Generic Bathymetry Data - Interface Control Document

For

WASSP

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Version 2.2

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Revision History

Name	Date	Reason For Changes	Version
Keith Fletcher	13/08/10	Initial draft	0.01- Draft
Matthew Taylor	9/9/10	Fixed errors.	0.5
Matthew Taylor	30/11/10	Updated specification after development testing. Beam angle changed to degrees, flags information updated to support current and future development.	1.0
Matthew Taylor	22/11/11	Modified protocol to be more generic and compatible with future expansion. Also changed Time base of time stamps to be UTC time rather than Computer time.	1.1
Matthew Taylor	22/11/11	Added data request Section	1.2
Matthew Taylor	29/11/11	Modified to new Raw data format (without Time zone and duplicate time field). Added Processed Data fields	1.3
Matthew Taylor	29/11/11	Updated definitions, added fixes and further explanations	1.31
Matthew Taylor	16/1/12	Modified sensor format to add port number. Fixed and improved timing description. Added notes on urethane sound speed.	1.4
Matthew Taylor	24/1/12	Modified WCD data header to be more informative.	1.5
Matthew Taylor	7/2/12	Modified all non compliant Headers to Marine Format Fixed errors in Revision History Dates	1.6
Matthew Taylor	22/8/12	Added Raw water column information record	1.7
Matthew Taylor	24/8/12	Slight mods to water column format.	1.8
Stefan	22/8/13	Updated product information	1.9
Raj Srirangam	11/9/13	Updated with review comments from Stefan and Matthew. Added logo in header, copy right and version in footer.	2.0
Raj Srirangam	13/9/13	Added time and backscatter type in CORBATHY Updated descriptions for backscatter and corrected bathymetry	2.1
Raj Srirangam	15/10/13	Removed NUM BEAMS from CORBATHY Updated Beam Data array value in GENBATHY Added checksum in processed data Added Sample Type for GENBATHY Updated Descriptions Updated versions for GENBATHY, RAWSONAR, NVUPDATE and added nadir depth to Nav Data Message	2.2

1. Introduction

1.1 Purpose

This document defines the generic interface message output by the ENL WASSP system.

1.2 References

None

1.3 Abbreviations / Acronyms

Abbreviation / Acronym	Description
char	Signed 8bit character (printable)
float	Single precision floating point number 32bit (IEEE 754)
double	Double precision floating point number 64bit (IEEE 754)
S16	Signed 16bit word
U32	Unsigned 32bit word
I32	Signed 32bit word
U8	Unsigned 8bits (one byte)
RMS	Root Mean Square

1.4 UTC Timing

In order to provide useful data for an external program the data packets described in this format have UTC time stamps. These time stamps are derived from high precision timing internally in the WASSP software combined with information gathered from a UTC time source. The time stamps are in milliseconds, and have decimal values of microseconds but the accuracy of the time stamps is only designed to be within +/- 1 millisecond. If the UTC time source is not stable this will induce small timing compression and expansion, which will cause an error proportional to the time between events and the jitter. If the jitter is 4 milliseconds and sentences are received once a second then there will be an error of up to 1 millisecond for every 250ms difference between events.

Examples of UTC millisecond timestamps:
In this example local time is around 8am and this is a +8 Hour time zone, though local time is not used in the generation of timestamps. ZDA time sentences will read 00:00:01 (1 second past midnight), the time zone modifier in the ZDA sentence is ignored.
86399999.99 (immediately prior to midnight UTC time)
00000000.00 (Midnight UTC time - 8am local time)
00001010.45 (1 second and 10.45ms past midnight UTC time, local time 08:00:01.01045)
00001110.49 (1 second and 110.49ms past midnight)
00002010.56 (2 seconds and 10.56 ms past midnight UTC time)
The just before midnight the time will be just less than 1000x60x60x24 (the number of seconds in a day).

1.5 Endianness

All the data formats described in this document are based on Little-Endian.

2. Raw Output Data

Supported Products:

- WMB-3250

Use this data if corrections and bathymetry placement are done externally. Correction data can be from external source or can use WASSP transducer corrected attitude data from section 3.1. For example in situation raw data will be post processed. Note that these data packets are sent with UTC time. No data is sent until the WASSP system has received enough information to Sync the output data to UTC time. This will require at minimum ZDA to be received by the WASSP system.

2.1 Uncorrected Bathymetry

The output format is defined in Table 1 and Table 2. All the bottom detection points will be supplied as range and angle values. The length of the output message is variable, dependant on the number of beam data. In addition to the Flags the sample number will be set to zero when detection is invalid.

Name	Size	Description
Sync pattern	U32	0x77F9345A
Size	U32	Size in bytes of this record from start of sync pattern to end of checksum
Header	char[8]	"GENBATHY"
Version	U32	3
Time (accurate)	double	A millisecond time stamp of rising edge of Transmit pulse in UTC time (UTC time is calculated from the timestamp of the ZDA sentence and or a PPS signal when available) No local time zone correction is applied.
UTC Time: day	U8	01 to 31 Based on the NMEA ZDA time message
UTC Time: month	U8	01 to 12 Based on the NMEA ZDA time message
UTC Time: year	U16	Based on the NMEA ZDA time message e.g. 2011
Ping number	U32	Sequential number.
Sonar model	U32	1 at this time
Sonar Id	U64	Transducer serial number.
N	U32	Number of beams
Flags	U32	Bit field: Bit 0: Roll information invalid (Not Implemented) Bit 1: Backscatter information is valid in beam data. Bits 2-31: Reserved for future use
Sampling Rate	F32	Sonar's sampling frequency in Hz
Acoustic Frequency	F32	Sonar nominal acoustic Frequency in Hz

Name	Size	Description
Tx Source Level	F32	Voltage (volts) rms applied to transmitter in dB.
Pulse Width	F32	Pulse width in milliseconds
Absorption Loss	F32	Configurable value applied by WASSP.
Spreading Loss	U32	0, 30 or 40 as selected by WASSP GUI, units dB (as function of target range in metres)
Sample Type	U32	Set to 0 if un-calibrated. Set to 1 if calibrated.
Sound velocity	F32	Sound velocity at the sonar head in m/s (that was used in beam forming)
Beam Data	16 * N	The beam data is defined in Table 2, and is repeated for each beam.
Checksum	U32	checksum format TBD

Table 1 Generic Bathymetric data output

Name	Size	Description
Detection point	F32	Non-corrected fractional sample number with the reference to the receiver's acoustic centre with the zero sample at the transmit time.
Rx Angle	F32	Beam steering angle with reference to receiver's acoustic centre in the sonar reference frame, at the detection point; in degrees.
Flags	U32	Bit fields: Bit 0: Detection Success Bit 1: Detection Valid Bit 2: WMT Detection Bit 3: SAC Detection Bits 4-31: Reserved for future use
Backscatter	F32	Max target strength (dB) at seafloor on this beam.

Table 2 Beam Data

2.2 External Sensor Data

The External Sensor Data would be a WASSP time-stamped replica of the External Sensor Data (e.g. Attitude, NMEA data) received by the WASSP. This data may be required to provide a facility to undo the sensor stabilization performed by WASSP.

Name	Size	Description
Sync pattern	U32	0x77F9345A
Size	U32	Size in bytes of this record from start of sync pattern to end of checksum
Header	char[8]	"GEN_SENS"
Version	U32	2
Time (accurate)	double	A millisecond time stamp of first transmission character in UTC time (UTC time is calculated from the timestamp of the ZDA sentence and or a PPS signal when available) No local time zone correction is applied
Port Number	U8	Serial port stream number (1-10)
Serial String data (ASCII)	char[length]	Copy of Sensor Data Length of this field = Size – 33 (followed by line feed and or carriage return characters) e.g. $HEHDT,45.2,,*67
Checksum	U32	checksum format TBD

Table 3 External Sensor Data

2.3 Raw water column data (roll stabilized sonar)

This packet is only roll stabilized if the WASSP system has valid roll information available.

The data contained in this packet is to be dB signal levels received by time and angle. Some filtering of the data may be applied to remove side lobes and noise. This data is likely to be a subset of the full sampling resolution of the system – less beams and less samples. The first sample of raw data is the first sampling period starting from the rising edge of the transmit pulse and ending at the end of the sampling period determined by the Sample Rate.

Name	Size	Description
Sync pattern	U32	0x77F9345A
Size	U32	Size in bytes of this record from start of sync pattern to end of checksum
Header	char[8]	"RAWSONAR"
Version	U32	2

Name	Size	Description
Time (accurate)	Double	A millisecond time stamp of rising edge of Transmit pulse in UTC time (UTC time is calculated from the timestamp of the ZDA sentence and or a PPS signal when available) No local time zone correction is applied.
Ping number	U32	Sequential number.
Sample Rate	F32	Frequency (Hz) of raw data in this packet
N	U32	Number of beams of raw data in this packet
M	U32	Number of samples (per beam) of raw data in this packet
Tx Power	F32	Voltage (volts) rms applied to transmitter in dB.
Pulse Width	F32	Pulse width in milliseconds
Sample Type	U32	Set to 0 if un-calibrated. Set to 1 if calibrated.
Spare	U16[N]	Set to 0 until assigned a function
Beam index	U16[N]	Equivalent beam Index into uncorrected bathy (GENBATHY) record of each beam.
Det point	U32[N]	Index of sample which most closely matches seafloor detection. 0 = not valid.
Beam angle	F32[N]	Beam angle for this beam in degrees (negative port side of nadir)
Raw Data	S16[NxM]	If Sample Type = 0 then Signal Levels at sample/beam in dB*100 (divide by 100 to get actual signal level dB). The order is N x sample 1 then N x sample 2… etc. If Sample Type = 1 then calibrated db*100.
Checksum	U32	checksum format TBD

Table 4 Raw water column data

3. Processed Data

Supported Products:

- WMB-3250
- WMB-3230
- WMB-5230

These data packets contain processed records dependent on current settings in WASSP application.

3.1 Corrected Bathymetry

Use this data for use as fully corrected bathymetry data. The ships sensors integrated into the WASSP correct this information for leaver arm, pitch, roll, yaw, heave, tide etc. Each total message contains the detections data for a single ping.

Name	Size	Comments
Sync pattern	U32	0x77F9345A
Size	U32	Size in bytes of this record from start of sync pattern to end of checksum
Header	char[8]	"CORBATHY"
Version	U32	3
Time (accurate)	Double	A millisecond time stamp of rising edge of Transmit pulse in UTC time (UTC time is calculated from the timestamp of the ZDA sentence and or a PPS signal when available) No local time zone correction is applied.
NUM POINTS	U32	Fixed by software. Invalid points have depth set to 0.0.
PING NUMBER	I32	Ping sequence number
LATITUDE	double	Latitude at transducer in degrees
LONGITUDE	double	Longitude at transducer, degrees
BEARING	float	Bearing/Heading of vessel on transmit in degrees
ROLL	float	Roll of vessel on transmit in radians
PITCH	float	Pitch of vessel on transmit in radians
HEAVE	float	Heave of vessel on transmit at transducer in meters
Sample Type	U32	Set to 0 if un-calibrated. Set to 1 if calibrated.
Spare	U32[6]	Unused
POINTS	**DetStruct2** [NUM POINTS]	Bottom detection points for this ping. See detStruct2
Checksum	U32	checksum format TBD

Table 5 Corrected Bathy

NOTES:

1) **Sign of Latitude (N = +ve)**
2) **Sign of Longitude (E = +ve)**
3) **All points are sent for every beam even if they contain no detection data. So you can check if it is valid by checking the Y value, if this is 0 then the detection is not valid and should not be used.**

DetStruct2

This is how the data is stored for each of the bottom detections for a ping.

Name	Size	Comments
BEAM	I32	Beam index number
X	float	Distance to detection point in metres laterally along west/east axis. East of vessel is positive.
Y	float	Distance to detection point in metres laterally along north/south axis. South of vessel is positive.
Z	float	Depth in meters for the detection point. –ve = down. **0 = not valid**

BEAM ANGLE	float	Angle of the beam this detection appears on in radians positive for starboard side of vessel.
BACKSCATTER	float	Max target strength (dB) at seafloor on this beam.
QUALITY	Byte	Detection information - (0=none, 1=WMT, 2=SAC)
FISH	Byte	Fish intensity value for all fish targets vertically above detection point.
ROUGHNESS	Byte	Unused
EMPTY	Byte	Unused
PAD	U32	Unused

Table 6 Corrected Bathy Points

Please Note:

1. The X,Y,Z positions are based on the fully corrected output using leaver arm, sensor data and sound speed information available. This means if the X, Y, Z offsets in the WASSP application are correct, there is no need to account for the distance between GPS antenna and transducer or any pitch/roll/heave inclination.
2. Sign of Longitude is normal (East = positive)
3. Depths are tide corrected unless tides are disabled in the WASSP system.

3.2 Nav Data Message

This message is used to update the external application with the most current navigation data. This is output at approx 100ms interval.
This data **DOES NOT** relate to the detection data or water column data and is just the most recent nav data the WASSP system is processing. Data shown will be that configured to be used by the WASSP system. All serial data is also sent via the raw data format.

Name	Size	Comments
Sync pattern	U32	0x77F9345A
Size	U32	Size in bytes of this record from start of sync pattern to end of checksum
Header	char[8]	"NVUPDATE"
Version	U32	4
LAT DEG	double	Latitude from GPS sensor in degrees and decimal degrees
LONG DEG	double	Longitude from GPS sensor in degrees and decimal degrees
SOG	float	speed over ground in knots
COG	float	course over ground in degrees
HEADING	float	vessel heading in degrees
ROLL	float	vessel roll in degrees
PITCH	float	vessel pitch in degrees
HEAVE	float	vessel heave in meters
Nadir Depth	float	Roll corrected depth below transducer in meters
Checksum	U32	checksum format TBD

Table 7 Nav Data Message

NOTES:

- **Sign of Longitude is E positive, W negative**
- **Sign of Latitude is N positive, S negative**

3.3 Water Column Information

This message is sent over the network after each detection message is sent, thus the water column data is valid for the previous ping that has just been received.

Name	Size	Comments
Sync pattern	U32	0x77F9345A
Size	U32	Size in bytes of this record from start of sync pattern to the end of checksum
Header	char[8]	"WCD_NAVI"
Version	U32	3
LAT DEG	double	Latitude at Transducer in degrees and decimal degrees
LONG DEG	double	Longitude at Transducer in degrees and decimal degrees
NUM POINTS	I32	Number of water column points to follow
BEARING	float	Bearing of vessel for fish targets, degrees
Time (accurate)	double	A millisecond time stamp of rising edge of Transmit pulse in UTC time (UTC time is calculated from the timestamp of the ZDA sentence and or a PPS signal when available) No local time zone correction is applied.
Ping Number	I32	Ping sequence number
Sampling Rate	F32	Sampling frequency in Hz for the Water Column Information
DATA	**wcData[NUM POINTS]**	wcData point for NUM POINTS
Checksum	U32	checksum format TBD

Table 8 Water column Information Message

wcData

This is how the data is stored for each of the water column data points.
Please refer to **3.1** to get an example of how to use this information as the water column data is formatted the same as the detection point data.

Name	Size	Comments
X	float	Distance in meters to water column point port/stbd from vessels heading. Negative value is port.
Y	float	Depth in meters for the water column point.
MAG	float	Intensity value for water column point, not referenced

Table 9 Water column target Data

Please Note: MAG value has no units at this time. The value is the intensity of the returned echo at the detection point, this value is affected by transmission losses and power levels.

