DESCRIPTION OF THE EDGETECH (.jsf) FILE FORMAT

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Email: sales@edgetech.com
Web: http://www.edgetech.com

4 Little Brook Road
West Wareham, MA 02576
Tel: (508) 291-0057
Fax: (508) 291-2492

141 Holland Drive, Suite 1
Boca Raton, FL 33487
Tel: (561) 995-7767
Fax: (561) 995-7761

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INTRODUCTION

EdgeTech topsides by default record in JSF file format, which consists of a set of messages. Each message begins with a 16-byte header which indicates the type of data to follow and its size. Different types of data will have different message numbers (Message Type field). Sonar data is recorded on a per-channel basis. Therefore, for a single frequency side-scan system there will be two messages per ping – one for port (channel 0) and one for starboard (channel 1). Other types of sensors (such as pitch roll) will have their own message numbers as well, and will similarly have a single message per reading set. A typical file might have the following:

Header1: Sonar Data for Subsystem SSL and channel 0 (Port Side)
  Sonar Data Header for Message 1 (Ping number 1, Port, TimeStamp)
  Sonar Data for Message 1 (16-bit integers – one per sample)

Header2: Sonar Data for Subsystem SSL and channel 1 (Stbd Side)
  Sonar Data Header for Message 2 (Ping number 1, Stbd, TimeStamp)
  Sonar Data for Message 2 (16-bit integers – one per sample)

Header3: Pitch Roll reading
  Serial Device Standard Header (Time Stamp)
  Pitch Roll Data Structure

Header4: Sonar Data for Subsystem SB
  Sonar Data Header for Message 4 (Ping number 1, TimeStamp)
  Sonar Data for Message 4 (16-bit integer pairs – one pair per sample)

Since data is stored in a binary format, the byte ordering of 16-bit and 32-bit values is important. JSF format uses little endian (Intel) format for binary data where the LSBs are stored first. This is the native format for Intel x86 computers such as the IBM PC and compatibles. If data is read on a big endian machine (such as most Sun Workstations), you will need to byte reverse the data so that the 2 bytes of a 16-bit value are flipped, and the 4 bytes of a 32-bit value are flipped (so that Bytes 0, 1, 2, 3 become Bytes 3, 2, 1, 0).

EdgeTech topsides often have an option to limit the size of created files, and will generate a sequence of files for a long data run. In this case, the concatenation of these files will yield a valid JSF file for a longer run time if desired.

C/C++ Code Example for Reading a JSF File

Here is a C code example for reading an entire JSF file.

```
void readFile(char *fileName)
{
  FILE *fid;
  int i;
  SonarMessageHeaderType hdr; /* Basic 16-byte message header */

  fid = fopen(fileName, “rb”);
  if (fid == NULL) return;

  while(!feof(fid))
  {
    if (fread(&hdr, sizeof(hdr), 1, fid) != 1)
      break;
    if (hdr.startOfMessage != SONAR_MESSAGE_HEADER_START)
    {
      printf(“Invalid file format\n”);
      break;
    }
    for(i = 0; i < hdr.byteCount; i++)
    {
      if (getc(fid) == EOF)
      {
        printf(“Invalid file format\n”);
        break;
      }
    }
    printf(“Message Type %d\n”, hdr.sonarMessage);
  }
  fclose(fid);
}
```

Details of data structure of the types of messages in a JSF file are described below.

16-Byte Message Header

Every message in a JSF file begins with a sixteen byte long header. It identifies the type and size of the message, as well as the originating subsystem and channel.

Byte Offsets	Description	Size
0 – 1	Marker for the Start of Header (always 0x1601)	UINT16
2	Version number of protocol used	UINT8
3	Session Identifier	UINT8
4 – 5	Message Type (eg: 80 = Sonar Trace Data)	UINT16
6	Command Type...	UINT8
	2 = Normal data source	
7	Subsystem Number	UINT8

	0 = Sub-bottom	
	20 = 75 or 120 kHz Side Scan (typical)	
	21 = 410 kHz Side Scan (typical)	
8	Channel for a Multi-Channel Subsystem	UINT8
	For Side Scan Subsystems	
	0 = Port	
	1 = Starboard	
9	Sequence Number	UINT8
10 – 11	Reserved	UINT16
12 – 15	Size of following Message in Bytes	UINT32

The Message Type field (bytes 4-5) defines the type of data to follow. Data formats for each message type are detailed in the following sections.

If the Message Type field contains an unknown (i.e. not defined below) type (and it may well do), use the Size of the message (bytes 12 –15) to skip over the data to the next Message Header.

Message Type 80: Sonar Data Message (segydefs.h)

The Sonar Data Message consists of a single ping (receiver soundung period) of data for a single channel (such as Side-Scan Low Frequency, Port Side). In some cases, a subsystem can have more than 2 channels of data. For example, in one SAS system, there are 6 sensor arrays on each side and 12 total channels of data per receive period. Depending on how the data was acquired, and the system used, only some of the fields may be filled in. Unlike other messages, this message contains combined data from other sources (such as pitch-roll sensors and a GPS navigation device) which may or may not be present. If GPS data is present, this is likely the only message that will need to be interpreted in a JSF file. By convention, if a value is not present the field will be set to 0.

A Sonar Data Message consists of a 240-byte header, which is very similar to a SEGY header, and the actual acoustic sample data follows the header. This 240-byte header is described below:

Byte Offsets	Description	Size
0 – 3	Trace Sequence Number within line (always 0)	INT32
4 – 7	Starting Depth (window offset) in samples	UINT32
8 – 11	Ping Number (increments with each ping)	UINT32
12 – 15	Reserved – Do not use (formerly Channel Number)	UINT32
16 – 27	Unused	UINT8 x 6
28 – 29	ID Code (always 1)	INT16
	1 = Seismic Data	
30 - 33	Unused	INT32

34 - 35	Data Format	INT16
	0 = 1 short per sample - Envelope Data	
	1 = 2 shorts per sample - Analytic Signal Data, (Real, Imaginary)	
	2 = 1 short per sample - Raw Data, Prior to Matched Filter	
	3 = 1 short per sample - Real portion of Analytic Signal Data	
	4 = 1 short per sample - Pixel Data / CEROS Data	
36 – 37	Distance from Antennae to Tow Fish in Centimeters, Aft + (Fish Aft = +)	INT16
38 – 39	Distance from Antennae to Tow Fish starboard direction in Centimeters (Fish to Stb = +)	INT16
40 – 71	RS-232 Data	INT8 x 32

Navigation data

The representation of the navigation data depends on the coordinate-units field. For Latitude / Longitude representations a positive value designates east of the Greenwich Meridian or north of the equator.

Byte Offsets	Description	Size
72 – 75	X in Meters OR	INT32
	Longitude in Seconds (see bytes 88-89)	
76 – 79	Y in Meters OR	INT32
	Latitude in Seconds	
80 – 83	X in Millimeters OR Decimeters OR	INT32
	Longitude in Minutes/10000	
84 – 87	Y in Millimeters OR Decimeters OR	INT32
	Latitude in 0.0001 Minutes	
88 – 89	Coordinate Units	INT16
	1 = X, Y	
	2 = Longitude, Latitude	
	3 = X, Y Decimeters	

If Coordinate Units = 1, Bytes 72-75 gives the X position in meters, AND bytes 80-83 gives the SAME information with better resolution in millimeters.

If Coordinate Units = 3, Bytes 72-75 gives the X position in meters, AND bytes 80-83 gives the SAME information with better resolution in decimeters.

If Coordinate Units = 2, Bytes 72-75 gives the Longitude in Seconds of Arc, AND bytes 80-83 gives the SAME information with better resolution in (Minutes of arc)/10000.

Pulse Information

This data describes the outgoing pulse characteristics, as well as sampling parameters.

Byte Offsets	Description	Size
90 – 113	Annotation String	INT8 x 24
114 – 115	Number of data Samples in this packet Note: Large sample sizes (more than 65535 samples) require multiple packets.	UINT16
116 – 119	Sampling Interval in Nanoseconds	UINT32
120 – 121	Gain Factor of ADC	UINT16
122 – 123	User Pulse Power Setting (0 – 100) percent	INT16
124 – 125	Reserved – not used	INT16
126 – 127	Chirp starting Frequency in deca-Hertz (units of 10Hz)	UINT16
128 – 129	Ending Frequency in deca-Hertz (units of 10Hz)	UINT16
130 – 131	Sweep Length in milliseconds	UINT16
132 – 135	Pressure in milliPSI (1 unit = 1/1000 PSI)	INT32
136 - 139	Depth in millimeters	INT32
140 – 141	Reserved	UINT16
142 – 143	Outgoing pulse identifier	UINT16
144 – 147	Altitude in millimeters	INT32
148 - 155	Reserved	INT32 x 2

CPU Time

The time that the data was recorded.

Byte Offsets	Description	Size
156 – 157	Year (eg 2004)	INT16
158 – 159	Day (1 – 366)	INT16
160 – 161	Hour	INT16
162 – 163	Minute	INT16
164 – 165	Second	INT16
166 – 167	Time Basis (always 3) (Other not specified by SEG-Y standard)	INT16

Weighting Factor

The trace data is transmitted as sixteen bit integers in block floating point format per message. This saves bandwidth and storage space while preserving dynamic range. The weighting factor MUST BE applied to each of the sixteen bit integer values to restore the original floating point value.

Byte Offsets	Description	Size
168 – 169	Weighting Factor N (Signed Value !) Defined as 2^-N	INT16
170 – 171	Number of pulses in the water (4200 & 4300MP-X Systems)	INT16

Orientation Sensor Data

Byte Offsets	Description	Size
172 – 173	Compass Heading (0 to 360) in units of 1/100 degree	UINT16
174 – 175	Pitch: Scale by 180 / 32768 to get degrees, + = bow up	INT16
176 – 177	Roll: Scale by 180 / 32768 to get degrees, + = port up	INT16
178 – 179	Not Used	INT16

These fields contain useful information about the attitude of the sonar sensor. The Compass heading will be magnetic heading of the towfish. If a Gyro sensor is properly interfaced to the Discover Topside acquisition unit, with a valid NMEA HDT message, this field will contain the Gyro heading, relative to true north.

User defined area from 180-239

Byte Offsets	Description	Size
180 – 181	Heave Compensation offset (samples)	INT16
182 – 183	Trigger Source	INT16
	0 = Internal	
	1 = External	
184 – 185	Mark Number	UINT16
	0 = No Mark	

NMEA Navigation Data

Byte Offsets	Description	Size
186 – 187	Hour (0 – 23)	INT16
188 – 189	Minutes (0 – 59)	INT16
190 – 191	Seconds (0 – 59)	INT16
192 – 193	Course	INT16
194 – 195	Speed	INT16
196 – 197	Day (1 – 366)	INT16
198 – 199	Year	INT16

Other User Defined Data

Byte Offsets	Description	Size
200 – 203	Milliseconds today (since midnight)	UINT32
204 – 205	Maximum Absolute Value for ADC samples in this packet	UINT16
206 – 207	Not Used	INT16
208 – 209	Vehicle ID (Not Used)	INT16
210 – 215	Software Version Number	INT8 x 6
216 – 219	Initial Spherical Correction Factor (Useful for multi-ping / deep application) * 100	INT32
220 – 221	Packet Number Each ping starts with packet 1	UINT16

222 – 223	100 times the A/D Decimation Factor. Data is normally sampled at a high Rate. Digital filters are applied to precisely limit the signal bandwidth.	INT16
224 – 225	Decimation Factor after the FFT	INT16
226 – 227	Water Temperature in units of 1/10 degree	INT16
228 – 231	Layback in meters	FLOAT32
232 – 239	Unused	INT16 x 4

Ping Time: The time of the start of the ping of data represented by the following trace data can be determined from the Year, Day, Hour, Minute and Seconds as per bytes 156 to 165. Thus provides 1 second level accuracy and resolution. For higher resolution (milliseconds) use the Year, and Day values of bytes 156 to 159, and then use the milliSecondsToday value of bytes 200-203 to complete the timestamp. System time is usually set to UTC, regardless of time zone.

Sonar Trace Data

Sonar trace data follows the 240-byte header and consists of sixteen bit integer values. The number of integers to be read can be found by multiplying the number of samples in the trace (bytes 114-115) by the number of integers per sample for the data type used (1 or 2). Further doubling will yield the byte size of the data section. This should exactly match the preceding Message Header byte count, (bytes 12 –15) less the header size of 240.

Each of the data sample values then needs to be scaled by the weighting factor thus:

ScaledDatasample = datasample * 2^(-N). (NOTE Sign !)

Future expansions of this data format will use floating point values to represent samples, and will result in other valid values for Data Format (bytes 34-35). Data readers will be more robust if this data section is skipped over if the Data Type does not match the 4 values presented here.

Message Type 82: Side Scan Data Message (sidescandefs.h)

A Side-Scan Data Message is similar to a Sonar Data Message. It contains the exactly the same acoustic data. However, the header is more compact, providing for more efficient data storage. While the Side Scan Data Message was originally intended for Side Scan data, it can also be used for Subbottom data. The system configuration determines which type of data is actually stored. For maximum flexibility, an application should support both data messages. Each Side Scan Data Message has an 80 byte header, The content of which is defined below. As with Sonar Data Messages, unused fields should be set to 0.

Byte Offsets	Description	Size
0 – 1	Subsystem (0 .. n)	UINT16
2 – 3	Channel Number (0 .. n)	UINT16
4 – 7	Ping number (increments with each ping period)	UINT32
8 – 9	Packet number (1..n) Each ping starts with packet 1	UINT16
10 – 11	TriggerSource (0 = internal, 1 = external)	UINT16
12 – 15	Samples in this packet	UINT16
16 – 19	Sample interval in ns of stored data	UINT32
20 – 23	Starting Depth (window offset) in samples	UINT32
24 – 25	Weighting Factor : Defined as 2 ^–N volts for lsb	INT16
26 – 27	Gain factor of ADC	UINT16
28 – 29	Maximum absolute value for ADC samples for this packet	UINT16
30 – 31	Range Setting (in unit of meters X 10)	UINT16
32 – 33	Unique pulse identifier	UINT16
34 – 35	Mark Number (0 = no mark)	UINT16
36 – 37	Data format	UINT16
	0 = 1 short per sample - envelope data the total number of bytes of data to follow is 2 * samples.	
	1 = 2 shorts per sample - stored as real(1), imag(1), the total number of bytes of data to follow is 4 * samples	
	2 = 1 short per sample - before matched filter (raw) the total number of bytes of data to follow is 2 * samples.	
	3 = 1 short per sample - real part analytic signal the total number of bytes of data to follow is 2 * samples.	
38	Number of simultaneous pulses in the water	UINT8
39	Reserved field to round up to a 32-bit word boundary	UINT8

Computer date / time data acquired

Byte Offsets	Description	Size
40 – 43	Milliseconds today	UINT32
44 – 45	Year	INT16
46 – 47	Day of year (1 – 366)	UINT16
48 – 49	Hour of day (0 – 23)	UINT16
50 – 51	Minute (0 – 59X)	UINT16
52 – 53	Second (0 – 59Δ)	UINT16

Auxiliary sensor information

Byte Offsets	Description	Size
54 – 55	Compass heading in minutes (0 – 360) x 60	UINT16
56 – 57	Pitch Scale by 180 / 32768 to get degrees, + = bow up	INT16
58 – 59	Roll Scale by 180 / 32768 to get degrees, + = port up	INT16
60 – 61	Heave (centimeters)	INT16
62 – 63	Yaw (minutes)	INT16
64 – 67	Pressure in units of 1/1000 PSI	UINT32
68 – 69	Temperature in units of 1/10 of a degree Celsius	INT16
70 – 71	Water Temperature in units of 1/10 of a degree Celsius	INT16
72 – 75	Altitude in millimeters (or -1 if no valid reading)	INT32

76 – 79	Reserved for future use	UINT8 x 4

Sonar Trace Data

Sonar trace data follows the 80-byte header and consists of sixteen bit integer values. The number of integers to be read can be found by multiplying the number of samples in the trace (bytes 114-115) by the number of integers per sample for the data type used (1 or 2). Further doubling will yield the byte size of the data section. This should exactly match the preceding Message Header byte count, (bytes 12 –15) less the header size of 80. Each of the data sample values then needs to be scaled by the weighting factor thus:

ScaledDatasample = datasample * 2^(- N).

Message Type 2020: Pitch Roll Data

A pitch roll message consists of a single reading from a pitch roll sensor such as a Seatex MRU, TSS or Octans device. Not all devices provide all data for the defined structure. Use the validity Flag to extract good data only.

Byte Offsets	Description	Size
0 – 3	Time in seconds (since the start of time based on time() function) (1/1/1970)	INT32
4 – 7	Milliseconds in the current second	INT32
8 – 11	Reserved / unused	UINT8 x 4
12 – 13	Acceleration in x: Multiply by (20 * 1.5) / (32768) to get Gs	INT16
14 – 15	Acceleration in y: Multiply by (20 * 1.5) / (32768) to get Gs	INT16
16 – 17	Acceleration in z: Multiply by (20 * 1.5) / (32768) to get Gs	INT16
18 – 19	Rate Gyro in x: Multiply by (500 * 1.5) / (32768) to get Degrees/Sec	INT16
20 – 21	Rate Gyro in y: Multiply by (500 * 1.5) / (32768) to get Degrees/Sec	INT16
22 – 23	Rate Gyro in y: Multiply by (500 * 1.5) / (32768) to get Degrees/Sec	INT16
24 – 25	Pitch Multiply by (180.0 / 32768.0) to get Degrees	INT16
26 – 27	Roll: Multiply by (180.0 / 32768.0) to get Degrees	INT16
28 – 29	Temperature in units of 1/10 of a degree Celsius	INT16
30 – 31	Device specific info. This is device specific info provided for Diagnostic purposes	UINT16
32 – 33	Estimated Heave in millimeters	INT16
34 – 35	Heading in units of 0.01 Degrees (0…360)	UINT16
36 – 39	Data valid flags	INT32
	Bit 0: ax	
	Bit 1: ay	
	Bit 2: az	
	Bit 3: rx	
	Bit 4: ry	
	Bit 5: rz	
	Bit 6: pitch	

	Bit 7: roll	
	Bit 8: heave	
	Bit 9: heading	
	Bit 10: temperature	
	Bit 11: devInfo	
40 – 43	Reserved for future use	INT32

Message Type 2002: NMEA String

A NMEA String consists of a time stamp followed by a NMEA string as read from a GPS, Gyro or other device. Each message is a single NMEA string excluding the <CR>/<LF>.

Byte Offsets	Description	Size
0 – 3	Time in seconds (since the start of time based on time() function).	INT32
4 – 7	Milliseconds in the current second.	INT32
8 – 11	Reserved / unused	UINT8 x 4
12 – To Message Length	NMEA string data	INT8 x remaining length

Message Type 2060: Pressure Sensor Reading

These messages are present if the sonar unit is fitted with a pressure sensor.

A single pressure sensor reading is provided, along with a time-stamp. While pressure sensors can be configured in different units, the recommended units are PSI absolute.

Byte Offsets	Description	Size
0 – 3	Time in seconds (since the start of time based on time() function).	INT32
4 – 7	Milliseconds in the current second.	INT32
8 – 11	Reserved / unused	UNIT8 x 4
12 – 15	Pressure in units of 1/1000 th of a PSI	INT32
16 – 19	Temperature in units of 1/1000 th of degree Celsius.	INT32
20 – 23	Salinity in Parts Per Million	INT32
24 – 27	Data valid flags:	INT32
	Bit 0: pressure	
	Bit 1: temp	
	Bit 2: salt PPM	
	Bit 3: conductivity	
	Bit 4: sound velocity	
28 – 31	Conductivity in micro-Siemens per cm	INT32
32 – 35	Velocity of Sound in mm per second	INT32
36 – 65	Reserved for future use	INT 32 x 10

Message Type 2040: Miscellaneous Analog Sensors

This message is from some miscellaneous sensors which are generally included for system diagnostic purposes. To be ignored by 3rd party readers.

Message Type 2080: Doppler Velocity Log Data (DVL)

This is data from a DVL (if fitted) and often includes velocity and altitude readings.

Byte Offsets	Description	Size
0 – 3	Time in seconds (since the start of time based on time() function).	INT32
4 – 7	Milliseconds in the current second.	INT32
8 – 11	Reserved / unused	UINT8 x 4
12 – 15	Flags. Indicates which values are present.	UINT32
	Bit 0: X, Y Velocity present	
	Bit 1: 1 => Velocity in ship coordinates 0 => Earth coordinates	
	Bit 2: Z (Vertical Velocity) present	
	Bit 3: X, Y Water Velocity present	
	Bit 4: Z (Vertical Water Velocity) present	
	Bit 5: Distance to bottom present	
	Bit 6: Heading present	
	Bit 7: Pitch present	
	Bit 8: Roll present	
	Bit 9: Temperature present	
	Bit 10: Depth present	
	Bit 11: Salinity present	
	Bit 12: Sound velocity present	
	Bit 31: Error detected	
16 – 31	4 Integers: Distance to bottom in cm for up to 4 beams.	INT32 x 4
	A 0 value indicates an invalid or non-existing reading.	
32 – 33	X Velocity with respect to the bottom in mm / second Positive => Starboard or East. -32768 indicates an invalid reading.	INT16
34 – 35	Y Velocity: Positive => Forward or North (mm/second)	INT16
36 – 37	Z Vertical Velocity: Positive => Upward (mm/second)	INT16
38 – 39	X Velocity with respect to a water layer in mm / second Positive => Starboard or East	INT16 x 3
40 - 41	Y Velocity: Positive => Forward or North	
42 - 43	Z Vertical Velocity: Positive => Upward	
44 - 45	Depth from depth sensor in deci-meters	UINT16
46 - 47	Pitch -180 to +180 degree (units = 0.01 of a degree) + Bow up	INT16
48 - 49	Roll -180 to +180 degrees (units = 0.01 of a degree) + Port up	INT16
50 - 51	Heading: 0 to 360 degrees (in units of 0.01 of a degree)	UINT16
52 - 53	Salinity in 1 part per thousand	UINT16
54 - 55	Temperature in units of 1/100 of a degree Celsius	INT16
56 - 57	Sound velocity in meters per second	INT16
58 - 71	Reserved for future use	INT16 x 7

Message Type 2090: Situation Message

A situation message is a composite of several motion / position sensors. This message is currently only present in SAS (Synthetic Aperture Systems). The detailed data structure is shown below:

Byte Offsets	Description	Size
0 - 3	Time in seconds (since the start of time based on time() function).	INT32
4 - 7	Milliseconds in the current second.	INT32
8 - 11	Reserved / unused	INT8 x 4
12 - 15	Validity Flags Validity Flags indicate which of the following fields are valid. If the corresponding bit is set the field is valid.	UINT32
	Bit 0: microsecond Timestamp	
	Bit 1: latitude	
	Bit 2: longitude	
	Bit 3: depth	
	Bit 4: heading	
	Bit 5: pitch	
	Bit 6: roll	
	Bit 7: X Relative Position	
	Bit 8: YRelativePosition	
	Bit 9: ZRelativePosition	
	Bit 10: XVelocity	
	Bit 11: YVelocity	
	Bit 12: ZVelocity	
	Bit 13: NorthVelocity	
	Bit 14: EastVelocity	
	Bit 15: downVelocity	
	Bit 16: XAngularRate	
	Bit 17: YAngularRate	
	Bit 18: ZAngularRate	
	Bit 19: XAcceleration	
	Bit 20: YAcceleration	
	Bit 21: ZAcceleration	
	Bit 22: latitudeStandardDeviation	
	Bit 23: longitudeStandardDeviation	
	Bit 24: depthStandardDeviation	
	Bit 25: headingStandardDeviation	
	Bit 26: pitchStandardDeviation	
	Bit 27: rollStandardDeviation	
16 - 19	Reserved for future expansion	UINT x 4
20 - 27	Microsecond timestamp, us since 12:00:00 am GMT, January 1, 1970	UINT64
28 - 35	Double float: Latitude in degrees, north is positive	FLOAT64
36 - 43	Double float: Longitude in degrees, east is positive	FLOAT64
44 - 51	Double float: Depth in meters	FLOAT64
52 - 59	Double float: Heading in degrees	FLOAT64
60 - 67	Double float: Pitch in degrees, bow up is positive	FLOAT64
68 – 75	Double float: Roll in degrees, port up is positive	FLOAT64
76 - 83	Double float: X, forward, relative position in meters, surge	FLOAT64
84 - 91	Double float: Y, starboard, relative position in meters, sway	FLOAT64
92 - 99	Double float: Z, downward, relative position in meters, heave	FLOAT64
100 - 107	Double float: X, forward, velocity in meters per second	FLOAT64

108 - 115	Double float: Y, starboard, velocity in meters per second	FLOAT64
116 - 123	Double float: Z, downward, velocity in meters per second	FLOAT64
124 - 131	Double float: North velocity in meters per second	FLOAT64
132 - 139	Double float: East velocity in meters per second	FLOAT64
140 - 147	Double float: Down velocity in meters per second	FLOAT64
148 - 155	Double float: X angular rate in degrees per second, port up is positive	FLOAT64
156 - 163	Double float: Y angular rate in degrees per second, bow up is positive	FLOAT64
164 - 171	Double float: Z angular rate in degrees per second, starboard is positive	FLOAT64
172 - 179	Double float: X, forward, acceleration in meters per second per second	FLOAT64
180 - 187	Double float: Y, starboard, acceleration in meters per second per second	FLOAT64
188 - 195	Double float: Z, downward, acceleration in meters per second per second	FLOAT64
196 - 203	Double float: Latitude standard deviation in meters	FLOAT64
204 - 211	Double float: Longitude standard deviation in meters	FLOAT64
212 - 219	Double float: Depth standard deviation in meters	FLOAT64
220 - 227	Double float: Heading standard deviation in degrees	FLOAT64
228 - 235	Double float: Pitch standard deviation in degrees	FLOAT64
236 - 243	Double float: Roll standard deviation in degrees	FLOAT64
244 - 275	Reserved	UINT16 x 16

Message Type 86: 4400-SAS Processed Data

SAS (Synthetic Aperture Sonar) Processed data consists of a 152 byte header, followed by port and starboard data. This message is only present if there is SAS image data present. Unused fields are set to 0.

Byte Offsets	Description	Size
0 - 3	Range line counter	INT32
4 - 7	Year	INT32
8 - 11	Month: 1 - 12	INT32
12 - 15	Day: 1 - 31	INT32
16 - 19	Hour: 0 - 23	INT32
20 - 23	Minute: 0 - 59	INT32
24 - 27	Second: 0.0 - 59.999	FLOAT32
28 - 35	Double float: Latitude in degrees	FLOAT64
36 - 43	Double float: Longitude in degrees	FLOAT64
44 - 47	Float: Heading in degrees	FLOAT32
48 - 51	Float: Pitch in degrees	FLOAT32
52 - 55	Float: Roll in degrees	FLOAT32
56 - 59	Float: Speed over bottom in meters per second	FLOAT32
60 - 63	Float: Depth in meters	FLOAT32
64 - 67	Float: Altitude in meters	FLOAT32
68 - 71	Float: Sound speed in meters per second	FLOAT32
72 – 75	Beam number 0 - #	INT32
76 - 79	Data format	INT32
	7 = 2 floats per sample - stored as real(1), imag(1)	
	8 = 1 float per sample - envelope data	
80 - 83	Port data available 0 = No, all bits set = Yes	INT32

84 - 87	Port carrier frequency in Hertz	INT32
88 - 91	Port waveform ID	INT32
92 - 95	Float: Port long track sample size in meters	FLOAT32
96 - 99	Float: port long track resolution in meters	FLOAT32
100 – 103	Float: port cross track sample size in meters	FLOAT32
104 – 107	Float: port cross track resolution in meters	FLOAT32
108 – 111	Float: port starting range in meters	FLOAT32
112 - 115	Port number of samples	INT32
116 – 119	Starboard data available 0 = No, all bits set = Yes	INT32
120 – 123	Starboard carrier frequency in Hertz	INT32
124 – 127	Starboard waveform ID	INT32
128 – 131	Float: starboard long track sample size in meters	FLOAT32
132 – 135	Float: starboard long track resolution in meters	FLOAT32
136 - 139	Float: starboard cross track sample size in meters	FLOAT32
140 – 143	Float: starboard cross track resolution in meters	FLOAT32
144 – 147	Float: starboard starting range in meters	FLOAT32
148 – 151	Starboard number of samples	INT32

Port data begins at byte 152, and has portSamples points in it. Starboard data follows the port data and has starboardSamples points in it. Each Sample is represented by a FLOAT32 value.