Automatic Identification System (AIS) Option

User Guide

Version 1.0

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Revision History

Rev	Changes	Author(s)
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TRADEMARKS

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PATENTS & INVENTIONS

The Wave Glider mechanism is patented under US Patent Number 7,371,136 and other patents pending. All aspects of the Wave Glider product have been developed at private expense by Liquid Robotics, Inc.

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Preface

The Automatic Identification System (AIS) option is one of a set of sensor options that Liquid Robotics, Inc. (LRI) provides for its Wave Glider ocean-going unmanned sensor platforms. The AIS option adds a high-performance AIS receiver and a one-meter (3 ft.) antenna to the Wave Glider's Command & Control (C&C) module. The AIS option receives AIS reports from class A and class B vessels in the vicinity of the Wave Glider. These reports provide vessel ID, position, heading and other standard AIS data.

A process running in the C&C module stores received AIS reports and periodically transmits them to shore-side operations using the Wave Glider's Iridium satellite communications channel. Operators shore-side can view the AIS reports in the Wave Glider Management System (WGMS) console, where they appear graphically as vessel icons in a map of the area around the Wave Glider. They can also view them in text form.

WGMS can feed received AIS reports to third-party marine mapping software for display there if desired, and a custom web application can retrieve AIS reports directly from the WGMS database through SOAP calls. A custom application can also receive AIS reports directly, bypassing WGMS completely.

This Document

This user guide provides information for people who may work with the AIS option in different roles:

◆ **All readers** can read the "AIS Option Overview," which introduces the hardware and software in the AIS option. It is a useful overview for anyone working with the AIS option.

◆ **Mission planners** can use "Planning to Use the AIS Receiver" to see how to integrate the AIS option with other Wave Glider components. This section contains specification details for hardware and software and a short description of the work required to set up and use the option.

◆ **Wave Glider deployment teams** will find instructions in "Preparing the AIS Hardware" for the minimal preparation necessary to set up the AIS option before Wave Glider deployment.

◆ **Shore-side operators and system administrators** should read "Working With AIS In WGMS." It describes how to view AIS reports in graphic and tabular form, how to export AIS report data, how to turn the AIS receiver on or off on the Wave Glider, and how to turn the iPIB board that controls the AIS receiver on or off. It also describes how to set up WGMS to display incoming AIS reports on third-party marine mapping software.

◆ **Software developers** should read "Developing Custom AIS Software." It provides AIS-specific details that a custom web application uses to work with WGMS-stored AIS data via SOAP calls. It also provides necessary details for software that reads AIS reports directly from a Wave Glider's Iridium packets without going through WGMS: commands used to turn the AIS receiver and iPIB board on and off, and packet formats for AIS data.

You will find detailed information about Wave Glider mission planning, operation, and using the WGMS dashboard in "Wave Glider User Manual." System administrators will find more information about setting up and using WGMS in "Wave Glider System Administration." "Wave Glider Interface Control" provides details physical details of the Wave Glider as well as interface details for software developers.

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Chapter 1: AIS Option Overview

The AIS option includes hardware installed on a Wave Glider and software that runs both onboard the Wave Glider and shore-side on computers located on land or in a ship.

Hardware Architecture

The AIS option adds an AIS receiver to the C&C dry box and an antenna to the dry box lid. It uses the logic board present in the C&C dry box to run controlling software. All of the hardware is factory installed by LRI except the antenna, which must be screwed onto a base before using the AIS option.

The AIS Receiver

The AIS receiver is mounted directly on the bottom of the printed circuit board in the C&C dry box where it is covered by electromagnetic shielding. It draws power from and communicates with the internal Personality Interface Board (iPIB) in the C&C dry box. The iPIB can turn the AIS receiver on and off.
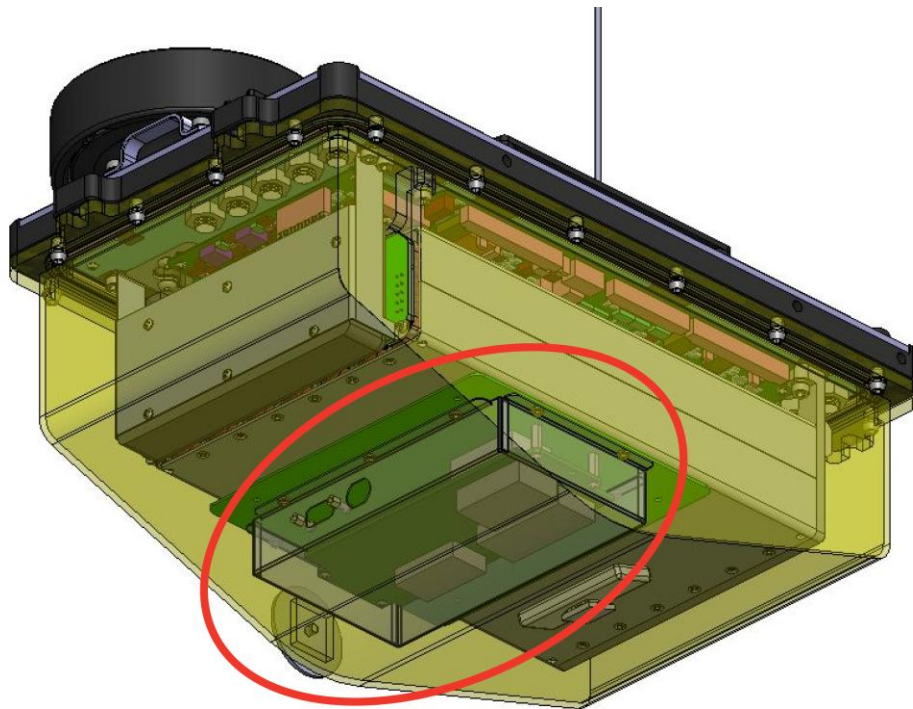
Figure 1:   The AIS receiver is mounted within the C&C dry box.

The Antenna

The receiver's antenna is mounted externally above the Wave Glider's turtle deck. The antenna is screwed into a firm plastic base built into the dry box lid and extends through the turtle deck.
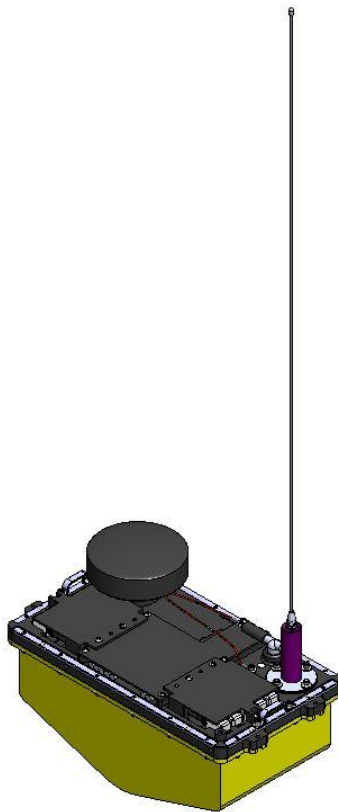
Figure 2:   The AIS antenna is mounted on a base built into the C&C dry box lid.

The Logic Board

The logic necessary to buffer AIS reports, compress and packetize them, and submit them for shore-side transmission runs on the iPIB that is resident within the C&C dry box. The iPIB contains a CPU and RAM and communicates directly with the AIS receiver and with the C&C controller. The C&C controller can turn the iPIB on and off and, through the iPIB, the AIS receiver on and off.

The iPIB receives AIS reports from the AIS receiver and stores the reports in an internal buffer. The iPIB transmits buffered AIS reports after compressing and packetizing them by submitting them to the C&C controller, which transmits the AIS packets over the Wave Glider's Iridium communication channel. The C&C controller can also transmit AIS packets over the XBee communication channel if desired.

Software Architecture

The AIS option's software runs on-board the Wave Glider, where it receives and transmits AIS reports, and shore-side, where it processes AIS reports from the Wave Glider.

On-Board Software

An AIS process running on the iPIB receives AIS reports from the AIS receiver. It filters out selected AIS message types and buffers them in the iPIB's internal RAM. It buffers two general types of AIS messages for both class A and B vessels:

◆ *Static reports* contain relatively unchanging vessel data such as ship's name, MMSI (Maritime Mobile Service Identity) ship ID number, radio call sign, type of ship and cargo, dimensions, and so on. It also contains trip data such as the vessel's destination and its estimated time of arrival.

◆ *Position reports* contain an MMSI ID number to identify the ship and also contains current position data such as its latitude and longitude, rate of turn, speed over ground, true heading, and a time stamp. Each position report is associated with a static report so that position report viewers can refer to the static report for vessel details.
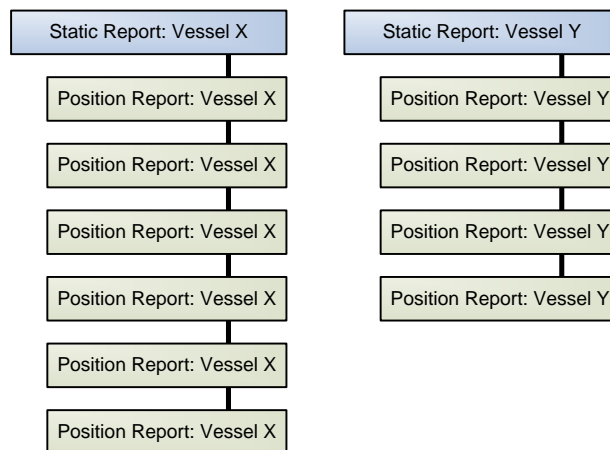
Figure 3: Each position report is associated with a static report that contains more information about the position report's vessel.

The AIS process buffers AIS reports from up to 100 individual vessels, always keeping the most recent position report for each vessel, discarding any earlier position reports for the vessel. Every 20 minutes the AIS process compresses and packetizes its buffered AIS reports and sends them to the C&C controller to transmit via Iridium (or XBee) to shore-side operations. The AIS process then clears from the buffer the static and position reports of any vessel that had no new reports come in during the 20-minute buffering period.

If the AIS process receives an AIS report (static or position) from a vessel not currently in the buffer, which indicates that a new vessel has come into reception range, the AIS process immediately transmits all buffered data for that vessel. The AIS process immediately transmits all buffered data for a vessel if the vessel sends a changed static report.

If the AIS process receives AIS reports from more than 100 vessels while buffering data, it simply discards new vessel reports until the buffer drops to below 100 vessels and can accept new AIS data.

Shore-Side Software

The Wave Glider Management System (WGMS) receives, stores, and displays AIS reports from one or more Wave Gliders that have the AIS option. WGMS may also use third-party marine mapping software to display AIS reports. Custom applications can retrieve AIS reports directly from the WGMS database and may also receive AIS reports directly from Wave Gliders via Iridium without going through WGMS.

WGMS

AIS reports come to WGMS as standard payload data via operations packets transmitted by Wave Gliders over Iridium or XBee channels. WGMS unpacks and decompresses the packets and reads the AIS reports

from an AIS packet format (described later in this document). WGMS then parses the AIS reports, associating position reports with corresponding static reports. It stores tables of AIS messages in the WGMS database. It also stores the original AIS packets in the database.

An operator uses the WGMS dashboard to view the AIS reports, where they appear in graphic form as vessel icons on a background supplied by Google maps. Clicking on a vessel icon provides static and position data about that vessel. Another click links to more details about the vessel provided by maritimetraffic.com.
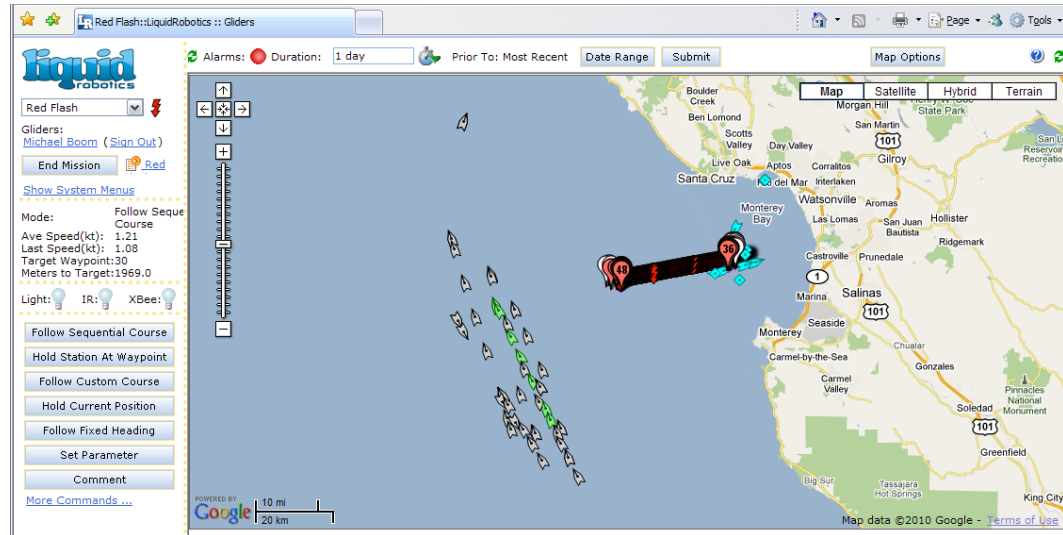

Figure 4:   The WGMS dashboard displays AIS reports in graphic form.

The WGMS dashboard displays current vessel positions by default, but can also display historical reports, showing vessels' positions over time on the map.

The WGMS dashboard can display received AIS reports in tabular form that shows all message details in text, with reports listed in chronological order by vessel. An operator can export the AIS messages there in HTML format for import into Microsoft Excel or other spreadsheet programs.
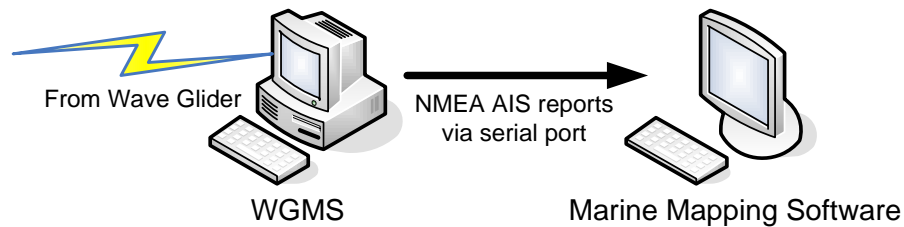
Third-Party Marine Mapping Software

The WGMS dashboard requires an Internet connection to Google maps to provide background maps in the graphic AIS display. If operations are located on a ship or another position without Internet access, those maps are not available. If so, WGMS can send its received AIS reports to third-party marine mapping software for display in that software. The mapping software typically has its own maps stored locally for display.

Coastal Explorer is an example of marine mapping software that can display AIS reports from WGMS. Any software that can accept AIS reports in NMEA-string format (the format typically sent by stand-alone AIS receivers) should work with WGMS.

To enable third-party mapping display, a system administrator sets WGMS to translate incoming AIS reports into NMEA strings that it stores in the WGMS database. (This is in addition to the AIS report storage it already performs).

The administrator also sets the WGMS communication server to check the WGMS database periodically (every two minutes) for new NMEA AIS reports. If it finds one or more new reports, it sends those

reports via a serial port to the mapping software connected there. The mapping software then displays those reports just as it would display reports coming from a connected AIS receiver.

Figure 5: *Third-party marine mapping software receives AIS reports from WGMS for display. Note that WGMS and the marine mapping software can run on the same computer.*

When WGMS sends NMEA AIS reports to mapping software, it also creates NMEA AIS reports for each Wave Glider so that Wave Glider positions appear on the mapping software along with AIS-reporting vessels.

Custom Web Applications

Developers can create custom web applications that have direct access to the WGMS database and the AIS reports stored there. These applications can use SOAP calls from the WGMS SOAP API to retrieve AIS reports and act on them as desired.

Custom Operations Software

Developers who wish to bypass WGMS completely can write their own software to receive AIS option transmissions arriving via Iridium or XBee. The software is responsible for unpacking AIS packets, reading them, and then acting on the AIS reports they contain.

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Chapter 2: Planning to Use the AIS Option

When planning a Wave Glider mission that includes the AIS option, there are some minimal physical operating conditions to consider and a small amount of software setup necessary. This chapter describes those considerations and provides hardware and software specifications.

Weight

The AIS option adds a little less than one kilogram of weight (approximately two pounds) to the C&C module. A mission plan should include this extra weight and ensure that it does not take the total weight of the float over its maximum allowed weight.

Power Budget

The AIS option draws two watts of power that must be planned to fit within the overall Wave Glider power budget including other sensors and payloads.

The AIS receiver is off and draws no power until it is turned on through the WGMS dashboard or through a direct C&C controller command. It can be turned on or off at any time by shore-side operations.

Operating Conditions

The AIS option meets or exceeds the Wave Glider's operating condition limits, so there are no special operating condition considerations for the AIS option.

Software Setup

The onboard AIS option software needs no setup. It is already installed and runs when the Wave Glider is powered up.

WGMS

WGMS is installed to handle AIS reports by default. There is no special configuration necessary.

WGMS operators need to have roles with appropriate permission to work with AIS reports at different levels in the WGMS dashboard.

Third-Party Marine Mapping Software

Setting up WGMS to send NMEA strings to third-party marine mapping software requires a few minutes of a system administrator's time to configure the WGMS communication server and a few more minutes of time to configure the mapping software to receive the NMEA strings.

Custom Software

Creating a custom web application to work with AIS data in the WGMS database or creating a custom application to work directly with AIS payload data from a Wave Glider is completely the responsibility of customer developers. LRI supplies complete information for the interfaces. Development time depends on the customer's software design and development team.

Specifications

These are the specifications for the components of the AIS option.

The AIS Receiver

The AIS receiver is a Shine Micro RadarPlus SM161R-2 Dual AIS receiver. Its reception specifications:

◆ Receives Class A & B vessel reports

◆ Provides dual-stage RJ input protection

◆ Frequencies & channel bandwidth: RX AIS1: 161.975 MHz at 25 kHz, RX AIS2: 162.024 MHz at 25 kHz

◆ Receiver sensitivity: 20% PER at -113 dbm

◆ Adjacent channel rejection: 70 dB at 25 kHz

◆ Blocking: 80 dB

◆ Intermodulation: 65 dB

◆ Large signal PER: 0.1% or better

◆ Image rejection: 70 dB for 20%PER

◆ Spurious rejection: 70 dB for 20% PER

The receiver works within a temperature range of -15 to +55 C (5 to 130 degrees F).

The Antenna

The antenna is approximately 1 meter (3 ft.) long, and is a Shakespeare-brand stainless steel half-wave antenna mounted on the C&C dry box lid.

Shipboard Controlling Logic

The AIS option logic buffers and transmits these AIS message types: 1, 2, and 3 (class A position reports), type 5 (class A static and voyage-related data), type 18 (class B position report), and type 24 (class B static data report). The buffer holds AIS transmissions for up to 100 vessels. The logic transmits buffered reports every 20 minutes. It transmits a static AIS report whenever it receives one.

Chapter 3: Preparing the AIS Option Hardware

The AIS option is installed in the C&C dry box by Liquid Robotics. It requires no internal preparation before launching a Wave Glider equipped with the option. The only required preparation is installing the AIS antenna.

Antenna Installation

The AIS antenna mounts on a pre-installed antenna base built into the C&C dry box lid. The base extends through the turtle deck above the lid. Before mounting the antenna on the base, ensure that the base and antenna are both completely dry.

To mount the antenna on the base:

1. Put one drop (no more) of blue Loctite (Loctite Threadlocker 243) on the threads of the antenna base.

2. Screw the antenna clockwise onto the base by hand until the antenna makes contact with the bottom of the threads.

3. Use a 12-mm open-end wrench to snug the antenna into place, no more than ¼ turn clockwise.

4. Let the Loctite dry before launching.

Precautions

Be careful not to catch the antenna on obstructions during transport or launch—you can bend or break the antenna.

If the antenna is bent and the bend is not too bad, it is possible in a pinch to straighten the antenna by removing it, putting it in a vise, and rebending.

Rebending may compromise the antenna's structural integrity, though, so a replacement antenna is the best solution after bending.

Powering Up the AIS Receiver

The AIS receiver and the iPIB that controls it do not turn on when the Wave Glider powers up. They must be turned on remotely through shore-side operations (typically through the WGMS dashboard) as described later in this document.

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Chapter 4: Working With AIS In WGMS

Wave Gliders equipped with the AIS option regularly send AIS reports back to shore-side operations. If operations are set up to use the Wave Glider Management System (WGMS), operators can use the WGMS dashboard to view and work with AIS reports. This section describes how to do that.

Some operations set up to use WGMS will use third-party marine mapping software to display AIS reports graphically instead of the WGMS dashboard. This allows the display to use the mapping software's locally-stored maps. This section describes how to set up WGMS to forward AIS reports to the mapping software.

Using the WGMS Dashboard

You will find detailed instructions for using the WGMS dashboard in the "Wave Glider User Manual," including instructions for connecting your web browser to WGMS and logging into the dashboard.

Once you have logged into the dashboard, the features available to you depend on your role and the permissions your role gives you within WGMS. Not every role can perform all of the actions described here. To view AIS data through the WGMS console, you can have any role, including that of Guest. To perform more involved AIS work, you must have a more advanced role such as Data Analyst, Master, System Administrator, or Root.

If your role does not have permission to perform actions described here, you may not see those actions available in the dashboard. For example, to turn a Wave Glider's AIS receiver on or off, or the iPIB board that controls the AIS receiver on or off, you must have a role of Master, System Administrator, or Root.

Viewing AIS Reports On the Map

The map view in the WGMS dashboard displays AIS reports by default if any AIS reports have been received.

Turning the AIS Report Display On and Off

To turn AIS report display on and off in the map:

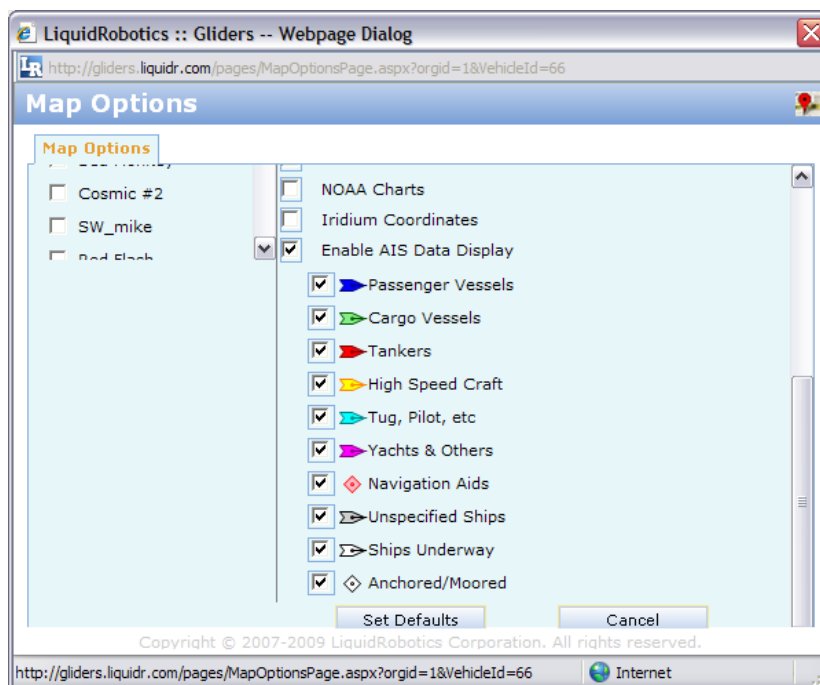> 1. Click the "Map Options" button above the map.

Figure 6: The Map Options dialog box

2. In the Map Options dialog box that opens, check "Enable AIS Data Display" to view AIS reports on the map. (Unchecking it removes AIS reports from the map.)

3. Below the "Enable AIS Data Display" option, check all types of vessels and entities you want to see on the map. Unchecking any of them removes from the map any reports from those vessel and entity types.

4. Close the dialog box.

5. Reload the page on the browser to see new options displayed.

Selecting a Wave Glider

The map on the WGMS dashboard displays combined AIS reports from all AIS-equipped Wave Gliders within an organization. To see the AIS reports centered around a single Wave Glider, choose that Wave Glider:

◆ Choose the name of the Wave Glider from the pulldown located just below the Liquid Robotics logo in the upper left of the main page of the WGMS dashboard.

> The map displays the Wave Glider's current position in its center with AIS reports shown (from all Wave Gliders) around that. Use the map's zoom and pan features to change the view.

Getting More Vessel Information

To get more information about any vessel whose icon appears on the WGMS map:

1. Click on the vessel icon.

A pop-up appears reporting the Wave Glider that received the AIS report, the reporting vessel's name, contact time, course data, position data, and more depending on how much data was contained in the AIS report.
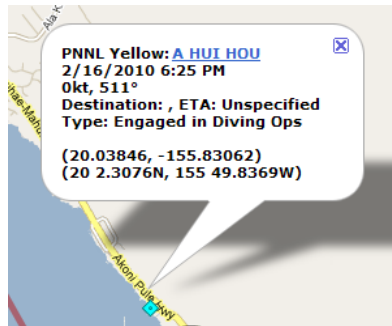

Figure 7:   A pop-up appears with vessel information when you click on an AIS vessel icon.

2.   Click the vessel name in the pop-up.

It links to any information available about the ship in the marinetraffic.com web site.

Viewing Historical AIS Data

The WGMS dashboard map by default shows only the most recent AIS reports. To see a historical display of reports that occurred from a set time in the past up to the present:

1.   Enter a period of time in the "Duration" text box located directly above the map.

You can either enter a value directly as text or you can click on the clock icon to the right of the text box to choose from a pull-down list. A direct-enter value must start with a number followed by a value of minutes, hours, or days.

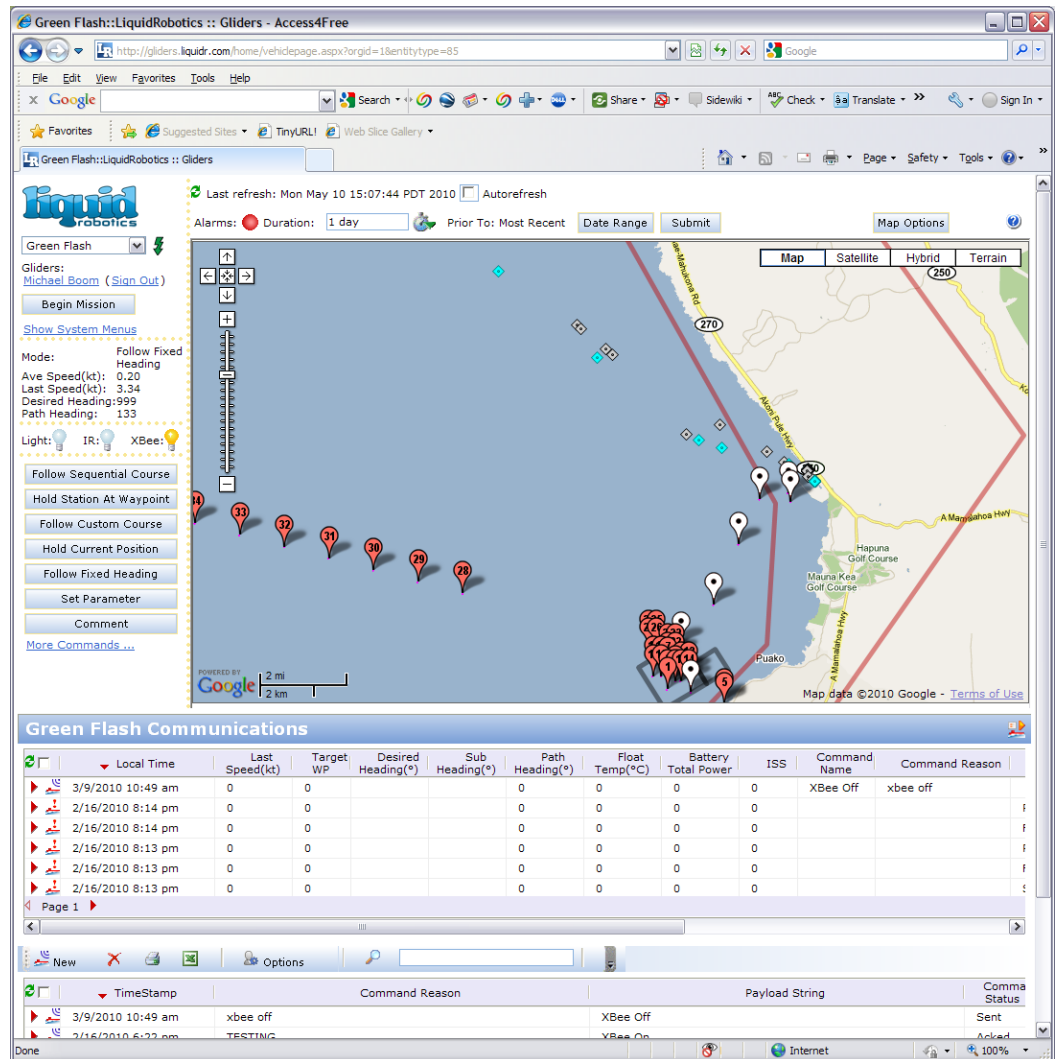2.   Click the Submit button to the right of the "Date Range" button.

Figure 8:   Setting a period of time for historical display shows a trail of AIS crumbs (diamonds in this example) where vessels have passed.

To view AIS reports over a range of time that ends before the present, first set the ending date and time, then set a duration before that ending time:

1. Click the "Date Range" button above the map.

2. Enter a data in the first "Prior To:" text box by either typing a date directly into the text box or choosing a date from the pull-down list to the right of the text box.

3. Enter a time in the second "Prior To:" text box by either typing a time directly into the text box or choosing a time from the pull-down list to the right of the text box.

4. Click the Submit button.

To leave the historical view at any time, click the "Most Recent" button above the map.

Viewing AIS Reports in a Table

The WGMS dashboard can display AIS reports in tabular form just as it can display other Wave Glider-received data in tabular form:

1. Click the "Vehicles" button at the bottom of the System Menus bar on the left of the dashboard. (If the bar is not visible, click "Show System Menus" below the Liquid Robotics logs in the upper left of the dashboard.)

2. Click "AISyG Records" under Payload Data in the System Menus bar.

   Static AIS records received by all Wave Gliders in the current organization appear in tabular form. Because these are static records, they are in essence a list of vessels detected by the Wave Gliders. The column headings list the types of data in each report—all standard AIS report fields.

Figure 9:   AIS records displayed in tabular form.

3. Click the twirl-down arrow at the beginning of an AIS report line to see a list of position AIS reports associated with the vessel. (Click the arrow again to close the list.)

4. Click on any of the column headings to sort the list by the values in that column.

5. Click on the icon at the beginning of an AIS report line to see further details about the AIS report.

6. If the list is longer than one page, click the page arrows at the bottom left of the list to move from page to page.

Exporting AIS Reports From a Table

When viewing AIS reports in tabular form in the WGMS dashboard, you can export those records into an HTML file that any spreadsheet such as Microsoft Excel can read:

1. Click the Excel icon at the top left of the table to open the export dialog box.

2. Enter a file name and specify a folder if desired, then click Save.

The file contains all AIS records stored in the WGMS database for all the Wave Gliders in the current organization. It has an .xls extension so that it opens by default in Microsoft Excel.

Turning the iPIB and AIS Receiver On or Off

The AIS receiver in a Wave Glider and the iPIB controlling the receiver must be turned on before the receiver can begin receiving and passing on AIS reports. Once the receiver is on, there may be times when you want to turn it off again—to conserver power, for example.

The iPIB and receiver do not turn on when the Wave Glider is powered up, so they must be turned on independently. The iPIB powers the AIS receiver and may also power other C&C sensors such as the WeatherStation option. When you turn the iPIB on or off, it turns all connected sensors on or off with it.

To turn the iPIB on or off and the AIS sensor with it:

1. In the WGMS dashboard Home page, choose the Wave Glider you want from the pull-down list below the Liquid Robotics logo in the upper left corner.

2. Click the "Set Parameter" button on the left side of the page to open the Set Parameter Command dialog box.

3. Choose "Internal Payload Power" from the "Select Parameter" pull-down list.

4. Enter explanatory text in the "Enter Reason" text box. The text will be stored with the command in the WGMS database and can help later to clarify why the command was issued.

5. Click the "Add" button. The internal payload power parameter appears in the bottom half of the dialog box.
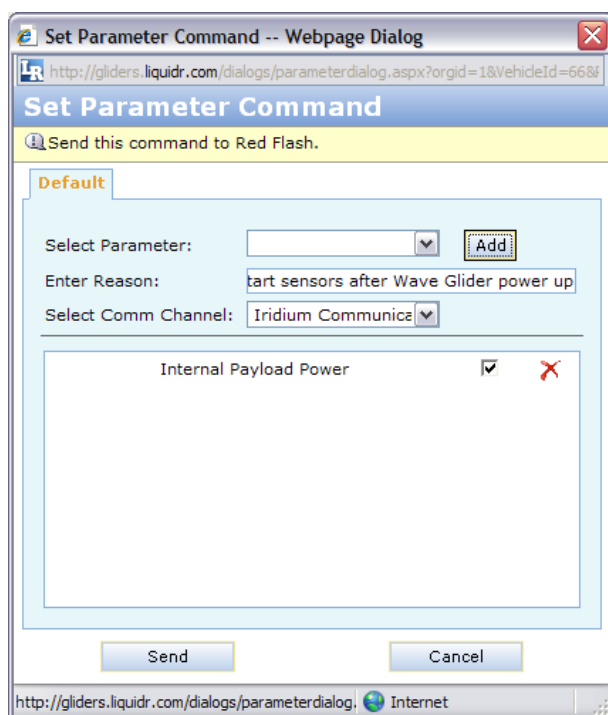
Figure 10: The Set Parameter displays the Internal Payload Power parameter set to turn on.

6. If the check box after the parameter is checked, the parameter performs a power on. If the check box is unchecked, the parameter performs a power off. Set the check box for the option you want.

7. Click "Send" to send the command. WGMS will send the command to the Wave Glider the next time the Wave Glider checks for new commands.

Remember that all sensors connected to the iPIB power up or down with the iPIB.

Once the iPIB is on, you can turn the AIS receiver on or off independent of the iPIB:

1. Use the same procedure as you would to turn the iPIB on or off, but use the parameter "AIS Receiver Power" instead of "Internal Payload Power."

Note that whenever you turn the AIS receiver off, the iPIB will clear its buffer of AIS reports. Note also that if the iPIB is off, you cannot power up the AIS receiver because the AIS receiver gets its power from the iPIB.

Viewing AIS Reports in Third-Party Marine Mapping Software

When Google maps is not available through an Internet connection, the WGMS dashboard cannot display AIS reports graphically. You can configure WGMS in that case to export received AIS reports to an external third-party marine mapping program such as Coastal Explorer for display there on the program's own locally-stored marine maps.

To configure WGMS for AIS export, you must be a system administrator with access to WGMS components outside the dashboard—in particular, the WGMS communication server. There are three main steps to configuring WGMS to work with third-party marine mapping software:

1. Use the dashboard to set up WGMS to convert received AIS reports into NMEA strings and to store those NMEA AIS reports in the WGMS database.

2. Configure the communication server to poll the WGMS database regularly and export any new NMEA AIS reports to the third-party software.

3. Set up the third-party software so that it accepts NMEA strings from the WGMS communication server.

The following sections describe each of these steps in more detail.

Turning On NMEA Storage In the Dashboard

To turn on NMEA storage in the dashboard:

1. Click the Settings button on the bottom of the System Menus bar. (If the bar is not visible, click Show System Menus to see it.)

2. Click "Organizations" in the System Menus bar if it is not already selected.

3. Double-click on the name of the organization (if there is more than one) for which you want to turn on NMEA string storage. The Organization Gliders Edit dialog box appears and displays the Organization panel.
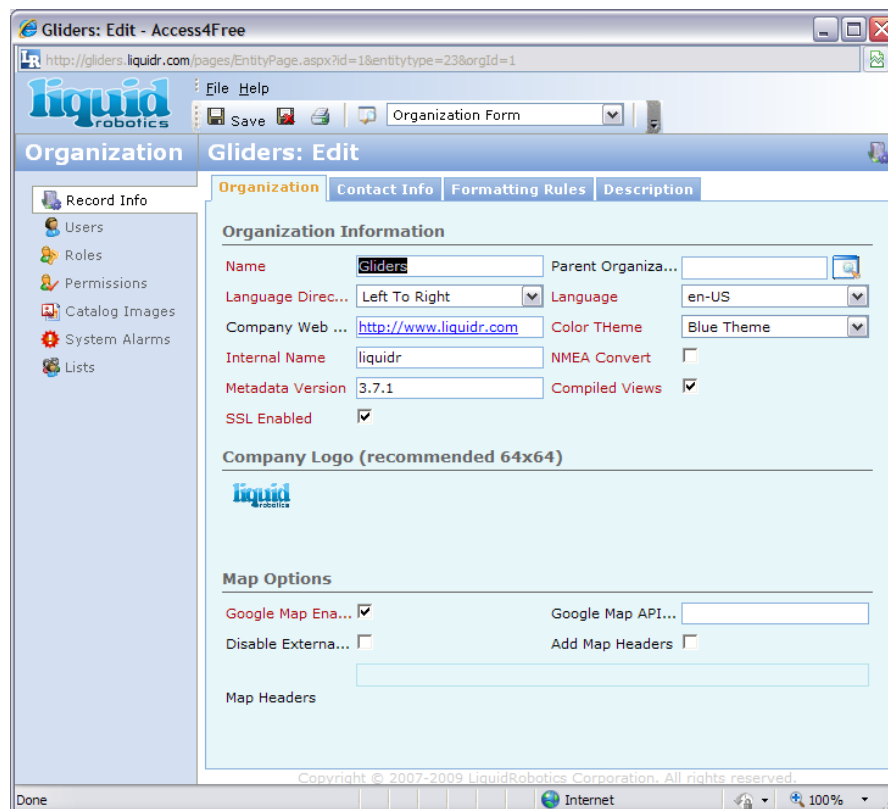
Figure 11: The Organization Gliders Edit dialog box.

4. Check the "NMEA" check box.

5. Click the save and close organization button at the top of the dialog box. (It is an icon of a disk with a red ex on it.)

Note that when you turn on NMEA conversion, WGMS stores AIS reports in NMEA string form in addition to the WGMS-native form it already uses to store the reports, so they are available in either form.

Configuring the Communication Server For NMEA String Export

To configure the WGMS communication server, you must have desktop access to the computer on which it runs.

1. Open the Communication Server window.

2. Click the "Management Account" tab if it is not already open.
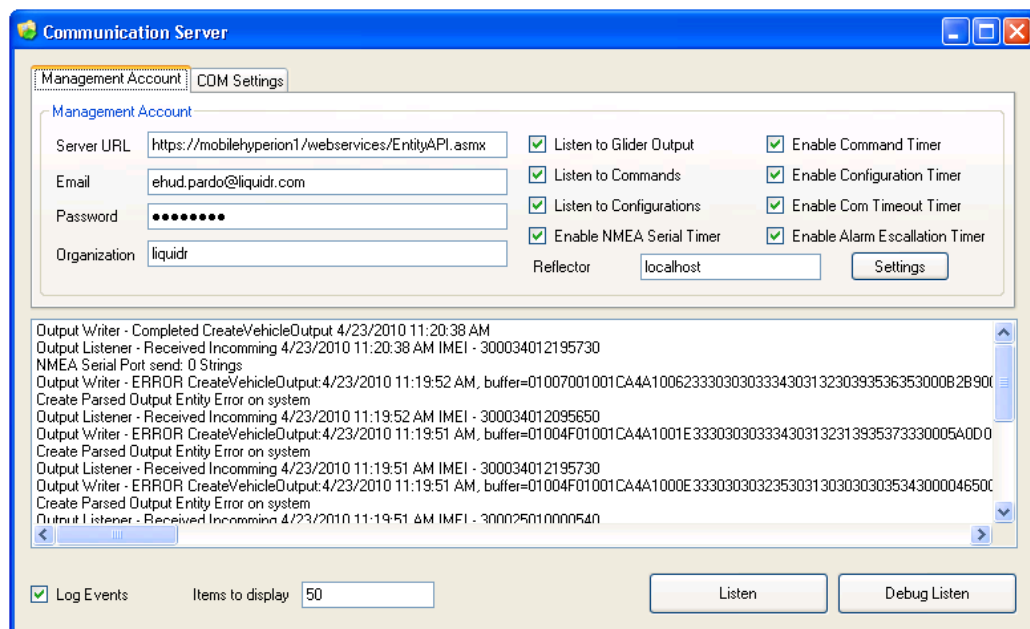
Figure 12: The Management Account panel of the Communication Server window.

3. Check the "Enable NMEA Serial Timer" checkbox. This sets the server to check the WGMS database every two minutes for new NMEA AIS reports and to export new reports if found.

4. Click the "COM Settings" tab at the top of the window to view the COM Settings panel.
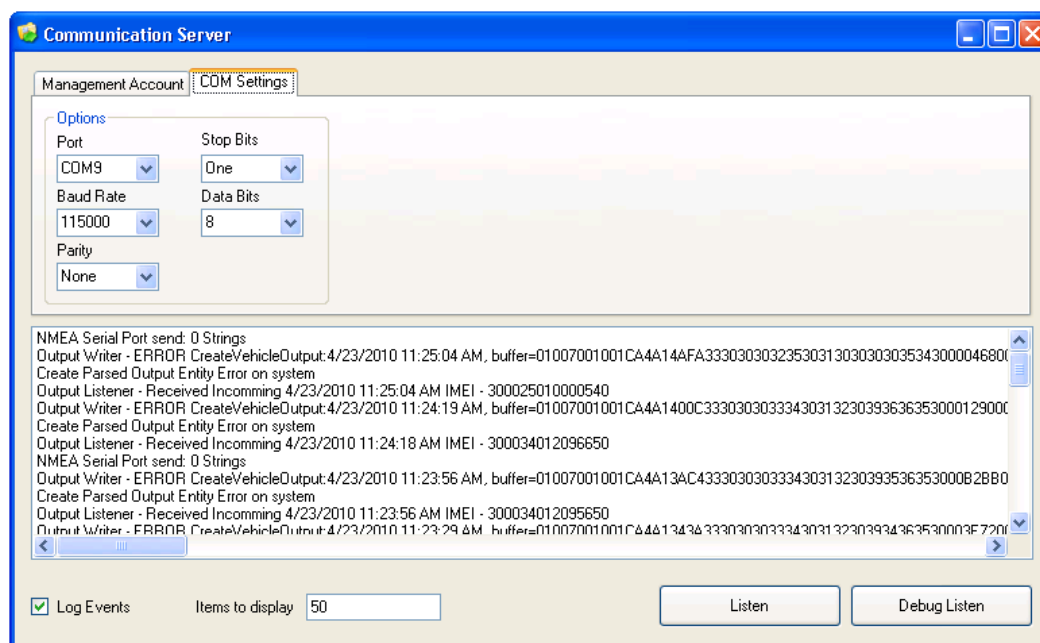
Figure 13: The COM Settings panel of the Communication Server window.

5. Set the port number and transmission settings to match the port to which you have connected the third-party software.

Setting Up Mapping Software to Receive WGMS NMEA Strings

The third-party mapping software must be connected through COM ports to the WGMS communication server. If the mapping software and communication server run on different computers, then they may be connected physically via a serial cable going between serial ports on both computers. This works much the same as connecting a standard AIS receiver's serial output to the third-party software.

If both the communication server and the mapping software run on the same computer, then their COM ports may be connected logically through null-modem emulator software such as the open-source program com0com, available at http://com0com.sourceforge.net.

Once you have ve decided how to connect both programs, you must set the mapping software to receive NMEA strings through the connecting COM port. This will vary depending on the software you use. The steps in Coastal Explorer are, as an example:

1. Choose Configure Vessel and Electronics from the Tools menu to open the Configure Vessel and Electronics dialog box.

2. Click the Data Ports option on the left.

3. Click Port Settings to open the Instrument Ports dialog box.

4. Choose the port you have connected the WGMS communication server to in the Communications Ports list.

5. Choose "NMEA 0183" in the Interface pull-down list.

6. Choose a baud rate that matches the rate of the COM connection set in the WGMS communication server.

7. Check the Listener check box.

8. Close the dialog boxes.

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Chapter 5: Developing AIS Custom Software

Developers can create their own custom software to work with AIS reports from Wave Gliders. They can either get AIS reports from the WGMS database through the WGMS SOAP API, or by they can handle AIS reports directly as they come from the Wave Glider, bypassing WGMS completely.

Using WGMS SOAP Functions

A custom web application uses simple SOAP function calls to read and otherwise work with data in the WGMS database. "Wave Glider Interface Control Description" describes the WGMS SOAP functions in the section "Wave Glider Management System" under the heading "SOAP Envelopes." It provides functional descriptions and lists arguments and returned data for each function.

Entity Type Numbers and Column Names

WGMS stores AIS records as entities in the WGMS database. An entity is, in essence, a record, and its columns are the fields of the record. To work with AIS entities through the SOAP calls, you need to know the entity type numbers and the names of the columns within each entity type. There are three types of AIS entity types; the following sections describe them.

AISyG Records

AISyG Records are AIS static records stored in native WGMS format. Their default entity type number is 91, and they contain the following columns:

Table 1:AISyG Record columns

Column Name	Contents
AISClass	The class (A or B) of the vessel making the AIS report
AISyGRecordId	The unique identification number of this AIS record entity
Breadth	The breadth of the vessel in meters
CallSign	The vessel's call sign
CreatedBy	Used internally by WGMS, not for outside use
CreatedOn	Used internally by WGMS, not for outside use
Destination	The reported destination of the vessel
DeviceType	The position fix type used to determine the vessel's location—GPS, etc.
ETA	The estimated time of arrival for the vessel in the numeric format MMDDHHMM (month, day, hour, minute)
IMONumber	The IMO number (International Maritime Organization ID number) of the reporting vessel
IsDeleted	Used internally by WGMS, not for outside use
Latitude	The latitude of the vessel's current position.
Length	The length in meters of the vessel
Longitude	The longitude of the vessel's current position.
MMSI	The Marine Mobile Service Identity of the vessel

Column Name	Contents
OrgId	The identification number of the WGMS organization to which this entity belongs
OwnerId	Used internally by WGMS, not for outside use
PayloadPacketId	The identification number of the payload packet in which the AIS report was transmitted
ShipCargoType	The type of cargo the vessel is carrying
ShipName	The name of the vessel

AISyG Locations

AISyG Locations are AIS position records stored in native WGMS format. Their default entity type number is 92, and they contain the following columns:

Table 2: AISyG Location columns

Column Name	Contents
AISyGLocationId	The unique identification number of this AIS location entity
AISyGRecordId	The unique identification number of the AIS record entity (static AIS report) with which this position report is associated
CourseOverGround	The direction the vessel is traveling over ground, measured in degrees
CreatedBy	Used internally by WGMS, not for outside use
CreatedOn	Used internally by WGMS, not for outside use
Heading	the direction the vessel is pointed, measured in degrees
IsDeleted	Used internally by WGMS, not for outside use
Latitude	The latitude of the vessel's current position.
Longitude	The longitude of the vessel's current position.
MMSI	The Marine Mobile Service Identity of the vessel
NavigationStatus	The ship's current travel status: at anchor, underway, etc.
OrgId	The identification number of the WGMS organization to which this entity belongs
OwnerId	Used internally by WGMS, not for outside use
PayloadPacketId	The identification number of the payload packet in which the AIS report was transmitted
RateOfTurn	Not currently used
RateOfTurnNumber	The vessel's rate of turn, right or left, a value from 0 to 720 degrees per minute
SpeedOverGround	The vessel's reported speed over ground
TimeStamp	The universal time to the nearest second when the report was generated
UpdateBy	Used internally by WGMS, not for outside use
UpdatedOn	Used internally by WGMS, not for outside use
VehicleId	The identification number of the Wave Glider that transmitted this AIS report

AISyG NMEA Strings

AISyG NMEA strings are AIS static and position records stored in NMEA string format. They include Wave Glider positions reported by telemetry that have been translated to AIS NMEA reports and stored

along with other received AIS reports. Their default entity type number is 93, and they contain the following columns:

Table 3:AISyG NMEA string columns

Column Name	Contents
AISyGNMEAStringId	The unique identification number of this AIS NMEA string entity
CreatedBy	Used internally by WGMS, not for outside use
CreatedOn	Used internally by WGMS, not for outside use
EntityId	The ID of the AIS entity that this NMEA string report was translated from
IsDeleted	Used internally by WGMS, not for outside use
Latitude	The latitude of the vessel's current position
Longitude	The longitude of the vessel's current position
MetadataTableId	The ID of the metadata table AIS entity that this NMEA string report is associated with
NMEAString	The AIS report translated into NMEA string format
OrgId	The identification number of the WGMS organization to which this entity belongs
OwnerId	Used internally by WGMS, not for outside use
ProcessedFlag	Used internally by WGMS, not for outside use
TimeStamp	The universal time to the nearest second that the report was generated
UpdateBy	Used internally by WGMS, not for outside use
UpdatedOn	Used internally by WGMS, not for outside use
VehicleId	The identification number of the Wave Glider that transmitted this AIS report

Reading Entity Information in the WGMS Dashboard

The WGMS dashboard displays current entity type numbers and column names under Record Customization in the Settings page, which also allows changing their values. (This feature is available only to operators with the role of System Administrator or Root.) To see what the current values are:

1. Click the Settings button in the left-side menu bar. (Click "Show Menus" if the bar is not visible.)

2. Click "Record Customization" in the left-side menu bar.

   The panel displays different entity types. The Record Type column provides the entity type ID for each type.

3. Double-click on any of the entity rows to see what columns that entity contains.

   The Record Edit dialog box appears.

4. Click Fields on the left side of the dialog box.

   The Fields panel displays the field names and column names of the entity type.

Working Directly With the Wave Glider AIS Option

Custom software that works with AIS data outside of WGMS must understand the Iridium and XBee packets described in detail in "Wave Glider Interface Control Description." The software reads AIS data contained within those packets, and—to turn the AIS transmitter and iPIB board on or off—issues C&C commands through those packets.

Reading AIS Packets

Payload packets arriving from a Wave Glider via Iridium can carry either an AIS static record or an AIS position record.

AIS Static Packets

An AIS static payload packet starts with a four-byte value of 17 that specifies an AIS static record type. It follows with 86 more bytes that contain the following data:

Table 4: AIS static packet contents (following a four-byte value of 17)

Field Name	Bytes Used	Byte #
Hour	1	0
Minute	1	1
Second	1	2
Month	1	3
Day	1	4
Year	1	5
MMSI	4	6
AISClass	1	10
Ship Name (20 characters)	20	11
Call Sign (7 characters)	7	31
Ship and Cargo Type	1	38
Device Used for the Position Fixes	1	39
Destination (20 characters)	20	40
ETA (Month, Day, Hour, Minutes)	4	60
Dimension and Point Of Reference	4	64
IMO	4	68
Latitude	4	72
Longitude	4	76
Course Over Ground	2	78
Speed Over Ground	2	80
Rate Of Turn	1	82
Heading	2	83
Navigation Status	1	85

AIS Position Packets

An AIS position payload packet starts with a four-byte value of 18 that specifies an AIS position record type. The packet can contain multiple AIS position reports, so it is variable in length. The first byte following the four-byte type header is a value from 0-255 that specifies how many position records the packet contains.

Each position record in the packet takes 26 bytes and contains the following values:

Table 5: AIS position record contents (one of many possible within an AIS position packet)

Field Name	Bytes Used	Byte #
Hour	1	0
Minute	1	1
Second	1	2
Month	1	3
Day	1	4
Year	1	5
MMSI	4	6
Latitude	4	10
Longitude	4	14
Course Over Ground	2	18
Speed Over Ground	2	20
Rate Of Turn	1	22
Heading	2	23
Navigation Status	1	25

Powering the AIS Receiver and iPIB On and Off

Custom software uses C&C commands to turn the AIS receiver and the iPIB on or off. "Wave Glider Interface Control Description" describes the commands. The SetParameters command powers the AIS receiver and iPIB up or down.

Use the field "AIS Receiver Power" to turn the AIS receiver on or off; use the field "C&C Internal Payload Power" to turn the iPIB board on or off. Set the field value to 1 to turn the component on; set the field value to 0 to turn the component off.

Note that the iPIB powers the AIS receiver. Turning the iPIB off automatically powers down the AIS receiver. Turning the iPIB on automatically powers up the AIS receiver. The AIS receiver cannot be turned on while the iPIB is off.