	0.88 meters	1.76 meters	0.88 meters
First bin depth	2.1 meters	6.17 meters	2.1 meters
Last bin depth	41.0 meters	102.17 meters	41.0 meters
Max range at water temp 5C	42.01 meters	103.66 meters	42.01 meters
Max range at water temp 25C	38.39 meters	70.55 meters	38.39 meters
Standard deviation	0.64 cm/sec	0.32 cm/sec	0.9 cm/sec
Bins corrupted with short umbilical	Centered at 3, 6	1, 2*	Centered at 3, 6
Bins corrupted with regular umbilical	Centered at 5, 10	1, 2, 3*	Centered at 5, 10

If alternative ADCP configurations or different C2 sample report rates are required, contact LRI operations for the desired changes to the mission plans.

Refer to the Wave Glider ADCP Sensor Integration Guide for detailed instructions on how to setup and configure the ADCP.

Glossary

ADCP	Acoustic Doppler Current Profile uses the Doppler effect to monitor the speed and direction of objects at various depths.
ADCP configuration file	A script (sequence of commands) collected in a file intended to be executed in sequential order by the ADCP.
Benthos modem	Teledyne Benthos acoustic modems.
C&C	Command and Control module: The C&C is located in the center dry box, which also houses the primary control electronics. The C&C transfers information between the SMC to the WGMS.
CS	CS is the ADCP command that is executed when the LRI ADCP command ADCP --ping is issued.
ensembles	A Teledyne RDI term, ensembles are blocks of data consisting of the data collected and averaged during the ensemble interval. An ensemble can include header, leader, velocity, correlation magnitude, echo intensity, percent good, and status data. The ADCP streams ensembles to the SMC, where WHAM can eliminate redundant data before storing it in the SMC. WHAM can also filter the data before it is sent to shore.
GPS	Global positioning system.
HVB	High voltage power board in the payload dry box.
Iridium modem	Modem communicating with the Iridium satellite constellation.
PD0	This is RDI's standard format. PD0 is a binary output format. It provides the most information possible including a header, fixed and variable leader, bottom track, and water profile information. The fixed and variable leader is a recording of time, DVL setup, orientation, heading, pitch, roll, temperature, pressure, and self test diagnostic results. Data fields to be output are user selectable.
PlanADCP	Windows-based software from Teledyne RDI to create scripts that configure, command, and control the ADCP. When done, the scripts are edited and then uploaded to the SMC.
RUDICS	Router-based Unrestricted Digital Interworking Connectivity Solution: A connection-based Iridium communications protocol used in the for file transfer. This usage is distinct from the C&C-based Iridium Short Burst Data protocol.
script	A sequence of commands collected in a file intended to be executed in sequential order by WHAM.
SMC	Sensor Management Computer: The SMC controls and monitors all sensors mounted on the Wave Glider SV2. The SMC runs WHAM.
Teledyne RDI	Teledyne RD Instruments
VmDas	Software from Teledyne RDI that can be used to post-process ADCP data ensembles.

Wave Glider	A marine robot developed by LRI.
WGMS	Wave Glider Management System: WGMS provides the applications and programming interfaces for users to send commands to, and receive data from, the Wave Glider and its payloads.
WHAM	Workhorse ADCP Manager: LRI software application that resides on the Wave Glider SMC. WHAM has no user interface. WHAM sends ADCP configuration files to the ADCP which collects PD0 ensembles. WHAM runs WGMS scripts to eliminate data redundancies before storage on the SMC. WHAM also filters data before delivery to shore.
WinADCP	Software from Teledyne RDI that can be used to post-process data from the ADCP.
Workhorse Monitor ADCP	Teledyne RD Instruments' Acoustic Doppler Current Profiler; this manual assumes ADCP is a Workhorse Monitor ADCP