3D at Depth

Multi Subsea Lidar (MSL)™

Range Angle Angle Data Format

And CTD & INU

Prepared by: 3D at Depth, LLC

Ref.: **3D-SL1-RAA Data Format-003**
Version 1.3 April 2019

Change Record

Version	Date	Notes	Author
1.0	11/2013	Initial Release	B. Nickerson
1.1	5/2013	V 1.1, SL1 RAA	B. Nickerson
1.2	10/2015	V 1.2, SL1 RAA, CTD, INU	B. Nickerson
1.3	4/2019	V 1.3, MSL RAA	D. Florin

Table of Contents

Sensor Data Output

The 3D at Depth binary sensor data is defined below. The RaaToCsv_v2.4 tool is used to processes the binary .raa file into corresponding range, angle, time and other useful data, saved as a Comma Separated Values (CSV) file that is easily viewed by excel. A timestamp is provided for each scan recorded in the file. This timestamp is the time of the first laser pulse for that scan. The µsec time value listed for each laser pulse is the relative time between each successive pulse, offset from the timestamp. The value for the first pulse should be subtracted from all pulses in that scan (including itself), such that the first pulse would be 0 µsec accordingly.

Range Angle Angle data format (binary)		
Item	**Value**	**Bytes**
File Header		
Record ID - LIDAR	0x3D47	2 (1 UINT16)
File Magic Number	0x3D08	2 (1 UINT16)
File version	1	2 (1 UINT16)
File sub version	2	2 (1 UINT16)
Scan Information		
Cross track angle start (deg)		4 (1 float32)
Cross track angle end (deg)		4 (1 float32)
Counts per cross track (AZEL raster)		2 (1 UINT16)
Pulses Per LOS		1 (1 UINT8)
Scan line Count Head A		2 (1 UINT16)
Scan line Count Head B		2 (1 UINT16)
Calibration Information		
WS Calibration Head A		Size of calibration structure
WS Calibration Head B		Size of calibration structure
Scan Information		
Record ID – Head A, Head B	0x3D53, 0x3D54	1 (1 UINT16)
First Pulse Timestamp (1 to n Scans)		
Timestamp year (true year)		2 (1 UINT16)
Timestamp month (1-12)		1 (1 UINT8)
Timestamp day		1 (1 UINT8)
Timestamp days since Jan 1		2 (1 UINT16)
Timestamp hour		2 (1 UINT16)
Timestamp minutes		1 (1 UINT8)
Timestamp seconds		1 (1 UINT8)
Timestamp nano seconds		4 (1 UINT32)

Gain (Laser Power)		1 (1 UINT8)
Digitizer Temperature		4 (1 Float32)
CTD Temperature C		4 (1 Float32)
CTD Salinity Psu		4 (1 Float32)
CTD Pressure dBar		4 (1 Float32)
Index of Refraction		4 (1 Float32)
Start Processing Range m		4 (1 Float32)
End Processing Range m		4 (1 Float32)
Pulse Count per scan line		1 (1 UINT32)
Laser Pulse Data (1 to m pulses per scan line)		
Cross track angle (deg)		4 (1 float32)
Forward track angle (deg)		4 (1 float32)
Cross track offset (m)		4 (1 float32)
Forward track offset (m)		2 (1 short int)
Pulse time offset (µsec)		4 (1 UINT32)
Line of Sight Range (from glass front) meters		LOS*4 (1 float32)
Intensity (Amplitude of signal)		LOS*2 (1 UINT16)
Diagnostic		LOS*1 (1 UINT8)

For each scan per file, a “First Pulse Timestamp” and “m” sets of “Laser Pulse Data” will exist. For example, for a AZ Raster Scan file with 500 scans per file, and 200 pts per scan, the following data would be present:

File Header
Scan Information
(1) First Pulse Timestamp
200 Laser Pulse Data sets
(2) First Pulse Timestamp
200 Laser Pulse Data sets

…

(500) First Pulse Timestamp
200 Laser Pulse Data sets

Note, if processing is interrupted by selecting the “Cancel Processing” button, an indeterminate number of records may exist in the current processing file. All processed files will be written to the same folder location of the raw file. The same file name is used for processed files, but with a “.raa” or “.bin” file extension. If data is reprocessed in the same folder location, previously processed data files will be overwritten.

The RaaToCsv_v2.4 tool CSV data includes in the header:

AZ Start deg
AZ End deg
Pulses per Scanline
Pulses per LOS
Head A Scanline Cnt

Head B Scanline Cnt

And for each scan line, the Pulse Count in the current Scanline and for each pulse:

AZ deg
EL deg
AZ offset m
EL offset m
time offset s
Range m
Intensity

X local
Y local
Z local
X global
Y global
Z global

CTD Ethernet Interface

The 3D at Depth laser sensor listens for CTD data packets available on port `CTD_TCP_PORT` as defined in the configuration file (currently defined as port 2009) in the file WSparams_ec.cfg. The packet format is as follows.

CTD Packets		
Item	Value	Bytes
Header Magic Number	0x3D03	2 (1 UINT16)
Header Version	1	1 (1 UINT8)
Water Temperature C		8 (1 double)
Water Salinity psu		8 (1 double)
Water Pressure dbar		8 (1 double)