



Document Status: Release 4.0.5

Interface Control Document



Ship to/from Shore ICDChange Record

Date	Description of change
5/9/08	Original Document
5/21/2008	Incorporated Jim Kirklin Feedback
6/13/2008	Added LSB only to new formats and updated open issues
6/19/08	Release
6/25/2008	Light and IR On/Off commands
7/1/2008	Added Telemetry bits for lights and IR
7/19/2008	Added XBee bits
9/11/2008	Added Multi-Record ship to shore format
10/15/2008	Telemetry 6 format definition, Identification and power control status entities
10/21/2008	Waypoint read using new status structure type.
10/28/2008	New structure id on follow course
10/30/2008	Power Control Status as new telemetry type
10/30/2008	Rudder control entity, set and retrieve commands definition
11/14/2008	Added Set Parameters command
12/18/2008	Added Retrieve Debug Buffer
2/3/2009	Added Payload Packet type
2/24/2009	Added Weather Station Payload Type 1 section
4/6/2009	Added Bubble and Sub Power Parameters and GPS count
4/9/2009	Added Payload Alarm bit re-use of sub battery bit
4/15/2009	Added Follow Course with Options
4/25/2009	Added PID and Rudder Position commands
8/28/2009	Added AISyG Records, support full SBD buffer sizes
10/4/2009	Added Iridium Modem Default power bits to Parameters
10/19/2009	Added Communication Channels/Relay/Unique Id Support
10/20/2009	Mobile to Mobile Read Image File Support
10/20/2009	Added XBee set parameters
10/21/2009	Added Program Upload support
10/28/2009	Corrected default values in status, added File Delete and File List Commands and responses
10/26/2010	Console Commands and Acks support
11/24/2010	Encryption Support
4/23/2011	Enhanced AIS Handling
11/29/2011	Virtual Relay Command Formats
1/24/2012	0x71 and Secure Encrypted Partition Support
6/19/12	Adding new fields to Datawell record



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1. Scope

Ships to Shore Interfaces are Iridium based communications between Wave Gliders and the shore based management system. This Document is intended to capture all the protocols and data formats that make up this interface. Currently the document will cover version 1.0 of the SHARC target release only.

2. Related Documents

- **SHARC Firmware** Requirements specification (<svn+ssh://repos/gliders/trunk/EmbeddedSystems/Documents/SHARCFirmwareRequirements.doc>)
- **Wave Glider Management System** Planning document ([svn+ssh://repos/gliders/trunk/WaveGliderManagementSystem/Documents/LiquidR – Planning.doc](svn+ssh://repos/gliders/trunk/WaveGliderManagementSystem/Documents/LiquidR-Planning.doc))
- **Wave Glider Management System** Communication Channel Requirements Spec ([svn+ssh://repos/gliders/trunk/WaveGliderManagementSystem/Documents/ Communication Channels Specs.docx](svn+ssh://repos/gliders/trunk/WaveGliderManagementSystem/Documents/CommunicationChannelsSpecs.docx))
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3. System Overview

3.1 Short Burst Data

We use the Iridium defined short burst data to define the packet maximum lengths in communications between the shore side (Hyperion Software) and the ship side (our vehicles).

Iridium 9601 modem defines Short Burst Data (SBD) packet sizes (incl. Iridium header):

Up to 390bytes	Telemetry, Status and Ack/Nack (51 bytes Iridium header, up to 339 bytes of content)	Ship to Shore
Up to 390bytes	Multi-packet (version 2.0) (51 bytes Iridium header, up to 339 bytes of content)	Ship to Shore
Up to 300bytes	Multi-packet (version 2.0) (30 bytes of Iridium header, up to 270 bytes of content)	Shore to Ship
Up to 300bytes	Commands (30 bytes of Iridium header, up to 270 bytes of content)	Shore to Ship

Table 1

3.2 Data Integrity

Communications between ship and shore will all carry CRC-16 2 byte that will be checked by the receiving party.



3.3 Ack Protocol

Shore to ship commands will be acknowledged by the ship. This is a “stateless” protocol where a command is sent, and the ship then responds with Ack/Nack that carries the command ID to allow for shore system to track the command being acknowledged without having to maintain an additional state.

- Ack signals the successful reception of a packet and acceptance of its content.
- Nack signals the successful reception of a packet but rejection of its content.
- No response (timeout) signals bad reception of packet.
- Float Reboot command is not expected to Ack or Nack.

Ack packets will also carry a payload to allow for responses from ship to shore (read status command will acknowledge with status payload), for commands that don't have a response Ack/Nack packets will carry telemetry payload from the ship.

The Iridium communication model is basically a single operation at the glider end that does an upload and a download at the same time so the Ack/Nack to any command sent from the shore to the ship should be in the following communication from the Ship, so in most cases, the shore will see 1 or more incoming data packets after the command has been sent and before an Ack/Nack will be received.

4. Interface Packet Formats (Level 3)

Packets are made up of a header section and a payload.

4.1 Iridium Shore to Ship Packet Format

Single Shore to ship packets can be up to 370 bytes long (current packet types are usually 60 bytes long), up to 320 bytes of payload data (current packet types only use up to 30 bytes of payload data) and 30 bytes of Iridium defined header content. These types of packets are used to send commands to the ships.

Iridium Shore to Ship (header and payload) packet type:

Field Name	Index	Length (bytes)	Default Value
Protocol_Revision	0	1	1
Message_Length	1	2	Total length - 3
MT_Header_IEI	3	1	65
MT_Header_Length	4	2	21
CDR_Reference	6	4	"Msg1"
IMEI	10	15	
MT_Disposition_Flags	25	2	0
MT_Payload_IEI	27	1	66
MT_Payload_Length	28	2	Payload length
Interface level 2 Content	30	Up to 270 (current is 30)	

Table 2



4.2 Relay Shore to Ship Packet Format

Single Shore to ship packets can be up to 370 bytes long, up to 320 bytes of payload data and 30 bytes of Relay defined header content. These types of packets are used to send commands to the ships.

Relay Packet Shore to Ship format:

Field Name	Index	Length (bytes)	Default Value
Protocol Revision	0	1	See: Protocol Revision
Message Length	1	2	Total length - 3
MT Header IEI	3	1	65
MT Header Length	4	2	21
CDR Reference	6	4	See: CDR Reference
Unique Id	10	4	
IP Addr	14	4	
IP Port	18	4	
Spare	22	3	0
MT Disposition Flags	25	2	0
MT Payload IEI	27	1	66
MT Payload Length	28	2	Payload length
Interface level 2 Content	30	Up to 270	

Table 3

4.3 Virtual Relay Shore to Ship Packet Format

Single Shore to ship packets can be up to 370 bytes long, up to 320 bytes of payload data and 30 bytes of Relay defined header content. These types of packets are used to send commands to the ships.

Relay Packet Shore to Ship format:

Field Name	Index	Length (bytes)	Default Value
Protocol Revision	0	1	See: Protocol Revision
Message Length	1	2	Total length - 3
MT Header IEI	3	1	65
MT Header Length	4	2	21
CDR Reference	6	4	See: CDR Reference
Unique Id	10	4	
Internal IP Addr	14	4	
Session Id	18	4	
Spare	22	3	0
MT Disposition Flags	25	2	0
MT Payload IEI	27	1	66
MT Payload Length	28	2	Payload length
Interface level 2 Content	30	Up to 270	

Table 4

4.4 Relay Protocol Version Formats



Protocol Version

Protocol	Value
Iridium (Plug-In)	1
Xbee	2
Serial	3
802.11	4
Alt Iridium	5
Secure Iridium	6
Spare	7 – 31
Virtual Relay WiFi	32
Virtual Relay Cell	33
Virtual Relay BGAN	34
Virtual Relay RUDICS	35

Table 5

CDR Reference

Protocol	Value
Iridium (Plug-In)	"Msg1"
Xbee	"Xbee"
Serial	"Ser1"
802.11	"WiFi"
Alt Iridium	"Irid"
Secure Iridium	"Msgx"
Virtual Relay WiFi	"VRWF"
Virtual Relay Cell	"VRCL"
Virtual Relay BGAN	"VRBG"
Virtual Relay RUDICS	"VRRX"

Table 6**4.5 Iridium Ship to Shore Packet Format**

Ship to Shore packets are usually telemetry, Ack and Nack packets (up to 270 bytes long) have up to 339 bytes of payload and 51 bytes of header content.

Field Name	Index	Length (bytes)
Protocol_Revision	0	1
Message_Length	1	2
MO_Header_IEI	3	1
MO_Header_Length	4	2
CDR_Reference	6	4
IMEI	10	15
Session Status	25	1
MOMSN	26	2
MTMSN	28	2
Time_Of_Session	30	4
MO Location Info IEI	34	1
MO Location Info Length	35	2



MO Lat/Long *	37	7
CEP Radius **	44	4
MO_Payload IEI	48	1
MO Payload Length	49	2
Interface Level 2 Content	51	Up to 339

Table 7

* MO Lat/Lng structure breakdown:

Field Name	Index	Description
NSI (bit 6), EWI (bit 7)	0	NSI: North/South Indicator (0=North, 1=South) EWI: East/West Indicator (0=East, 1=West)
Latitude (Degrees)	1	Decimal Range: 0 to 90 Hex Range: 0x00 to 0x5A
Latitude (MS thousands of minute)	2	Decimal Range: 0 to 59,999 (unsigned integer, American notation) Hex Range: 0x0000 to 0xEA5F
Latitude (LS thousands of minute)	3	
Longitude (degrees)	4	Decimal Range: 0 to 180 Hex Range: 0x00 to 0xB4
Longitude (MS thousands of minute)	5	Decimal Range: 0 to 59,999 (unsigned integer, American notation) Hex Range: 0x0000 to 0xEA5F
Longitude (LS thousands of minute)	6	

Table 8

** The CEP radius provides the radius (in Kilometers) around the center point within which the IMEI is located with a 80% probability of accuracy

4.6 Relay Ship to Shore Packet Format

Ship to Shore packets are usually telemetry, Ack and Nack packets (up to 270 bytes long) have up to 340 bytes of payload and 50 bytes of header content.

Relay Packet Shore to Ship format:

Field Name	Index	Length (bytes)	Value
Protocol Revision	0	1	See: Protocol Revision
Message Length	1	2	Total length - 3
MO Header IEI	3	1	0
MO Header Length	4	2	0
CDR Reference	6	4	See: CDR Reference
Unique Id	10	4	
IP Addr	14	4	
IP Port	18	4	
Spare	22	3	0
Session Status	25	1	0
MOMSN	26	2	0
MTMSN	28	2	0
Time Of Session	30	4	0
MO Location Info IEI	34	1	0
MO Location Info Length	35	2	0



MO Lat/Long	37	7	0
CEP Radius	44	4	0
MO Payload IEI	48	1	0
MO Payload Length	49	2	Payload length
Interface Level 2 Content	51	Up to 339	

Table 9

4.7 Virtual Relay Ship to Shore Packet Format

Ship to Shore packets are usually telemetry, Ack and Nack packets (up to 270 bytes long) have up to 340 bytes of payload and 50 bytes of header content.

Relay Packet Shore to Ship format:

Field Name	Index	Length (bytes)	Value
Protocol Revision	0	1	See: Protocol Revision
Message Length	1	2	Total length - 3
MO Header IEI	3	1	0
MO Header Length	4	2	0
CDR Reference	6	4	See: CDR Reference
Unique Id	10	4	
Internal IP Addr	14	4	
Session Id	18	4	
Length	22	2	0-Unlimited, 1 -64K
Spare	24	1	0
Session Status	25	1	0
MOMSN	26	2	0
MTMSN	28	2	0
Time Of Session	30	4	Unix Timestamp format
MO Location Info IEI	34	1	0
MO Location Info Length	35	2	0
MO Lat/Long	37	7	0
CEP Radius	44	4	0
MO Payload IEI	48	1	0
MO Payload Length	49	2	Payload length
Interface Level 2 Content	51	Up to 339	

Table 10

5. Interface Structure Formats (Level 2)

All packets carry type as the first byte. All packets types are listed in the following table:



Packet Type	Type Value	Platform
Telemetry	0x1	Legacy
Configuration	0x2	Legacy
NAL Tracker Telemetry	0x3	Tracker Record
Telemetry	0x4	Legacy
Shout Tracker Telemetry	0x5	Model 08
Telemetry	0x6	Model 08
Power Control Status	0x7	Model 08
DB3.5 Power Control Status	0x8	Model 08
Twist Status	0x9	Model 08
Multi-Record Ship to Shore	0x30	Model 08
Command	0xa	All
Configuration	0xb	Legacy
Echoed Configuration	0xc	Legacy
Ack-Status with Waypoint Read	0x10	Model 08
Ack – Status	0x11	Model 08
Ack – Identification	0x12	Model 08
Ack	0x13	Model 08
Ack – Power Status	0x14	Model 08
Ack – Rudder Control	0x15	Model 08
Ack – Debug Buffer	0x16	Model 08
Ack – Sub Heading Buffer	0x17	Model 08
Ack – PID Integral Cache	0x18	Model 08
Ack – PID Operating Parameters	0x19	Model 08
Ack – DB3.5 Power Status	0x1A	Model 08
Ack – Read File Block	0x1B	Model 08
Ack – Twist Status	0x1C	Model 10
Reserved (XBee Relay)	0x1D	Model 10
Ack – Console Data	0x3D	Model 10
Ack – Unique Id	0x1E	Model 08
Ack – File At Destination	0x1F	Model 08
Ack File	0x31	Model 08
Ack - File List Item	0x33	Model 08
NAL Tracker	0x32	Model 08
Reserved (Internal Secure On Ack)	0xA1	Model 10
Ack – Secure On	0xA5	Model 10
Reserved	0x20	Model 08
Reserved	0x21	Model 08
Nack Cmd	0x22	Model 08
Nack Data	0x23	Model 08
Nack File	0x24	Model 08
Nack Security Failure	0x25	Model 10



Nack Console Data	0x26	Model 10
Set Parameter	0x40	Model 08
Reserved	0x44	Iridium MT Confirmation
New File Available	0x60	Model 08
Relay Status	0x70	Model 08
Single Payload Packet	0x80	Model 08
Multi Payload Packet	0x81	Model 08
Single Payload Packet Record	0x82	Model 08
Payload Packet	0x90	Model 08
Payload Packet	0x91	Model 08
Payload Packet Record	0x92	Model 08
Encrypted Output Packet³	0xA6	Model 10
Encrypted Command Packet⁴	0xA7	Model 10

NOTE 1: All new platform payload data is Least Significant Byte in low address (Little Endian – Intel Style) unless specifically indicated.

NOTE 2: No support for echo commands and status in new platform since IDs are unique per DB.

NOTE 3: Encrypted output is decrypted and re-packaged by the relay into the clear text form (header will have to have a header size changed to reflect clear text size.

NOTE 4: Command are encrypted by the relay and then sent to destination via channel. Header must be adjusted to reflect changed size of the packet sent.

Size is the Level 1 Interface Data byte count.

CRC is the CRC16 of all bytes in the Level 2 Interface Data except the last 2 bytes.

5.1 Command

Commands are single packet type (shore to ship), and An Ack/Nack packet is expected to be received for each command packet.

Legacy command types are 1 – 4.

Command payload format:

Type (1)	ID (4)	Size (2)	Level 1 Command Data (max 261)	CRC (2)
----------	--------	----------	--------------------------------	---------

Type = 0x0a

ID field is the ID stored for the command in the shore management system.

5.2 Ack

Ack (ship to shore) packet format:

Type (1)	ID (4)	Size (2)	Level 1 Interface Data (max 330)	CRC (2)
----------	--------	----------	----------------------------------	---------

ID field is the ID stored for the command being Ack-ed.

Payload contains Telemetry or command specific response (Requires new type allocation)



In case the payload is additional Ack information – details will be listed under the individual commands as to what that information might be (with appropriate type setup).

5.3 NACK

Nack (ship to shore) packet format:

Type (1)	ID (4)	Size (2)	Level 1 Interface Data (max 330)	CRC (2)
----------	--------	----------	----------------------------------	---------

ID field is the ID stored for the command being Nack-ed.

In case the payload is additional Nack information – details will be listed under the individual commands as to what that information might be (Requires new type allocation).

5.4 NAL Tracker Telemetry

Telemetry payload format:

Type (1)	Size (1)	Level 1 Interface Data (30)
----------	----------	-----------------------------

Type = 0x03

5.5 Telemetry

Telemetry payload format:

Type (1)	ID (4)	Size (2)	Level 1 Interface Data (max 330)	CRC (2)
----------	--------	----------	----------------------------------	---------

Type = 0x05, 0x06 Telemetry

Type = 0x07 Power Control Status

Type = 0x80 Single Packet Payload Data

Type = 0x81 Part of a Multi Packet Payload Data

ID = 0 Non command specific

5.6 Multi-Record Ship to Shore

A multi-Record packet contains up to 5 full iridium packets from ship to shore, each with its type, ID, Size, payload and CRC fields. When Shore side receives a multi-record packet it will break it up to its individual parts (plus Iridium header) and send to management system to be processed as if each one was received individually.

Telemetry payload format:

Type (1)	Count (1)	Level 2 Interface Data
----------	-----------	------------------------

Type = 0x30 Multi-Record packet

Count = Count of Telemetry/Ack/Nack packets in the payload

Each Telemetry packet payload is 39bytes, so up to 5 telemetry packets can be contained in a single Multi-Record Telemetry packet.



5.7 Encrypted Output/Command Packets

Encrypted Output/Command packets are transmitted between relays and vehicles in secure mode. A cipher level is implemented to transfer the LEVEL 2 data packet. Type is maintained to identify the direction of the packet (from/to vehicle) and counts are required to distinguish between the level 2 cipher data and the AES initialization vector data in the packet. If IV is not included (size = 0) then IV is assumed to be the previously used IV.

Packet format:

Type (1)	Size IV (1)	Size cipher (2)	IV	Level 2 Cipher Data	CRC (2)
----------	-------------	-----------------	----	---------------------	---------

Type = 0xA6 Vehicle to Shore

Type = 0xA7 Shore to Vehicle

5.8 Multi-Packet

TBD will be covered in Version 2.0 of ICD

5.9 Multi-Packet Ack/Nack

TBD.

6. Interface Data Definitions (Level 1)

6.1 Commands

List of all commands supported by all versions of the wave gliders.

Command Name	Command Value	Platform	Structure Id
<i>UHF Transmit Continuously</i>	0x0020	Legacy	16
Right Rudder	0x0004	All	16
Left Rudder	0x0005	All	16
Center Rudder	0x0006	All	16
Set Default Communication Channel	0x000A	Model 08	16
Channel Status	0x000B	Model 10	16
Reserved	0xA51E	Model 08	100
Set Unique Id	0x000F	Model 08	16
File Delete	0x9002	Model 08	26
Read File Request	0x9003	Model 08	18
Read File Transaction Closed	0x9007	Model 08	16
Initialize File Write	0x9000	Model 08	24
Write File Block	0x9001	Model 08	25
Write Console Script	0x9100	Model 08	25
Write Console Binary	0x9101	Model 08	25
Get File List	0x9008	Model 08	49



Select Program	0x9005	Model 08	16
Set Rudder Position	0x1006	Model 08	16
Twist Umbilical	0x1007	Model 08	16
<i>Capture Image</i>	<i>0x0007</i>	<i>Legacy</i>	<i>16</i>
Retrieve Configuration	0x4000	Legacy	16
Retrieve Status	0x4001	Model 08	16
Set Status	0x4002	Model 08	17
Retrieve Identification	0x4003	Model 08	16
Retrieve Power Status	0x5001	Model 08	16
Retrieve Rudder Control	0x5002	Model 08	16
Set Rudder Control	0x5003	Model 08	22
Retrieve Twist Status	0x5004	Model 08	16
Calibrate Twist	0x5005	Model 08	16
Set Parameters	0x6000	Model 08	21
Retrieve Debug Buffer	0x7000	Model 08	16
Retrieve Sub Heading Buffer	0x7001	Model 08	16
Retrieve PID Integral Cache	0x7002	Model 08	16
Retrieve PID Operating Params	0x7003	Model 08	16
Follow Fixed Heading	0x0008	All	16
New Waypoint	0x8000	All	16
New Waypoints (Not Implemented)	0x8001	Model 08	19
Clear Waypoints (Not Implemented)	0x8002	Model 08	19
Read Waypoint	0x8003	Model 08	16
<i>Say Configuration</i>	<i>0x0100</i>	<i>Legacy</i>	<i>16</i>
<i>WAD On</i>	<i>0x0080</i>	<i>Legacy</i>	<i>16</i>
Hold Station At Waypoint	0x0002	All	16
Toggle Marker Light	0x2000	Legacy	16
Light Off	0x2001	Model 08	16
Light On	0x2002	Model 08	16
IR Off	0x2003	Model 08	16
IR On	0x2004	Model 08	16
XBee Off	0x2005	Model 08	16
XBee On	0x2006	Model 08	16
<i>UHF TransmitNow</i>	<i>0x0010</i>	<i>Legacy</i>	<i>16</i>
Follow Sequential Waypoint Course	0x0003	All	16
Follow Course and Loop	0x8101	Model 08	18
Follow Course With Options	0x8102	Model 08	18
<i>Say Position</i>	<i>0x0040</i>	<i>Legacy</i>	<i>16</i>
Hold Current Position	0x0001	All	16



Add MMSI to Watch List	0x8200	Model 08	16
Float Reboot*	0xA000	Model 08	16
Secure On	0xA500	Model 10	100
Secure Authenticate	0xA501	Model 10	101
Secure Register Client**	0xA502	Model 10	102
Secure Off*	0xA504	Model 10	16
Secure Enable Partition**	0xA505	Model 10	16
No Command	0x0000	All	16

All successful command receptions respond with standard telemetry type ack unless specified otherwise.

*NOTE: only accessible for system admin role.

** NOTE: Only issued on secure channel

6.1.1 Set Default Communication Channel

Vehicle always defaults to Iridium as Communication Channel. When other Channel is specified but not available, Vehicle should switch back to Iridium.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x000A
Channel Number	1	See Protocol Version
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.2 Read Unique Id

Unique Id is programmed into Vehicle Non-Volatile memory. If not set previously it will return a -1 (0xFFFFFFFF).

Ack for this command is structure type 0x1E containing the Unique Id

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x000E
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0



6.1.3 Set Unique Id

Set Unique Id sets the Vehicle Unique Id programmed into Non-Volatile memory. It can only be issued by System Administrators. This command usually should be used only once in the Vehicle lifetime which is when the vehicle is first brought online. NOTE: This command can only be issued via Iridium.

Ack for this command is structure type 0x1E containing the Unique Id

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x000F
Hyperion Id	4	
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.4 File Delete

Send a request to delete a file from a vehicle file storage identified by the storage controller address..

Field Name	Bytes	Value
Structure ID	1	0x1A
Command Value	2	0x9002
Storage Controller Address	2	Any (0=Float C&C)
File Name	11	
File Hyperion Id*	4	Any
Override Read Only	1	0 = do not delete file if marked read-only, 0xFF = delete file even if file is marked as read-only

* Valid Hyperion Id uniquely identifies a file regardless of the File Name.

6.1.5 Read File Request

Send a request to read a file from the Vehicle. File Hyperion Id is the ID of this command that will be used to tag all the acks with file blocks that will then have to be assembled back to form the actual file.

Catalog-Image-Id contains the file notification entity Id which will house all the ack fragments for the file.

Transaction Id is -1 for first read and original read file id for retries.

Field Name	Bytes	Value
Structure ID	1	0x1B
Command Value	2	0x9003
Storage Controller Address*	2	Any (0=Float C&C)
File Name	11	



Field Name	Bytes	Value
Transaction Id	4	Any for retries
Offset (Seek)	4	0
Read Length	4	0
Max Response Size	2	175 + 18 (header)/ 1792 + 18 9522B

* Storage Controller address is copied from the New File Available request.

6.1.6 Read File Transaction Closed

Send a transaction closed message to the Vehicle to signify successful reception of the file and remove the file from the Vehicle memory. (command Transaction Id should be the read file command id)

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x9007
Storage Controller	2	Any (0=Float C&C)
Field 5	1	0
Field 6	1	0
Field 7	1	0
Transaction Id	4	Any
Longitude	4	0

6.1.7 Initialize File Write

Start a file download to the Vehicle..

Field Name	Bytes	Default Value
Structure Id	1	0x18
Command Value	2	0x9000
Storage Controller	2	Any (0=Float C&C)
File Name	11	
File Hyperion ID	4	Any
File Length	4	Any
Creation Date	6	0
Modified Date	6	0
File Attributes	1	0
Overwrite File	1	0xff
CRC-16 of content	2	
MD-5 of content	16	
Number of Data Bytes	2	0

6.1.8 Write File Block

Send a single block of data from the file. Ack should be type 0x13 (no payload). NACK uses the type 0x24 File Nack.



Field Name	Bytes	Default Value
Structure Id	1	0x19
Command Value	2	0x9001
Storage Controller	2	Any (0=Float C&C)
File Hyperion Id	4	Any
Offset (Seek)	4	Any
Number Of Bytes	2	246 relay 9601/ 182 iridium 9601/ 1792 9522B
Data	1..N	

6.1.9 Get File List

This command is used to request a directory listing or the listing for a specific file. Successful file check will transfer the file to its target storage controller. Ack should be type 0x31 (with payload) and NACK uses type 0x24 File Nack.

Field Name	Bytes	Default Value
Structure Id	1	0x31
Command Value	2	0x9008
Storage Controller Address	2	Any (0=Float C&C)
File Name	11	
File Hyperion Id	4	Any
Action Flags	1	0x1 check file(s) 0x0 don't check file(s)
Max Response Size	2	330 relay/ 266 Iridium

6.1.10 Program Select

Instructs the Vehicle to complete the file write and perform additional functions such as reprogram it's code.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x9005
Storage Controller	2	Any (0=Float C&C)
Number of Program Selections	2	1
Operation	1	0 = Select program as default (all others are deselected) 1 = Select program as current (all others are deselected) 2 = Select program as default and current (all others are deselected)
File Hyperion Id	4	Any



Board Address	2	Any
Spare Field	2	0

6.1.11 Follow Fixed Heading

Heading is entered by user in degrees but converted to BRADS when sent to vehicle.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x0008
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	Heading (BRADS)*
Field 7	1	0
Latitude	4	0
Longitude	4	0

* changed to two bytes (6 and 7) of heading in degrees for platform 2.

6.1.12 New Waypoint

Waypoint numbers 0 and 255 are not valid for waypoint creation. The Ack should include number of New Waypoints created, number of Previous Waypoints overwritten and as long as at least 1 Waypoint has been added or modified by the glider, it should respond with an Ack.

The glider will Nack if No Waypoints in the system have been added or modified.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x8000
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Waypoint Number	1	Waypoint number
Latitude	4	Latitude
Longitude	4	Longitude

6.1.13 Read Waypoint

The Ack should be structure type 0x10 which includes the status with latitude/longitude of the waypoint read in the hold lat/long fields.

The glider will NackData if No such Waypoint exists.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x8003



Waypoint Number	1	Waypoint number
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.14 Hold Station at Waypoint

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x0002
Field 3	1	Waypoint number
Field 4	1	0
Field 5	1	0
Waypoint CRC16	2	value
Flag	4	1 - check waypoint CRC 0 - Don't check waypoint CRC
Longitude	4	0

6.1.15 Follow Sequential Waypoint Course

The Nack will have the number of invalid waypoints in the loop (ex. The command is to loop from waypoint 10 through waypoint 20 but waypoints numbers 13, 16, and 17 were never set on the glider)

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x0003
Field 3	1	Target Waypoint number
Field 4	1	From Waypoint number
Field 5	1	To Waypoint number
Waypoint CRC16	2	value
Flag	4	1 - check waypoint CRC 0 - Don't check waypoint CRC
Longitude	4	0

6.1.16 Follow Course and Loop

Follow custom defined course and loop.



The Nack will have the number of invalid waypoints in the loop (ex. The command is to loop from waypoint 10 through waypoint 20 but waypoints numbers 13, 16, and 17 were never set on the glider)

Open Issue: Define NACK failure packet format.

Field Name	Bytes	Default Value
Structure Id	1	0x12
Command Value	2	0x8101
Target Waypoint	1	Target Waypoint number
Number of Waypoints	1	N
Payload	N (up to 213)	List of N ordered waypoints
Waypoint CRC16	2	value

6.1.17 Follow Course with Options

Follow custom defined course with added options field.

Field Name	Bytes	Default Value
Structure Id	1	0x12
Command Value	2	0x8102
Target Waypoint	1	Target Waypoint number
Navigation Option	1	0 - Loop 1 - Hold last waypoint 2 - Cover Area
Number of Waypoints	1	N
Payload	N (up to 212)	List of N ordered waypoints
Waypoint CRC16	2	value

6.1.18 Right Rudder

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x0004
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0



Longitude	4	0
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6.1.19 Left Rudder

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x0005
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.20 Center Rudder

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x0006
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.21 Set Rudder Position

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x1006
Position	1	Value (-30 - 30)
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.22 Twist Umbilical



Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x1007
Number of Twists	1	Value (-7 - 7)
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.23 Retrieve Configuration

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x4000
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.24 Retrieve Status

Ack for this command should have the status packet in it.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x4001
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.25 Set Status

Field Name	Bytes	Default Value
Structure Id	1	0x11
Command Value	2	0x4002
Status Packet	35	



6.1.26 Retrieve Power Status

Ack for this command should have the power controller status packet in it.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x5001
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.27 Retrieve Identification

Ack for this command should have the id packet in it.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x4003
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.28 Retrieve Rudder Control

Ack for this command should have the rudder control packet in it.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x5002
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.29 Set Rudder Control

Field Name	Bytes	Default Value
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Structure Id	1	0x16
Command Value	2	0x5003
Rudder Control Packet	32	

6.1.30 Set Parameters

Field Name	Bytes	Default Value
Structure Id	1	0x15
Command Value	2	0x6000
Number of parametes	1	N
Parameter 1 Id	2	
Parameter 1 Length	1	
Parameter 1 Data	Parameter 1 Length	
...		
Parameter N Id	2	
Parameter N Length	1	
Parameter N Data	Parameter N Length	

Parameters that are currently supported (Firmware Level 2.0):

Name	Id	Length	Type	Comment
Payload 1 Power	0x0100	1	Boolean	0=off, 1=on
Payload 2 Power	0x0200	1	Boolean	0=off, 1=on
Sub Payload Power	0x0300	1	Boolean	0=off, 1=on
Internal Payload Power	0x0400	1	Boolean	0=off, 1=on
AIS Receiver Power	0x401	1	Boolean	0=off, 1=on
Weather Station Power	0x402	1	Boolean	0=off, 1=on
Water Sensor Power	0x403	1	Boolean	0=off, 1=on
Bubble Power	0x0020	1	Boolean	0=off, 1=on
Sub Power	0x0021	1	Boolean	0=off, 1=on
Invalid GPS Count	0x000F	1	Numeric	0 – 255 default 12
Enable PID Navigation	0x0030	1	Boolean	0=off, 1=on
P Gain Value	0x0031	2	Numeric	-32768 – 32767
I Gain Value	0x0032	2	Numeric	-32768 – 32767
Integral Sat Limit	0x0033	2	Numeric	0 - 32767
Camera Controller Power	0x00FD	1	Boolean	0=off, 1=on
Payload File Transfer Reset	0x00FB	1	Boolean	0=off, 1=on
Iridium Modem Always On	0x0014	1	Boolean	0=off, 1=on



Iridium Modem Default On	0x0015	1	Boolean	0=off, 1=on
XBee PAN ID	0x0016	2	Numeric	0x5000
Default XBee Channel	0x0017	1	Numeric	12
Secondary Iridium Channel Polling Rate	0x001A	1	Numeric	0 = off 1 – 120 minutes
Temporary Channel Retries	0x001B	1	Numeric	1-32
Payload Power On Enumeration Delay	0x0018	2	Numeric	1 – 32767 default 15
Iridium Fast Mailbox Checks	0x001C	1	Boolean	0=off, 1=on
AIS Inner Circle	0x0423	2	Numeric	0 – 480, default 20
AIS Outer Circle	0x0424	2	Numeric	0 – 480, default 240
AIS Outer Angle	0x0425	2	Numeric	0 – 90, default 45

Parameters supported (CEROS Part):

Name	Id	Length	Type	Comment
Start CEROS Test	0x00FE	2	Numeric	0 – 65535

Parameters supported (DB3.5 – Firmware level 3.0):

Name	Id	Length	Type	Comment
Payload 3 Power	0x0500	1	Boolean	0=off, 1=on
Power Extension Port Power	0x0700	1	Boolean	0=off, 1=on
IPIB Reset	0x0410	1	Boolean	0=off, 1=on
Magnetic Declination	0x0019	1	Numeric	-90 - 90
Modem Off Required Port	0x0050	1	Numeric	1 – 3
Enable Alternate GPS	0x0040	1	Boolean	0=off, 1=on
Modem Off Required Address	0x0051	2	Numeric	Unsigned number
Modem Power	0x0052	1	Boolean	0=off, 1=on
Modem Power At Boot	0x0053	1	Boolean	0=off, 1=on
GPS Altitude Filter	0x0041	1	Boolean	When on (1) ignore GPS: > +100m OR < -100m

6.1.31 Retrieve Debug Buffer

Sys Admin/Developer roles have access to this command and Ack for this command should have the debug buffer packet in it.



Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x7000
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.32 Retrieve Sub Heading Buffer

Sys Admin/Developer roles have access to this command and Ack for this command should have the debug buffer packet in it.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x7001
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.33 Retrieve PID Integral Cache

Sys Admin/Developer roles have access to this command and Ack for this command should have the debug buffer packet in it.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x7002
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.34 Retrieve PID Operating Params

Sys Admin/Developer roles have access to this command and Ack for this command should have the debug buffer packet in it.

Field Name	Bytes	Default Value
Structure Id	1	0x10



Command Value	2	0x7003
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.35 Retrieve Log File

Sys Admin/Developer roles have access to this command and Ack for this command should have the start a file read process.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0xB001
Month	1	
Day	1	
Year	1	Year - 2000
Hour	1	
Minute	1	
Second	1	
Number of entries	2	1 - n
Sublog Number	1	1 - 99
Spare	4	

6.1.36 Toggle Marker Light

Ack for this command should have the status packet to indicate the state of the light.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x2000
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.37 Turn Off/On Light/IR/XBee Light

Ack for this command should have the status packet to indicate the state of the light/IR/XBee.

Field Name	Bytes	Default Value
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Structure Id	1	0x10
Command Value	2	0x2001/2/3/4/5/6
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.38 Hold Current Position

Hold current position is returned in the status so ack should have the status for this command.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x0001
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.39 Add MMSI to Watch List

Add MMSI to vehicle watch list to allow for increased reporting rate for the vessel under watch.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0x8200
MMSI	4	Any
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.40 Float Reboot

Sys Admin/Developer roles have access to this command to reset the float in case of no-response/debug. This command is not expected to be Acked by the vehicle and will be followed up by a Float Reboot alarm on the next telemetry.

Field Name	Bytes	Default Value
Structure Id	1	0x10
Command Value	2	0xA000



Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.41 Write Console Command (ASCII)

This is a single packet command to a particular 16-bit board address on a Wave Glider expecting either ASCII or binary data.

Field Name	Bytes	Value
Structure ID	1	0x1E (Write Console Input to Wave Glider)
Command Value	2	0x9100 (execute component command - ASCII format)
Destination Address	2	0 = Float C&C; otherwise, the address for the board to receive console input or command
Function	1	0 or destination specific value (user entered)
Number of Bytes in Data	2	The number of bytes in the Data field (at least 1)
Data	1..N	Data to send into Wave Glider Console input (ASCII)

6.1.42 Write Console Command (Binary)

This is a single packet command to a particular 16-bit board address on a Wave Glider expecting either ASCII or binary data.



Field Name	Bytes	Value
Structure ID	1	0x1E (Write Console Input to Wave Glider)
Command Value	2	0x9101(execute component command - binary format)
Destination Address	2	0 = Float C&C; otherwise, the address for the board to receive console input or command
Function	1	0 or destination specific value
Number of Bytes in Data	2	The number of bytes in the Data field (at least 1)
Data	1..N	Data to send into Wave Glider Console input (HEX)

6.1.43 Secure On

Command to start the process of switching to a secure (encrypted) channel communication between vehicle and WGMS. This command and its Ack is always sent in clear text.

Field Name	Bytes	Value
Structure ID	1	0x64
Command Value	2	0xA500
WGMS Ephemeral ECDH-P256 Public Key (in Vehicle Key Format**)	Variable (68)	
Client Channel Id	32	

*See secure On Ack message format for response.

** Vehicle Key Format is 68 byte Big Endian Key Format:

Description	Value	Length (bytes)	
Bit Length X (for P256 and SHA256)	256	2	Count of bits (Big Endian)
X	...	32	
Bit Length Y (for P256 and SHA256)	256	2	Count of bits (Big Endian)
Y	...	32	



6.1.44 Secure Authenticate

Command to send the vehicle a pass-phrase to authenticate WGMS to the Vehicle. This command is always sent in clear text, and Pass-Phrase field is encrypted with symmetric key.

Field Name	Bytes	Value
Structure ID	1	0x65
Command Value	2	0xA501
Client Channel Id	32	
IV size	1	
Cipher text size	2	
IV	Variable	
Pass-Phrase (cipher text)	Variable	

6.1.45 Secure Register Client

Command to send the vehicle a client registration, to allow for the vehicle to recognize future secure clients.

Field Name	Bytes	Value
Structure ID	1	0x66
Command Value	2	0xA502
Client Permanent ECDSA-P256 Public Key (Vehicle Key Format)	68	
Client Channel Id	32	
Pass-Phrase	20	

This command can only be sent on a secure channel

6.1.46 Secure Off

Command to start the process of switching from a secure (encrypted) channel to clear text communication between vehicle and WGMS.

Field Name	Bytes	Value
Structure ID	1	0x10
Command Value	2	0xA504
Field 3	1	0
Field 4	1	0
Field 5	1	0
Field 6	1	0
Field 7	1	0
Latitude	4	0
Longitude	4	0

* Ack message sent in the clear

This command can only be sent on a secure channel

6.1.47 Reserved

Ack for this command is structure type 0xA1



Field Name	Bytes	Default Value
Structure Id	1	0x64
Command Value	2	0xA51E
Internal Use	Variable (68)	
Internal Use	32	

6.1.48 Secure Enable Partition

This is a single packet command that will be intercepted by the Crypto Lib and be replaced by Write Debug Console with the appropriate encrypted partition mount command.

Field Name	Bytes	Value
Structure ID	1	0x10
Command Value	2	0xA505
PartId	4	User entered
Field 7	1	0
Latitude	4	0
Longitude	4	0

6.1.49 No Command

Command 0x0000 is not sent to vehicle but is stored in the vehicle command log.

6.2 Status

6.2.1 Status (Structure Type 0x11)

Status packet can be sent from shore to ship to set the configuration of a vehicle or can be received back from ship in response to a retrieve configuration command.

Field Name	Byte Index	Size	Bit Index	Default
Follow_Course (Read Only)	0	1	0	1
Manual_Navigation (Read Only)	0	1	1	0
Follow Heading (Read Only)	0	1	2	0
Hold Station (Read Only)	0	1	3	0
Unused	0	1	4	0
XBee_State (Read Only)	0	1	5	0
Marker_Light_State (Read Only)	0	1	6	0
IR_Light_State (Read Only)	0	1	7	0
Telemetry_Rate	1	2		2 (1 – 1440)
Battery_Check_Rate (Low_Battery_Report_Rate)	3	2		20 (1 – 1440)



Alarm_Check_Rate (Alarm_Report_Rate)	5	2		2 (1 – 30)
Reserved	7	1		0
Sub_Float_Timeout	8	1		20 (20 - 200ms)
Reserved	9	1		0
Reserved	10	1		0
Float_Low_Battery	11	1		20 (1 - 65) 10WH steps
Float_Critical_Battery	12	1		3 (1 - 65) 10WH steps
Reserved	13	1		0
Reserved	14	1		0
Reserved	15	1		0
Float_Pressure_Threshold_High	16	1		255
Float_Pressure_Threshold_Low	17	1		115
Float_Temperature_Threshold	18	1		70
Waypoint_Arrival_Distance	19	2		20 (5 - 5000)m
Reserved	21	1		0
Power Control Status Rate	22	2		60 (5 – 2880)
Reserved	24	2		0
Float_Sub_Comm_Period	26	1		15 (1 - 240sec)
Hold_Position_Latitude (Read Only)	27	4		0
Hold_Position_Longitude (Read Only)	31	4		0

6.2.2 Status with Waypoint Read Back (Structure Type 0x10)

This Status packet is received in response to Waypoint Read command.

Field Name	Byte Index	Size	Bit Index	Default
Follow_Course (Read Only)	0	1	0	1
Manual_Navigation (Read Only)	0	1	1	0
Follow Heading (Read Only)	0	1	2	0
Hold Station (Read Only)	0	1	3	0
Unused	0	1	4	0
XBee_State (Read Only)	0	1	5	0
Marker_Light_State (Read Only)	0	1	6	0
IR_Light_State (Read Only)	0	1	7	0
Telemetry_Rate	1	2		2 (1 – 1440)
Battery_Check_Rate	3	2		20 (1 –



(Low_Battery_Report_Rate)				1440)
Alarm_Check_Rate (Alarm_Report_Rate)	5	2		2 (1 – 30)
Reserved	7	1		0
Sub_Float_Timeout	8	1		20 (20 - 200ms)
Reserved	9	1		0
Reserved	10	1		0
Float_Low_Battery	11	1		20 (1 - 65) 10WH steps
Float_Critical_Battery	12	1		3 (1 - 65) 10WH steps
Reserved	13	1		0
Reserved	14	1		0
Reserved	15	1		0
Float_Pressure_Threshold_High	16	1		255
Float_Pressure_Threshold_Low	17	1		115
Float_Temperature_Threshold	18	1		70
Waypoint_Arrival_Distance	19	2		20 (5 - 5000)m
Reserved	21	1		0
Power Control Status Rate	22	2		60 (5 – 2880, 0 off)
Reserved	24	2		0
Float_Sub_Comm_Period	26	1		15 (1 – 240sec)
Waypoint_Read_Latitude (Read Only)	27	4		0
Waypoint_Read_Longitude (Read Only)	31	4		0

NOTE: Read Only are reported from Ship to Shore.

6.3 Telemetry

6.3.1 Telemetry type 3 (NAL Tracker Format)

Field Name	Byte Index	Size	Bit Index
Year – Hour (div 10 Hour – mod 10 decade)	0	1	
Minute	1	1	
Second (Mod 0x40)	2	1	
Decimal Seconds (.##)	3	1	
Year – Month (Div 10 Month – Mod 10 Year)	4	1	



Day	5	1	
Latitude (Deg)	6	1	
Latitude (Min)	7	1	
Longitude (Deg)	8	1	
Longitude (Min)	9	1	
Latitude (Decimal Min .##)	10	1	
Latitude (Decimal Min .00##)	11	1	
Longitude (Mod 10 - Decimal Min .#)	12	1	
Longitude (Decimal Min .0##)	13	1	
Longitude (Decimal Min .000##)	14	1	
Misc info (not used)	15	14	
Configuration Byte	29	1	

6.3.2 Telemetry type 5 (Deprecated)

Field Name	Byte Index	Size	Bit Index
Sub Leak Alarm	0	1	0
Float Leak Alarm	0	1	1
Sub to Float Comms Alarm	0	1	2
Sub Battery Low Alarm	0	1	3
Float Battery Low Alarm	0	1	4
Umbilical Fault Alarm	0	1	5
Sub Pressure Threshold Alarm	0	1	6
GPS Not Functioning	0	1	7
Unused	1	1	0
Sub Reboot Alarm	1	1	1
Float to Sub Comms Error	1	1	2
Unused	1	1	3
Float Temperature Threshold Exceeded	1	1	4
Float Pressure Threshold Exceeded	1	1	5
Sub Temperature Threshold Exceeded	1	1	6
Float Reboot Alarm	1	1	7
Temp_Surface	2	2	
Latitude	4	4	
Longitude	8	4	
Last_Fix_Time_Hours	12	1	
Last_Fix_Time_Minutes	13	1	
Last_Fix_Time_Seconds	14	1	
Last_Fix_Date_Month	15	1	
Last_Fix_Date_Day	16	1	
Last_Fix_Date_Year	17	1	
Battery Voltage	18	1	



Temperature_Sub	19	2	
Distance_Over_Ground (m)	21	2	
Rudder Count	23	4	
Heading_Sub (degrees)	27	2	
Iridium_Signal_Strength	29	1	
Target_WayPoint	30	1	
Desired_Bearing (Degrees)	31	2	
Heading_Float (Degrees)	33	2	
Pressure_Sensor_Float	35	1	
Pressure_Sensor_Sub	36	1	
Navigation_Mode	37	1	
Light_State	38	1	0
IR_State	38	1	1
Xbee_State	38	1	2
Unused	38	1	3
Unused	38	1	4
Unused	38	1	5
Unused	38	1	6
Unused	38	1	7

6.3.3 SHOUT Tracker (Telemetry type 5)

Byte 0 = 0x05 (format type)

Byte 1 is a bit map of the input pins (read as 0)

Bytes 2--9 is a 64 bit unsigned integer -- convert it to the decimal value and then use DIV and MOD type functions to pull out the appropriate digits based on this format

dLLLMMFFFIImmfffHHHH where:

d = latitude direction (0 North, 1 South)

l = latitude degrees

m = latitude minutes

f = latitude fraction minutes

L = longitude degrees with direction (<200 East, >200 West)

M = longitude minutes

F = longitude fraction minutes

H = horizontal dilution of precision which is set to always have 4 digits with the last 2 being decimal values.

Bytes 10--17 is a 64 bit unsigned integer -- treat it as a decimal value and then use DIV and MOD type functions to pull out the appropriate digits based on this format



sMMDDYYYYHHmmSSTVVVV where:

s = vertical velocity sign (1 positive, 0 negative) – Not Recorded

M = month of year

D = day of month

Y = year

H = hour m = minute of hour

S = second

T = tenths of seconds (hundredths of second is always a 0 because of time alignment)

VVVV = Last 4 digits in vertical velocity

Bytes 18--25 is a 64 bit unsigned integer -- treat it as a decimal value and then use DIV and MOD type functions to pull out the appropriate digits based on this format

sCCCCCaAAAAAgGGGGGOO where:

s = altitude sign (1 positive, 0 negative) – Not Recorded

C = course in degrees with always 2 digits behind the decimal

a = altitude decimal place – Not Recorded

A = altitude value – Not Recorded

g = ground velocity decimal place

G = ground velocity value

O = 6 output pins. This number can range from 00 to 63 and each bit represents one pin value. – Not Recorded

Byte 26--27 is a 16 bit unsigned integer -- treat it as a decimal value and then use DIV and MOD type functions to pull out the appropriate digits based on this format

DVVVV -

First digit is the decimal place in the vertical velocity -

Next 4 digits are the VDOP value which is set to always have 4 digits with the last 2 being decimal values. – Not Recorded

Byte 28 is an unsigned 8 bit value -- treat it as a decimal value and then use DIV and MOD type functions to pull out the appropriate digits based on this format

SSV -

First 2 digits number of GPS satellites used - – Not Recorded

Last digit is the first digit in vertical velocity – Not Recorded

Byte 29 are the GPS Quality Indicators and is decoded according to this table:

bit	Value
0	2D-Fix – Not Recorded
1	Dead Reckoning – Not Recorded
2	Valid Position Fix – Not Recorded
3	ID Included or extra data follows – Not Recorded
4	Emergency Alert – Not Recorded
5	Motion sensor triggered report, 1 if triggered by motion sensor. – Not Recorded



6 Unused
7 Unused

6.3.4 Telemetry type 6

Field Name	Byte Index	Size	Bit Index
Sub Leak Alarm	0	1	0
Float Leak Alarm	0	1	1
Sub to Float Comms Alarm	0	1	2
Payload Error Condition Alarm	0	1	3
Float Battery Low Alarm	0	1	4
Umbilical Fault Alarm	0	1	5
Sub Pressure Threshold Alarm	0	1	6
GPS Not Functioning	0	1	7
Internal Vehicle Comm Error	1	1	0
Sub Reboot Alarm	1	1	1
Float to Sub Comms Error	1	1	2
Over Current Error	1	1	3
Float Temperature Threshold Exceeded	1	1	4
Float Pressure Threshold Exceeded	1	1	5
Sub Temperature Threshold Exceeded	1	1	6
Float Reboot Alarm	1	1	7
Temp_Surface	2	2	
Latitude	4	4	
Longitude	8	4	
Last_Fix_Time_Hours	12	1	
Last_Fix_Time_Minutes	13	1	
Last_Fix_Time_Seconds	14	1	
Last_Fix_Date_Month	15	1	
Last_Fix_Date_Day	16	1	
Last_Fix_Date_Year	17	1	
File Read Transaction Timeout Error	18	1	0
File Write Fallback Image Activated	18	1	1
File Write Program Image Burned	18	1	2
File Write Fallback Image Bad or Not Found	18	1	3
File Write Selected Image Bad or Not Found	18	1	4
File Write Tentative Image Retry	18	1	5
Boot Config Corrupt	18	1	6
IPIB Not Responding	18	1	7
Temperature_Sub	19	2	
Distance_Over_Ground (m)	21	2	



Rudder Count	23	4	
Heading_Sub (degrees)	27	2	
Iridium_Signal_Strength	29	1	
Target_WayPoint	30	1	
Desired_Bearing (Degrees)	31	2	
Heading_Float (Degrees)	33	2	
Pressure_Sensor_Float	35	1	
Pressure_Sensor_Sub	36	1	
Navigation_Mode	37	1	See Nav Modes
Light_State	38	1	0
IR_State	38	1	1
Xbee_State	38	1	2
Payload 1 Power	38	1	3
Payload 2 Power	38	1	4
Sub Payload Power	38	1	5
Bubble Com Error	38	1	6
Battery Com Error	38	1	7
Reset_Flags	39	1	
Total_Power (10mWh)	40	2	
Iridium_Read_Errors	42	1	
Iridium_Write_Errors	43	1	
Iridium_Session_Errors	44	1	
Water Speed	45	2	
Water Direction	47	2	
Water Speed Std Dev	49	1	
Water Direction Std Dev	50	1	
Humidity	51	1	
Payload 3 Status	52	1	0
Payload 4 Status	52	1	1
PEP Status	52	1	2
IPIB Status	52	1	3
Modem Power	52	1	4
Increased Mailbox Checks	52	1	5
Regulus Alarm	52	1	6
Reserved	52	1	7

6.3.5 Telemetry type 7

Same as Power Control Status Packet.



6.3.6 System Information Telemetry (Packet 0x71)

This message format is identical to that of Message type 0x91 except that the information contained in this message is a system information/configuration in nature.

Field Name	Bytes Used	Byte #	Format
System Information Type	4	0-3	
Board Id	1	4	Unsigned 8-bit integer
Task Id	1	5	Unsigned 8-bit integer
Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer
Repeat Count	1	7	Unsigned 8-bit integer
System Information Record(s)	[variable]	8-	

6.3.6.1 Telemetry type 113 Records (System Information Records)

All system information records must provide space and time using the following format. Message 0x71 provide for repeat counts for multiple samples within a message.

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
System Information Data	[variable]	12-	

6.3.6.2 System Information Types

Field Name	Number
Unspecified	0
Partition State	1
Power Status	32

6.3.6.3 Partition State Record (type 1)

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
Partition State	1	12	0: partition disabled 1: partition enabled

6.3.6.4AMPS Power Status Records (type 3)

6.3.6.4.1 Output Port Details (Data Format = 1)

(Typically 12 Output Ports per message in an Alpha System)

Field Name	Bytes Used	Byte #	Format	Value (If known)
System Information Type	4	0-3		0x00000003
Board Id	1	4	Unsigned 8-bit integer	0
Task Id	1	5	Unsigned 8-bit integer	
Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer	1
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII	0
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer	
Repeat Count	1	7	Unsigned 8-bit integer	1
Latitude	4	8	Signed 32-bit integer	
Longitude	4	12	Signed 32-bit integer	
Time Stamp	4	16	Signed 32-bit integer	
Power Domain	1	20	Unsigned 8-bit integer	
Port Type	1	21	Unsigned 8-bit integer	
Number of Ports in Message (N - usually 12 for Alpha systems)	1	22	Unsigned 8-bit integer	
Number of Ports in Power Domain	1	23	Unsigned 8-bit integer	
Report Format Revision	1	24	Unsigned 8-bit integer	
<i>(N Blocks of Data)</i>		<i>0 ≤ n < N</i>	<i>Repeat the following block N times - N is from the Number of Ports in Message field located at byte 22 above</i>	
Port Number	1	25 + n*12	Unsigned 8-bit integer	



Module Number	1	$26 + n \times 12$	Unsigned 8-bit integer	
Port Status	2	$27 + n \times 12$	16 Bit Bitfield Bit 0: On/Off (1 = On) Bit 1: Port Fault (OR of bits 2-14) Bit 2: Power Low Alarm Bit 3: Voltage Low Alarm Bit 4: Current Low Alarm Bit 5: Power High Alarm Bit 6: Voltage High Alarm Bit 7: Current High Alarm Bit 8: Power Low Failure Bit 9: Voltage Low Failure Bit 10: Current Low Failure Bit 11: Power High Failure Bit 12: Voltage High Failure Bit 13: Current High Failure Bit 14: Port Hardware Fault Bit 15: Not Used	
Average Power	2	$29 + n \times 12$	Unsigned 16-bit integer 0.00 to 655.35 W in 0.01W	
Average Voltage	2	$31 + n \times 12$	Unsigned 16-bit integer 0.00 to 655.35V in 0.01V	
Average Current	2	$33 + n \times 12$	Unsigned 16-bit integer 0.00 to 655.35A in 0.01A	
Sample Time	2	$35 + n \times 12$	Unsigned 16-bit integer: Seconds	

6.3.6.4.2 Battery Port Details (Data Format = 2)

(Typically 10 Battery Ports per message in an Alpha System)

Field Name	Bytes Used	Byte #	Format	Value (If known)
System Information Type	4	0-3		0x00000003
Board Id	1	4	Unsigned 8-bit integer	0
Task Id	1	5	Unsigned 8-bit integer	
Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer	2
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII	0
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer	
Repeat Count	1	7	Unsigned 8-bit integer	1
Latitude	4	8	Signed 32-bit integer	
Longitude	4	12	Signed 32-bit integer	
Time Stamp	4	16	Signed 32-bit integer	



Power Domain	1	20	Unsigned 8-bit integer	
Port Type	1	21	Unsigned 8-bit integer	
Number of Ports in Message (N – usually 10 for Alpha systems)	1	22	Unsigned 8-bit integer	
Number of Ports in Power Domain	1	23	Unsigned 8-bit integer	
Report Format Revision	1	24	Unsigned 8-bit integer	
<i>(N Blocks of Data)</i>		<i>0 ≤ n < N</i>	<i>Repeat the following block N times – N is from the Number of Ports in Message field located at byte 22 above</i>	
Port Number	1	25 + n*23	Unsigned 8-bit integer	
Module Number	1	26 + n*23	Unsigned 8-bit integer	
Port Status	4	27 + n*23	32 Bit Bitfield Bit 0: Battery Present Bit 1-3: 0 – Not Used Bit 4: Fully Charged Bit 5: Fully Discharged Bit 6: Battery Discharging Bit 7: SOC Data Inaccurate Bit 8-10: 0 – Not Used Bit 11: Terminate Discharge Bit 12: Over Temp Bit 13: 0 – Not Used Bit 14: Terminate Charge Bit 15: Over Charged Bit 16: Calibration Request Bit 17-31: 0 – Not Used	
Battery Capacity	2	31 + n*23	Unsigned 16-bit integer 0.00 to 655.35 W in 0.01Wh	
Average Power (Charging)	2	33 + n*23	Unsigned 16-bit integer 0.00 to 655.35 W in 0.01W	
Average Voltage (Charging)	2	35 + n*23	Unsigned 16-bit integer 0.00 to 655.35V in 0.01V	
Average Current (Charging)	2	37 + n*23	Unsigned 16-bit integer 0.00 to 655.35A in 0.01A	
Average Power (Discharging)	2	39 + n*23	Unsigned 16-bit integer 0.00 to 655.35 W in 0.01W	
Average Voltage (Discharging)	2	41 + n*23	Unsigned 16-bit integer 0.00 to 655.35V in 0.01V	
Average Current (Discharging)	2	43 + n*23	Unsigned 16-bit integer 0.00 to 655.35A in 0.01A	
Charging Ratio	1	45 + n*23	Unsigned 8-bit integer: 0=0%,	



			255=100%	
Sample Time	2	46 + n*23	Unsigned 16-bit integer: Seconds	

6.3.6.4.3 Solar Input Port Details (Data Format = 3)

(Typically 4 Solar Input Ports per message in an Alpha System)

Field Name	Bytes Used	Byte #	Format	Value (If known)
System Information Type	4	0-3		0x00000003
Board Id	1	4	Unsigned 8-bit integer	0
Task Id	1	5	Unsigned 8-bit integer	
Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer	3
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII	0
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer	
Repeat Count	1	7	Unsigned 8-bit integer	1
Latitude	4	8	Signed 32-bit integer	
Longitude	4	12	Signed 32-bit integer	
Time Stamp	4	16	Signed 32-bit integer	
Power Domain	1	20	Unsigned 8-bit integer	
Port Type	1	21	Unsigned 8-bit integer	
Number of Ports in Message (N – usually 4 for Alpha systems)	1	22	Unsigned 8-bit integer	
Number of Ports in Power Domain	1	23	Unsigned 8-bit integer	
Report Format Revision	1	24	Unsigned 8-bit integer	
<i>(N Blocks of Data)</i>		<i>0 ≤ n < N</i>	<i>Repeat the following block N times – N is from the Number of Ports in Message field located at byte 22 above</i>	
Port Number	1	25 + n*18	Unsigned 8-bit integer	
Module Number	1	26 + n*18	Unsigned 8-bit integer	
Port Status	1	27 + n*18	8 Bit Bitfield Bit 0: Monitoring Disables Bit 1-7: 0 -- Not Used	
Average Power (Boost Mode)	2	28 + n*18	Unsigned 16-bit integer 0.00 to 655.35 W in 0.01W	



Average Voltage (Boost Mode)	2	30 + n*18	Unsigned 16-bit integer 0.00 to 655.35V in 0.01V	
Average Current (Boost Mode)	2	32 + n*18	Unsigned 16-bit integer 0.00 to 655.35A in 0.01A	
Average Power (Panel Mode)	2	34 + n*18	Unsigned 16-bit integer 0.00 to 655.35 W in 0.01W	
Average Voltage (Panel Mode)	2	36 + n*18	Unsigned 16-bit integer 0.00 to 655.35V in 0.01V	
Average Current (Panel Mode)	2	38 + n*18	Unsigned 16-bit integer 0.00 to 655.35A in 0.01A	
Boost Ratio	1	40 + n*18	Unsigned 8-bit integer: 0=0%, 255=100%	
Sample Time	2	41 + n*18	Unsigned 16-bit integer: Seconds	

6.3.6.4.4 Bridge Power Port Details (Data Format = 4)

(Typically 4 or 6 Bridge Power Ports per message in an Alpha System)

Field Name	Bytes Used	Byte #	Format	Value (If known)
System Information Type	4	0-3		0x00000003
Board Id	1	4	Unsigned 8-bit integer	0
Task Id	1	5	Unsigned 8-bit integer	
Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer	4
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII	0
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer	
Repeat Count	1	7	Unsigned 8-bit integer	1
Latitude	4	8	Signed 32-bit integer	
Longitude	4	12	Signed 32-bit integer	
Time Stamp	4	16	Signed 32-bit integer	
Power Domain	1	20	Unsigned 8-bit integer	
Port Type	1	21	Unsigned 8-bit integer	
Number of Ports in Message (N – usually 4 or 6 for Alpha systems)	1	22	Unsigned 8-bit integer	
Number of Ports in Power Domain	1	23	Unsigned 8-bit integer	
Report Format Revision	1	24	Unsigned 8-bit integer	



<i>(N Blocks of Data)</i>		<i>$0 \leq n < N$</i>	<i>Repeat the following block N times – N is from the Number of Ports in Message field located at byte 22 above</i>	
Port Number	1	$25 + n*18$	Unsigned 8-bit integer	
Module Number	1	$26 + n*18$	Unsigned 8-bit integer	
Port Status	1	$27 + n*18$	8 Bit Bitfield Bit 0: Monitoring Disables Bit 1: Fault (Or Bits 2-5) Bit 2: Input Current Alarm Bit 3: Output Current Alarm Bit 4: Input Current Failure Bit 5: Output Current Failure Bits 6-7: 0 – Not Used	
Average Power (Input to Domain)	2	$28 + n*18$	Unsigned 16-bit integer 0.00 to 655.35 W in 0.01W	
Average Voltage (Input to Domain)	2	$30 + n*18$	Unsigned 16-bit integer 0.00 to 655.35V in 0.01V	
Average Current (Input to Domain)	2	$32 + n*18$	Unsigned 16-bit integer 0.00 to 655.35A in 0.01A	
Average Power (Output From Domain)	2	$34 + n*18$	Unsigned 16-bit integer 0.00 to 655.35 W in 0.01W	
Average Voltage (Output From Domain)	2	$36 + n*18$	Unsigned 16-bit integer 0.00 to 655.35V in 0.01V	
Average Current (Output From Domain)	2	$38 + n*18$	Unsigned 16-bit integer 0.00 to 655.35A in 0.01A	
Input Ratio	1	$40 + n*18$	Unsigned 8-bit integer: 0=0%, 255=100%	
Sample Time	2	$41 + n*18$	Unsigned 16-bit integer: Seconds	

6.3.6.5 Power Status Record (type 32)

TBD

6.3.7 Payload Telemetry

6.3.7.1 Payload Types

Field Name	Number
Unspecified	0
Weather	1



Status	2
Unused	3
AI SyG Status	16
AI SyG Record	17
AI SyG Location	18
CTD Data	32
Turner C3 Fluorometer	80
Turner C3 Fluorometer	96
CTD	112
ECO Puck	123
C Star	124
Benthos Modem	125
Datawell MOSE	126
VEMCO VR2C	127
ADCP	128
Aquatracka	130
WHOI Micro Modem	131
pCO2 Sensor	144
Thermistor Array	192

6.3.7.2 Telemetry type 128 (Payload 0x80)

Single Payload packet sent from ship to shore using glider core Iridium modem (Level 2).

Field Name	Byte Index	Size	Bit Index	Default
PayloadType	0	4		
PacketData	4	Variable		

See section 6.7 for individual definitions of payload types and parsing.

NOTE: Payload types 0 – 64K are LRI internal.

6.3.7.3 Telemetry type 129 (Payload 0x81)

Sequence of Payload packets sent from ship to shore using glider core Iridium modem.

Field Name	Byte Index	Size	Bit Index	Default
PayloadType	0	4		
PacketUId	4	4		
PacketCount	8	2		
PacketTotal	10	2		
PacketData	12	Variable		



See section 6.7 for individual definitions of payload types and parsing.

NOTE: Packet Uid is a vehicle unique identifier that is assigned to each multi-packet sequence in order to uniquely identify all packets that belong to that sequence.

6.3.7.4 Telemetry type 145 (Payload 0x91)

This message format is identical to that of Message type 0x90 except that the whole structure has a 4 byte PayloadType prepended. The PayloadType is identical in format and usage to the field of the same name and byte position in the deprecated Telemetry Type 0x80 message. The PacketData field of 0x80 would correspond to everything in 0x91 after the PayloadType field.

Field Name	Bytes Used	Byte #	Format
PayloadType	4	0-3	See Telemetry type 0x80
Board Id	1	4	Unsigned 8-bit integer
Task Id	1	5	Unsigned 8-bit integer
Sensor Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer
Repeat Count	1	7	Unsigned 8-bit integer
Sensor Sample(s)	[variable]	8-	

6.3.7.4.1 Telemetry type 145 Records (Sensor Samples)

All sensors must locate each sample in space and time using the following format. The software managing the sensor is responsible for providing the timestamp and the lat/lon. SMAC and PIBs should provide callable routines that report these values in a form that can be directly inserted into sensor sample records. Message types 0x90 and 0x91 provide for repeat counts for multiple samples within a message.

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
Sensor Data	[variable]	12-	

6.3.8 Navigation Modes

Vehicles return a Navigation mode value in the telemetry. Here are the values:

Mode Name	Value
NAV_MODE_UNDEFINED	0x00
NAV_COURSE_LOOP	0x01



NAV_COURSE_HOLD	0x02
NAV_CUSTOM_LOOP	0x03
NAV_CUSTOM_HOLD	0x04
NAV_CUSTOM_HEADING	0x10
NAV_RUDDER_POSITION	0x20
NAV_TARGET_WAYPOINT	0x40
NAV_HOLD_POSITION	0x41
NAV_MODE_UNDEFINED_ALT_GPS	0x80
NAV_COURSE_LOOP_ALT_GPS	0x81
NAV_COURSE_HOLD_ALT_GPS	0x82
NAV_CUSTOM_LOOP_ALT_GPS	0x83
NAV_CUSTOM_HOLD_ALT_GPS	0x84
NAV_COURSE_LOOP_PID	0x0A
NAV_COURSE_HOLD_PID	0x0B
NAV_CUSTOM_LOOP_PID	0x0C
NAV_CUSTOM_HOLD_PID	0x0D
NAV_COURSE_LOOP_PID_ALT_GPS	0x8A
NAV_COURSE_HOLD_PID_ALT_GPS	0x8B
NAV_CUSTOM_LOOP_PID_ALT_GPS	0x8C
NAV_CUSTOM_HOLD_PID_ALT_GPS	0x8D
NAV_CUSTOM_HEADING_ALT_GPS	0x90
NAV_RUDDER_POSITION_ALT_GPS	0xA0
NAV_TARGET_WAYPOINT_ALT_GPS	0xC0
NAV_HOLD_POSITION_ALT_GPS	0xC1

6.4 Unique Id

Unique Id returned from vehicle in response to Read Unique Id command..

Field Name	Byte Index	Size	Bit Index	Default
Unique Id	0	4		

0xFFFFFFFF Invalid value

Value > 0 is pre-set value in non volatile memory.

6.5 Identification

Identification packet can be sent from ship to shore only in response to a retrieve Identification command.

Field Name	Byte Index	Size	Bit Index	Default
Hour	0	1		
Minute	1	1		



Second	2	1		
Month	3	1		
Day	4	1		
Year	5	1		
Float_CC_Major_Version	6	1		
Float_CC_Minor_Version	7	1		
Float_CC_Build_Number	8	2		
Reported_IMEI	10	15		
Sub_Firmware_Major_Version	25	1		
Sub_Firmware_Minor_Version	26	1		
Sub_Hardware_Major_Version	27	1		
Sub_Hardware_Minor_Version	28	1		
Sub_Firmware_CRC32	29	4		
Sub_EEPROM_CRC32	33	4		
Sensor_Firmware_Major_Version	37	1		
Sensor_Firmware_Minor_Version	38	1		
Sensor_Hardware_Major_Version	39	1		
Sensor_Hardware_Minor_Version	40	1		
Sensor_Firmware_CRC32	41	4		
Sensor_EEPROM_CRC32	45	4		
Bubble_Firmware_Major_Version	49	1		
Bubble_Firmware_Minor_Version	50	1		
Bubble_Hardware_Major_Version	51	1		
Bubble_Hardware_Minor_Version	52	1		
Bubble_Firmware_CRC32	53	4		
Bubble_EEPROM_CRC32	57	4		
Batteries_Firmware_Major_Version	61	1		
Batteries_Firmware_Minor_Version	62	1		
Batteries_Hardware_Major_Version	63	1		
Batteries_Hardware_Minor_Version	64	1		
Batteries_Firmware_CRC32	65	4		
Batteries_EEPROM_CRC32	69	4		
Untwist_Firmware_Major_Version	73	1		
Untwist_Firmware_Minor_Version	74	1		
Untwist_Hardware_Major_Version	75	1		
Untwist_Hardware_Minor_Version	76	1		
Untwist_Firmware_CRC32	77	4		
Untwist_EEPROM_CRC32	81	4		
COM_Spec_Major	85	1		
COM_Spec_Minor	86	1		
COM_Spec_Revision	87	1		
MODEM_revision	88	2		



Spare1	90	1		
Spare2	91	1		
XBee_Channel	92	1		
XBee_Pan_Id	93	2		
XBee_Address	95	2		

6.6 Power Controller Status

Power Control Status packet format:

Field Name	Byte Index	Size	Bit Index	Default
Hour	0	1		
Minute	1	1		
Second	2	1		
Month	3	1		
Day	4	1		
Year	5	1		
Payload_1_Current	6	1		10mA
Payload_2_Current	7	1		10mA
Umbilical_Current	8	1		10mA
Untwist_Current	9	1		10mA
Total_Power_Remaining	10	2		10mWH
Battery_Current	12	2		Signed
System_Current	14	2		
System_Voltage	16	2		
Solar_Power_1_Indicator	18	1		
Solar_Power_2_Indicator	19	1		
Solar_Power_3_Indicator	20	1		
Solar_Power_4_Indicator	21	1		
Battery_0_Present	22	1	0	
Battery_0_Discharged	22	1	1	
Battery_0_Charged	22	1	2	
Battery_0_Discharging	22	1	3	
Battery_0_Terminate_Discharge	22	1	4	
Battery_0_Terminate_Charge	22	1	5	
Battery_0_Over_Temp	22	1	6	
Battery_0_Online	22	1	7	
Battery_0_Temp	23	1		
Battery_0_Power_Remaining	24	2		
Battery_0_Current	26	2		Signed
Battery_0_Voltage	28	2		
Battery_1_Present	30	1	0	
Battery_1_Discharged	30	1	1	



Battery_1_Charged	30	1	2	
Battery_1_Discharging	30	1	3	
Battery_1_Terminate_Discharge	30	1	4	
Battery_1_Terminate_Charge	30	1	5	
Battery_1_Over_Temp	30	1	6	
Battery_1_Online	30	1	7	
Battery_1_Temp	31	1		
Battery_1_Power_Remaining	32	2		
Battery_1_Current	34	2		Signed
Battery_1_Voltage	36	2		
Battery_2_Present	38	1	0	
Battery_2_Discharged	38	1	1	
Battery_2_Charged	38	1	2	
Battery_2_Discharging	38	1	3	
Battery_2_Terminate_Discharge	38	1	4	
Battery_2_Terminate_Charge	38	1	5	
Battery_2_Over_Temp	38	1	6	
Battery_2_Online	38	1	7	
Battery_2_Temp	39	1		
Battery_2_Power_Remaining	40	2		
Battery_2_Current	42	2		Signed
Battery_2_Voltage	44	2		
Battery_3_Present	46	1	0	
Battery_3_Discharged	46	1	1	
Battery_3_Charged	46	1	2	
Battery_3_Discharging	46	1	3	
Battery_3_Terminate_Discharge	46	1	4	
Battery_3_Terminate_Charge	46	1	5	
Battery_3_Over_Temp	46	1	6	
Battery_3_Online	46	1	7	
Battery_3_Temp	47	1		
Battery_3_Power_Remaining	48	2		
Battery_3_Current	50	2		Signed
Battery_3_Voltage	52	2		
Battery_4_Present	54	1	0	
Battery_4_Discharged	54	1	1	
Battery_4_Charged	54	1	2	
Battery_4_Discharging	54	1	3	
Battery_4_Terminate_Discharge	54	1	4	
Battery_4_Terminate_Charge	54	1	5	
Battery_4_Over_Temp	54	1	6	
Battery_4_Online	54	1	7	



Battery_4_Temp	55	1		
Battery_4_Power_Remaining	56	2		
Battery_4_Current	58	2		Signed
Battery_4_Voltage	60	2		
Battery_5_Present	62	1	0	
Battery_5_Discharged	62	1	1	
Battery_5_Charged	62	1	2	
Battery_5_Discharging	62	1	3	
Battery_5_Terminate_Discharge	62	1	4	
Battery_5_Terminate_Charge	62	1	5	
Battery_5_Over_Temp	62	1	6	
Battery_5_Online	62	1	7	
Battery_5_Temp	63	1		
Battery_5_Power_Remaining	64	2		
Battery_5_Current	66	2		Signed
Battery_5_Voltage	68	2		
Battery_6_Present	70	1	0	
Battery_6_Discharged	70	1	1	
Battery_6_Charged	70	1	2	
Battery_6_Discharging	70	1	3	
Battery_6_Terminate_Discharge	70	1	4	
Battery_6_Terminate_Charge	70	1	5	
Battery_6_Over_Temp	70	1	6	
Battery_6_Online	70	1	7	
Battery_6_Temp	71	1		
Battery_6_Power_Remaining	72	2		
Battery_6_Current	74	2		Signed
Battery_6_Voltage	76	2		

6.7 Power Controller Status (DB3.5)

Power Control Status packet format:

Field Name	Byte Index	Size	Bit Index	Default
Hour	0	1		
Minute	1	1		
Second	2	1		
Month	3	1		
Day	4	1		
Year	5	1		
Payload_1_Current	6	2		(mA) Signed



Payload_2_Current	8	2		(mA) Signed
Umbilical_Current	10	2		(mA) Signed
Internal_Payload	12	2		(mA) Signed
Payload_3_Current	14	2		(mA) Signed
Payload_4_Current	16	2		(mA) Signed
Power_Extension_Port	18	2		(mA) Signed
Light_Bar	20	2		(mA) Signed
Total_Power_Remaining	22	4		(mWH)
Battery_Current	26	2		Signed
Payload_Voltage	28	2		(mV)
Float_Voltage	30	2		(mV)
Payload_Current	32	2		(mA)
Float_Current	34	2		(mA)
Modem_Current	36	2		(mA)
Solar_Power_1_Power	38	2		(mW)
Solar_Power_2_Power	40	2		(mW)
Auxiliary_Power	42	2		(mW)
Reserved_Power	44	2		(mW)
PM_Status	46	1		
Reserved_0	47	1		
Reserved_1	48	1		
Reserved_2	49	1		
Reserved_3	50	1		
Reserved_4	51	1		
Reserved_5	52	1		
Reserved_6	53	1		
Reserved_7	54	1		
Reserved_8	55	1		
Reserved_9	56	1		
Reserved_10	57	1		
Reserved_11	58	1		
Reserved_12	59	1		
Count of batteries in report	60	1		0 – 7 batteries >0 – count of batteries



Battery_0_Present	61	1	0	
Battery_0_Discharged	61	1	1	
Battery_0_Charged	61	1	2	
Battery_0_Discharging	61	1	3	
Battery_0_Terminate_Discharge	61	1	4	
Battery_0_Terminate_Charge	61	1	5	
Battery_0_Over_Temp	61	1	6	
Battery_0_Online	61	1	7	
Battery_0_Temp	62	1		
Battery_0_Power_Remaining	63	2		
Battery_0_Current	65	2		Signed
Battery_0_Voltage	67	2		
Battery_1_Present	69	1	0	
Battery_1_Discharged	69	1	1	
Battery_1_Charged	69	1	2	
Battery_1_Discharging	69	1	3	
Battery_1_Terminate_Discharge	69	1	4	
Battery_1_Terminate_Charge	69	1	5	
Battery_1_Over_Temp	69	1	6	
Battery_1_Online	69	1	7	
Battery_1_Temp	70	1		
Battery_1_Power_Remaining	71	2		
Battery_1_Current	73	2		Signed
Battery_1_Voltage	75	2		
Battery_2_Present	77	1	0	
Battery_2_Discharged	77	1	1	
Battery_2_Charged	77	1	2	
Battery_2_Discharging	77	1	3	
Battery_2_Terminate_Discharge	77	1	4	
Battery_2_Terminate_Charge	77	1	5	
Battery_2_Over_Temp	77	1	6	
Battery_2_Online	77	1	7	
Battery_2_Temp	78	1		
Battery_2_Power_Remaining	79	2		
Battery_2_Current	81	2		Signed
Battery_2_Voltage	83	2		
Battery_3_Present	85	1	0	
Battery_3_Discharged	85	1	1	
Battery_3_Charged	85	1	2	
Battery_3_Discharging	85	1	3	
Battery_3_Terminate_Discharge	85	1	4	
Battery_3_Terminate_Charge	85	1	5	



Battery_3_Over_Temp	85	1	6	
Battery_3_Online	85	1	7	
Battery_3_Temp	86	1		
Battery_3_Power_Remaining	87	2		
Battery_3_Current	89	2		Signed
Battery_3_Voltage	91	2		
Battery_4_Present	93	1	0	
Battery_4_Discharged	93	1	1	
Battery_4_Charged	93	1	2	
Battery_4_Discharging	93	1	3	
Battery_4_Terminate_Discharge	93	1	4	
Battery_4_Terminate_Charge	93	1	5	
Battery_4_Over_Temp	93	1	6	
Battery_4_Online	93	1	7	
Battery_4_Temp	94	1		
Battery_4_Power_Remaining	95	2		
Battery_4_Current	97	2		Signed
Battery_4_Voltage	99	2		
Battery_5_Present	101	1	0	
Battery_5_Discharged	101	1	1	
Battery_5_Charged	101	1	2	
Battery_5_Discharging	101	1	3	
Battery_5_Terminate_Discharge	101	1	4	
Battery_5_Terminate_Charge	101	1	5	
Battery_5_Over_Temp	101	1	6	
Battery_5_Online	101	1	7	
Battery_5_Temp	102	1		
Battery_5_Power_Remaining	103	2		
Battery_5_Current	105	2		Signed
Battery_5_Voltage	107	2		
Battery_6_Present	109	1	0	
Battery_6_Discharged	109	1	1	
Battery_6_Charged	109	1	2	
Battery_6_Discharging	109	1	3	
Battery_6_Terminate_Discharge	109	1	4	
Battery_6_Terminate_Charge	109	1	5	
Battery_6_Over_Temp	109	1	6	
Battery_6_Online	109	1	7	
Battery_6_Temp	110	1		
Battery_6_Power_Remaining	111	2		
Battery_6_Current	113	2		Signed
Battery_6_Voltage	115	2		



--	--	--	--	--

6.8 Twist Status

Twist Status packet format:

Field Name	Byte Index	Size	Bit Index	Default
Hour	0	1		
Minute	1	1		
Second	2	1		
Month	3	1		
Day	4	1		
Year	5	1		
Motor_Activity	6	1	0, 1	
Twist_Direction	6	1	2	
Not_Used_3	6	1	3	
Twist_Activity	6	1	4	
Twist_Configuration	6	1	5	
Twist_Calibration_0	6	1	6	
Twist_Calibration_1	6	1	7	
Not_Used_8	7	1	0	
Not_Used_9	7	1	1	
Not_Used_10	7	1	2	
Not_Used_11	7	1	3	
Not_Used_12	7	1	4	
Not_Used_13	7	1	5	
Not_Used_14	7	1	6	
Twist_Debug	7	1	7	
Twist_Speed	8	2		(RPM)
Twist_Location	10	2		0-4795 = 0-360
Number_Of_Position	12	2		signed
Gearing_Ration	14	2		
Calibration_Offset	16	2		
Calibration_Threshold_A	18	2		Signed
Calibration_Threshold_B	20	2		Signed
Home_Position_A	22	2		Signed
Max_Delta_A	24	2		Signed
Home_Position_B	26	2		Signed
Max_Delta_B	28	2		Signed
MaxEffect_A	30	2		Signed
Max_Delta_Home_A	32	2		Signed
MaxEffect_B	34	2		Signed



MaxDelta_B	36	2		Signed

6.9 Rudder Control

Rudder Control packet format:

Field Name	Byte Index	Size	Bit Index	Default
Normal_Gain	0	2		
Normal_Timebase	2	1		
Normal_Deadband	3	1		
Normal_Goal	4	1		
Normal_Ruddermax	5	1		
Normal_Movemin	6	1		
Normal_Trimmax	7	1		
Low_Gain	8	2		
Low_Timebase	10	1		
Low_Deadband	11	1		
Low_Goal	12	1		
Low_Ruddermax	13	1		
Low_Movemin	14	1		
Low_Trimmax	15	1		
Critical_Gain	16	2		
Critical_Timebase	18	1		
Critical_Deadband	19	1		
Critical_Goal	20	1		
Critical_Ruddermax	21	1		
Critical_Movemin	22	1		
Critical_Trimmax	23	1		
Unused	24	4		
CRC32	28	4		

6.10 Console Data Ack

Write Console Output to Client ACK (using Level 2 type ID 0x1D; sent unsolicited or in response to a command)

Field Name	Bytes	Value
Format	1	0=ASCII format and 1=binary format
Disposition	1	3 = Succeeded TBD
Number of Bytes in Data	2	The size of the Data field in bytes



Field Name	Bytes	Value
Data	1..N	ASCII data to be written into Console or ASCII/binary data results from a command invocation

6.11 Console Data Nack

Nack of a Console Data Commands

Field Name	Bytes	Default Value
Count of Dispositions	2	1
Disposition	1	1 = Command Ok 2 = Response Truncated 10 = Unknown Command 11 = Device Busy 12 = Unsupported Command 13 = Empty Command 14 = Wrong Device 15 = Command Failed 16 = Device Not Responding 20 = Command Not Supported 30 = Invalid Command Length 31 = Unknown Destination

6.12 Vehicle Payload 0x80 Packets

Vehicle Payload packets are data that originates in the vehicle payload section and then transmitted via Iridium as a telemetry packet to the shore side.

These packets are transmitted as single (Telemetry Type 128) or Multiple packets (Telemetry Type 129) and then can be assembled and parsed if defined in this section.

6.12.1 Payload Weather Station Report Type 1

Field Name	Byte Index	Size	Bit Index	Units
Weather Data Version	0	2		
Flags	2	2		
Temperature	4	2		1/10 deg c
Pressure	6	2		mBars
Latitude	8	4		
Longitude	12	4		
Avg. Wind Speed	16	2		1/10 knots
Max Wind Speed	18	2		1/10 knots
Std. Dev. Wind Speed	20	2		1/10 knots
Avg. Wind Direction	22	2		1/10 deg
Std. Dev. Wind Dir	24	2		1/10 deg



Number of Wind Samples	26	2		
Hour	28	1		
Minute	29	1		
Second	30	1		
Day	31	1		
Month	32	1		
Year	33	2		

6.12.2 Payload Enhanced Pressure Weather Station Report Type 5

Field Name	Byte Index	Size	Bit Index	Units
Weather Data Version	0	2		
Flags	2	2		
Temperature	4	2		1/10 deg c
Pressure	6	2		1/10 mBars
Latitude	8	4		
Longitude	12	4		
Avg. Wind Speed	16	2		1/10 knots
Max Wind Speed	18	2		1/10 knots
Std. Dev. Wind Speed	20	2		1/10 knots
Avg. Wind Direction	22	2		1/10 deg
Std. Dev. Wind Dir	24	2		1/10 deg
Number of Wind Samples	26	2		
Hour	28	1		
Minute	29	1		
Second	30	1		
Day	31	1		
Month	32	1		
Year	33	2		

6.12.3 Payload Status Type 2

Field Name	Byte Index	Size	Bit Index	Units
Hour	0	1		
Minute	1	1		
Second	2	1		
Month	3	1		
Day	4	1		
Year	5	1		
Version	6	2		
Alarm0 - Leak1	8	2	0	



Alarm1 - Leak2	8	2	1	
Alarm2 - Pressure Low	8	2	2	
Alarm3 - Pressure High	8	2	3	
Alarm4 - Humidity	8	2	4	
Alarm5 - Temp Humid	8	2	5	
Alarm6 - Temp Pressure	8	2	6	
Alarm7	8	2	7	
Alarm8	8	2	8	
Alarm9	8	2	9	
Alarm10	8	2	10	
Alarm11	8	2	11	
Alarm12	8	2	12	
Alarm13	8	2	13	
Alarm14	8	2	14	
Alarm15	8	2	15	
Leak1	10	1		
Leak2	11	1		
HumidTemp	12	1		Deg C
Humidity	13	1		%
PressureTemp	14	1		Deg C
Pressure	15	1		kPa
BoardId	16	1		
PayloadPort	17	1		

6.12.4 Payload AISyG Status Type 16

Field Name	Byte Index	Size	Bit Index	Units
Hour	0	1		
Minute	1	1		
Second	2	1		
Month	3	1		
Day	4	1		
Year	5	1		
Latitude	6	4		
Longitude	10	4		
Temperature	14	2		
Pressure	16	2		
Humidity	18	2		
Alarms	20	2		TBD

**6.12.5 Payload AISyG Static Record Type 17**

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

6.12.6 Payload AISyG Position Report Type 18

Field Name	Byte Index	Size	Bit Index	Default
Number Of Contacts in Message	0	1		
(Record 1)				
Hour	1	1		
Minute	2	1		
Second	3	1		
Month	4	1		
Day	5	1		
Year	6	1		
MMSI	7	4		
Latitude	11	4		
Longitude	15	4		
Course Over Ground	19	2		
Speed Over Ground	21	2		
Rate Of Turn	23	1		
Heading	24	2		
Navigation Status	26	1		



...				
(Record N)				

6.13 Vehicle Payload 0x91Packets

6.13.1 Sensor Sample Record (Unparsed)

All sensors must locate each sample in space and time using the following format. The software managing the sensor is responsible for providing the timestamp and the lat/lon. SMAC and PIBs should provide callable routines that report these values in a form that can be directly inserted into sensor sample records. Message types 0x90 and 0x91 provide for repeat counts for multiple samples within a message.

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
Sensor Data	[variable]	12-	

6.13.1 Fluorometer (C3) Data Type 96

TBD

6.13.2 Compressed CTD Data Type 112

The GPCTD Data comes back as payload type 0x00000070 or 112 decimal. The format does use the sub-type field for a couple of different possible data formats. Currently we are only supporting sub-type 8 which is the CTD Data with no O2 data included (details are in section 9 in the document). At some point in the future we will also have units that use sub-type 9 which will have an extra 4 bytes in every GPCTD sample for the oxygen

6.13.2.1 Compressed CTD Data

This record reports the Pressure, Temperature, and Conductivity for each sample..

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
Pressure	4	12-15	Unsigned 32-bit integer
Temperature	4	16-19	Unsigned 32-bit integer
Conductivity	4	20-23	Unsigned 32-bit integer

Latitude and Longitude – the lat/lon reported by the C&C to the PIB – the location of the float at the time that the PIB obtained it from the C&C. Note that the reading of the GPS is not directly coordinated with the CTD, but should be close enough given other errors in the system.

Unix Timestamp – the standard Unix timestamp computed from the PIB RTC timestamp. The PIB clock is set from the C&C GPS and should be accurate within a second.

Pressure – The Pressure as measured by the CTD. $P(\text{in decibars}) = (\text{Value}/100) - 10$



Temperature – The Temperature as measured by the CTD. $T(\text{in deg C}) = (\text{Value}/10,000) - 5$

Conductivity – The Conductivity as measured by the CTD. $C(\text{in S/m}) = (\text{Value}/100,000) - 0.05$

6.13.2.2 Compressed CTD With Oxygen Sensor Data

This record reports the Pressure, Temperature, and Conductivity for each sample..

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
Pressure	4	12-15	Unsigned 32-bit integer
Temperature	4	16-19	Unsigned 32-bit integer
Conductivity	4	20-23	Unsigned 32-bit integer
Oxygen	4	24-27	Unsigned 32-bit integer

Latitude and Longitude – the lat/lon reported by the C&C to the PIB – the location of the float at the time that the PIB obtained it from the C&C. Note that the reading of the GPS is not directly coordinated with the CTD, but should be close enough given other errors in the system.

Unix Timestamp – the standard Unix timestamp computed from the PIB RTC timestamp. The PIB clock is set from the C&C GPS and should be accurate within a second.

Pressure – The Pressure as measured by the CTD. $P(\text{in decibars}) = (\text{Value}/100) - 10$

Temperature – The Temperature as measured by the CTD. $T(\text{in deg C}) = (\text{Value}/10,000) - 5$

Conductivity – The Conductivity as measured by the CTD. $C(\text{in S/m}) = (\text{Value}/100,000) - 0.05$

Oxygen – The Dissolved Oxygen as measured by the optional Oxygen sensor. $O(\text{in Hz}) = (\text{Value}/10)$

6.13.3 Payload ECO Puck Sensor Data Type 123

Payload in WGMS

```
39392F39392F393939393A39393A3939140222108A022210CC0122100C02
39392F39392F393939393A39393A3939140222108A022210CC0122100C02
```

Actual payload where samples are separated by tabs.

Note: this sample doesn't match with the payload above. Just an example.

```
99/99/99 99:99:99 532      306      650      476      460      190      532
```

How the payload should be interpreted

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
Unit	Date	Time	Sample 1	532nm	Sample2	650nm	Sample3	CDOM	therm
Raw samples	99/99/99	99:99:99	532	306	650	476	460	190	532
Type	8char String	8char String	INT16	INT16	INT16	INT16	INT16	INT16	INT16

**6.13.4 Payload CStar Sensor Data Type 124**

TBD

6.13.5 Payload Benthos Modem Data Type 125

Format code 0 – Range telemetry results (ATY/ATR)

Field Name	Bytes Used	Byte #	Format
PayloadType	4	0-3	125 (Benthos Modem)
Board Id	1	4	Unsigned 8-bit integer
Task Id	1	5	Unsigned 8-bit integer
Sensor Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer - 0
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII - 0
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer - 0
Repeat Count	1	7	Unsigned 8-bit integer - 1
Latitude	4	8-11	Latitude
Longitude	4	12-15	Longitude
Time	4	16-19	Unix time_t
Distance to Target	4	20-23	Unsigned 32-bit integer, tenths of meters

Records of the following format representing results for different baud rates, 6 sets (150 bytes):

Baud Rate	2	0-1	Signed 16-bit integer
Acquisition - SNR	2	2-3	Signed 16-bit integer
Acquisition - MPD	2	4-5	Signed 16-bit integer
Acquisition - SPD	2	6-7	Signed 16-bit integer
Header - CRC	1	8	Signed 8-bit integer (0=fail, 1=pass)
Header - SNR	2	9-10	Signed 16-bit integer
Header - CCERR	2	11-12	Signed 16-bit integer (-1 if not reported)
Data - MOD	2	13-14	Signed 16-bit integer
Data - ERR	2	15-16	Signed 16-bit integer
Data - SNR	2	17-18	Signed 16-bit integer
Data - AGC	2	19-20	Signed 16-bit integer
Data - SPD	2	21-22	Signed 16-bit integer
Data - CCERR	2	23-24	Signed 16-bit integer

6.13.6 Payload Datawell MOSE Sensor Data Type 126

Format code 0 – Reporting Hs/Tav/Tp/Dirp wave spectrum data

Field Name	Bytes Used	Byte #	Format
PayloadType	4	0-3	126 (Datawell MOSE)



Board Id	1	4	Unsigned 8-bit integer
Task Id	1	5	Unsigned 8-bit integer
Sensor Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer - 0
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII - 0
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer - 0
Repeat Count	1	7	Unsigned 8-bit integer

Records the following format:

Latitude	4	8-11	Latitude
Longitude	4	12-15	Longitude
Time	4	16-19	Unix time_t
Hs	8	20-27	double precision float
Tav	8	28-35	double precision float
Tp	8	36-43	double precision float
Dirp	8	44-51	double precision float
Number of Averaged Spectra	1	52	Signed int
Number of Samples per Spectrum	2	53-54	Signed int
Number of Sample Gaps	2	55-56	Signed int

6.13.7 Payload VEMCO VR2C Data Type 127

Format code 0 – Reporting a single tag reading

Field Name	Bytes Used	Byte #	Format
PayloadType	4	0-3	127 (VEMCO VR2C)
Board Id	1	4	Unsigned 8-bit integer
Task Id	1	5	Unsigned 8-bit integer
Sensor Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer - 0
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII - 1
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer - 0
Repeat Count	1	7	Unsigned 8-bit integer
Latitude	4	8-11	Latitude
Longitude	4	12-15	Longitude
Time	4	16-19	Unix time_t
Tag Reading String	Varies	20-	string, variable length

6.13.8 Payload ADCP Data Type 128

TBD



6.13.9 Payload Aquatracka Data Type 130

Format code 0 – Reporting a single tag reading

Field Name	Bytes Used	Byte #	Format
PayloadType	4	0-3	130 (Aquatracka)
Board Id	1	4	Unsigned 8-bit integer
Task Id	1	5	Unsigned 8-bit integer
Sensor Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer - 0
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII - 1
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer - 0
Repeat Count	1	7	Unsigned 8-bit integer
Record Format:			
Latitude	4	8-11	Latitude
Longitude	4	12-15	Longitude
Time	4	16-19	Unix time_t
Raw Temp. Mean	4	20-23	float
Raw Ref. Mean	4	24-27	float
Raw Sig. Mean	4	28-31	float
Conc. Mean	4	32-35	float
Temp. Mean	4	36-39	float
Raw Temp. Stddev	4	40-63	float
Raw Ref. Stddev	4	44-47	float
Raw Sig. Stddev	4	48-53	float
Conc. Stddev	4	54-57	float
Temp. Stddev	4	58-61	float

6.13.10 Payload WHOI Micro Modem Type 131

Format code 0 – Informational Report

Field Name	Bytes Used	Byte #	Format
PayloadType	4	0-3	131 (WHOI Micro Modem)
Board Id	1	4	Unsigned 8-bit integer
Task Id	1	5	Unsigned 8-bit integer
Sensor Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer - 0
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII - 1
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer - 0
Repeat Count	1	7	Unsigned 8-bit integer



Latitude	4	8-11	Latitude
Longitude	4	12-15	Longitude
Time	4	16-19	Unix time_t
Report string	Varies	20-	string, variable length

6.13.11 Payload CO2 Sensor Type 144

Field Name	Bytes Used	Byte #	Format
PayloadType	4	0-3	144 (pCO2)
Board Id	1	4	Unsigned 8-bit integer
Task Id	1	5	Unsigned 8-bit integer
Sensor Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer - 0
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII - 1
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer - 0
Repeat Count	1	7	Unsigned 8-bit integer
Latitude	4	8-11	Latitude
Longitude	4	12-15	Longitude
Time	4	16-19	Unix time_t
Custom Format	Varies	20-	Customer Specified

6.13.12 Payload Thermistor Array Data Type 192

Format code 0:

Field Name	Bytes Used	Byte #	Format
PayloadType	4	0-3	131 (WHOI Micro Modem)
Board Id	1	4	Unsigned 8-bit integer
Task Id	1	5	Unsigned 8-bit integer
Sensor Data Format	1	6 (bits 0-3)	Unsigned 4-bit integer - 0
Default Parser	1	6 (bit 4)	0=Binary/1=ASCII - 1
Delivery Priority	1	6 (bits 5-7)	Unsigned 3-bit integer - 0
Repeat Count	1	7	Unsigned 8-bit integer
Latitude	4	8-11	Latitude
Longitude	4	12-15	Longitude
Time	4	16-19	Unix time_t
T1	2	20-21	
T2	2	22-23	
T3	2	24-25	
T4	2	26-27	
T5	2	28-29	



T6	2	30-31	
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6.14 Vehicle File System Packets

6.14.1 New File Available

Level 1 Format: Mapping to a FileNotification Entity.

Field Name	Bytes	Size
Storage Controller Address	2	Any (0=Float C&C)
File Name	11	ASCII string 8.3 padded file name
File Size	4	
Creation Date	6	Hour (1 byte 0..23) Minute (1 byte, 0..59) Second (1 byte, 0..59) Month (1 byte, , 1..12) Day (1, 1..31) Years since 2000 (1 byte, 0..255)
Modified Date	6	Hour (1 byte 0..23) Minute (1 byte, 0..59) Second (1 byte, 0..59) Month (1 byte, , 1..12) Day (1, 1..31) Years since 2000 (1 byte, 0..255)
File Attributes	1	0
Provided CRC-16	2	Any
Provided MD-5	16	Any
Calculated CRC-16	2	Any
Calculated MD-5	16	Any

6.14.2 Read File Block Ack

Send a chunk of the file back in the acks for the Read File Request.

Field Name	Bytes	Default Value
Storage Controller Address	2	Any (0=Float C&C)
Offset (Seek)	4	Taken from request
EOF	1	0 = more responses will be sent 0xFF = end of file, no more responses to be sent
Number of Bytes in Data	2	The length of Data field (> 0)
Data	0..N	Data accompanying this message

6.14.3 File Nack

Nack of a Write File Block, Get File List.or Program Select command

Field Name	Bytes	Default Value
Count of Dispositions	2	1



Disposition	1	3 = Succeeded (other items failed) 5 = Naked Data (Invalid offset/length in file, unknown Hyperion ID, unknown storage controller or resource that cannot be written or deleted) 7 = File exists and marked for use 8 = File would be overwritten 9 = File is read-only 10 = Missing storage device 11 = Failed CRC-16 check; deleted file if requested 12 = Failed MD-5 check; deleted file if requested 13 = Storage full 14 = Storage I/O error 15 = File control structures corrupted 16 = Program selection configuration is corrupt 17 = Too many active file commands
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6.14.4 File Ack

Ack response to Get File List command

Field Name	Bytes	Default Value
Storage Controller Address	2	Any (matching request)
Offset	2	Number of files previously reported
Last Report	1	0 = more packets to report 0xFF = no more packets to report
Number of Files Reported This Message	2	1
Records as shown below:		
File Name	11	ASCII string padded by spaces 0x20..0x7E
File Hyperion ID	4	Any
File Size	4	Any
File Attributes	1	0x1 bit = 1 if read-only 0x80 bit = 1 if has been successfully MD5 checked (this bit cannot be set, but can be read back) All other bits are user defined

6.14.5 File at Destination Ack

File At Destination (using Level 2 type ID 0x1F; this is an additional response to Get File List or Select Program where the file is being checked)

Field Name	Bytes	Value
Storage Controller Address	2	Any (0=Float C&C)
File Hyperion ID	4	File Hyperion ID



6.15 Vehicle Crypto Packets

6.15.1 Secure On Ack

Field Name	Bytes	Size
Vehicle Perm. Public Key Size	2	
Vehicle Ephemeral Public Key Size	2	
Signature Size	2	
Vehicle Perm. Public Key (ECDSA in Vehicle Key Format)		
Vehicle (Ephemeral) Public Key (ECDH in Vehicle Key Format)		
Signature*		Relay will re-calculate this signature to authenticate the glider

* Digital Signature is the ECDSA signature of the SHA256 hash using WGMS

Perm.Public Key of the following data:

- 1) Power Controller Id
- 2) Vehicle Perm. Public Key (Vehicle Key Format)
- 3) Vehicle Ephemeral Public Key (Vehicle Key Format)
- 4) Channel Name
- 5) WGMS Perm. Public Key (Vehicle Key Format)
- 6) WGMS Ephemeral Public Key (Vehicle Key Format)
- 7) SHA256 hash of the Shared Secret Key (32 byte Big Endian)

6.16 Relay Status

Level 1 Format:

Field Name	Byte Index	Size	Bit Index	Default
Channel State	0	1	0	0=not active, 1=active
Message Not Sent Alarm	0	1	1	
Communications Error Alarm	0	1	2	
Channel Not Authenticated Alarm	0	1	3	
Unused	0	1	4	0
Unused	0	1	5	0
Unused	0	1	6	0
Channel Encrypted Status	0	1	7	0=not active, 1= active
Channel Revision major	1	1		2
Channel Revision Minor	2	1		0
Channel Revision Sub-Minor	3	1		0



Hour*	4	1		
Minute*	5	1		
Second*	6	1		
Month*	7	1		
Day*	8	1		
Year – 2000*	9	1		
Signal Strength**	10	1		0 – 5 bars

*Timestamp Date-Time in UTC.

** Only present in Virtual Relay (Structure Type >= 32)

6.16.1 Virtual Relay Channel Status Handshake

This 5 byte handshake between the Packet Reflector and the Virtual Relay in response to a RelayStatus, is sent prior to sending any pending commands in response to a connection.

Field Name	Bytes	Default Value
Relay Status Size	2	
Relay Status CRC16	2	
Disposition	1	0 – Channel Not Secure 1 – Channel is Secure

6.17 Alarms

Alarms are indicators from ship to shore for different failure modes. Some alarms constitute a action by the shore software.

6.17.1 Float Reboot Protocol

After receiving a float reboot alarm the shore side will attempt to restore the light state to the previous state it was in before the alarm. The ship will ack the on/off light command with status Ack packet.

7. Open Issues

Name	Status
Follow Custom Waypoint Course NACK format	TBD
Add Waypoints NACK Format	TBD