Data Acquisition of ATLAS PARASTORE

Reference: extracted from chapter 2.8 in Atlas Hydrographic (2007)
Operator Manual ATLAS PARASTORE, Doc. Id.: ED 6006 G 212:/ Version: 4.0 / Edition: 05/2007

ATLAS PARASTORE acquires digitally sampled raw data files of an ATLAS PARASOUND sub-bottom profiler in the new ASD (ATLAS Sounding Data) data format. To prevent aliasing, the data is already lowpass filtered with an appropriate pass frequency before digitisation. Digitising takes place at the control unit in older ATLAS PARASOUND Systems and inside the DEU in the current version of ATLAS PARASOUND, which acts as a centralised data server. Additional external sensor data is also collected here, i.e. motion sensor data (roll, heave and pitch) and navigational data (position, course, speed).

Older ATLAS PARASOUND systems provide two channels of data, i.e. the NBS data and the parametric data, the current version of ATLAS PARASOUND three: PHF, SHF und PLF/ SLF. All channels are sampled with a rate of typically 50 kHz at a gain adjustable resolution of 16 Bit. Therefore, nearly independent of the water depth a maximum data volume of approx. 200 kB of uncompressed data per second is created. This data is then distributed on demand via standard Ethernet network to one or more ATLAS PARASTORE clients for storage, processing and visualisation on screen and / or paper.

The user may choose between the following data acquisition modes:

1. Acquire both the parametric data and the NBS data (older ATLAS PARASOUND) or the PHF-, PLF and SLF/ SHF Data (current ATLAS PARASOUND).
2. Acquire parametric data only.
3. Acquire NBS data only (older ATLAS PARASOUND) or the PHF- and PLF Data1 only (current ATLAS PARASOUND).
4. No data are acquired; this is relevant when only the survey depth and navigation are of interest.

Data acquisition means the transfer of digitised raw data from the control unit to the ATLAS PARASTORE client. This data contains a complete sounding, starting at the time of the first emitted signal and ending after the last received echo and just before emitting the next signal. For convenience, it is easier to speak of a sounding sequence, as a ATLAS PARASOUND system supports different operation modes (e.g. PAR, NBS, NBS/PAR, PAR Pilot of older ATLAS PARASOUND systems), which result in different sequences of emitted and received signals. A complete sounding comprises a sounding sequence. The length of the sounding sequence depends on the water depth and the preferences, set by the user with ATLAS HYDROMAP CONTROL.

After acquiring the data, i.e. transferring it to the local hard disk, the user may select, if this data shall be stored for further data backup, or only be used for visualisation and removed after a settable amount of time. Based upon the maximum possible data stream, approx. 40 GB of space are required for 3 days of continuous system operation (older ATLAS PARASOUND systems). Hence, on a usual PC platform the system can operate without any need of backup for several days. For longer system operation, a parallel backup of the data with third party software is required.

ASD Storage Format for Echo Sounder Raw Data

The acquired ATLAS PARASOUND raw data are stored on the hard disk in the ASD raw data file format. ASD is a hybrid file format for storage of complete sounding profiles. It contains an XML-formatted ASCII header and an XDR-formatted binary section containing the sounding data2. ASD raw data files are recognisable by the file extension ".asd". There are two ASD format variants: version 1.0 for older ATLAS PARASOUND Systems and version 2.0 for the current version of ATLAS PARASOUND. These variants are incompatible. The file names are generated automatically and contain the date and time of file creation. In order to archive ASD files, standard Windows backup software can be applied. The ASD format specification is public and can be used for third-party software applications.

Additionally to the digitally sampled measurement data, ATLAS PARASTORE stores and visualises an extensive set of auxiliary data which is needed for system control as well as for further data processing and later data interpretation. This information is provided in the XML formatted header section of the ASD files.

ATLAS PARASOUND raw data headers include the following information:
- Mounting position of the ATLAS PARASOUND transducers
- Mounting position of the motion sensor
- Parametric signal frequency and signal length
- NBS signal frequency (older ATLAS PARASOUND systems), PHF-, PLF or SLF/ SHF signal frequencies (current version of ATLAS PARASOUND), signal length, gain, transmission power and beam width
- Complete motion sensor information (roll, heave, pitch) for the sounding
- ATLAS PARASOUND operation mode
- Absolute time of sounding start
- Number of samples and sample rate
- Heave corrected delay of recording

The stored data is in any case the plain raw data, i.e. no processing settings in ATLAS PARASTORE influence the data storage.

Auxiliary Data

Auxiliary data which is needed for system control as well as for further data processing and later data interpretation is also collected central at the control unit and distributed via network. It is visualized by ATLAS PARASOTORE-3 and may also be stored in standard data format (see section 2.8.4) and in separate ASCII files for logging purposes.

The following auxiliary parameters are recorded:
- Position
- Course over ground
- Heading
- Speed
- Water depth as determined by ATLAS PARASOUND

Storage also includes all major system settings as there are:
- PARASOUND Depth Range
- PARASOUND Operation Mode

- PARASOUND parametric signal frequency
- PARASOUND number of parametric signal pulses (parametric signal length)
- PARASOUND TVG setting
- PARASOUND NBS signal frequency (older ATLAS PARASOUND)
- PARASOUND NBS signal opening angle (older ATLAS PARASOUND)
- PARASOUND NBS gain setting (older ATLAS PARASOUND)
- PARASOUND NBS signal power setting (older ATLAS PARASOUND)
- Signal frequencies for the PHF, PLF or SHF/ SLF (current ATLAS PARASOUND)
- Signal opening angle of the PHF, PLF or SHF/ SLF beams (current ATLAS PARASOUND)
- Amplification settings for the PHF, PLF or SHF/ SLF (current ATLAS PARASOUND)
- Signal power setting for the PHF, PLF or SHF/ SLF (current ATLAS PARASOUND)
- Data sample frequency
- Data signal length in number of samples

Meta Information

Meta Information may be stored for each echogram window. A meta information record contains an exact time stamp and a depth value. This data is written in plain ASCII format, one line per record. It will become useful for offline operation of the system to reconstruct the operator activity during survey operation.

Data Storage in Standard Format

While ASD files contain the complete sounding including the whole water column, usually only the sediment response of the signal is of interest for scientific needs. Therefore, in parallel to ASD file storage also the depth window, which is chosen by the operator for visualisation may be stored in standard echo sounder or seismic data formats. Currently, storage in the SEG-Y format (current ATLAS PARASOUND) and in the SEG-D format, as well as PS3-format (older ATLAS PARASOUND) is supported. PS3 is a compressed data format, closely related to the SEG-Y standard, consisting of a 16 byte/sample data record with a 240 byte data header which contains most of the auxiliary information.

Data Storage Reduction

To reduce the volume of the data stream at locations, where the ship is not moving, e.g. at a probing site, an ATLAS PARASTORE wait time may be defined by the operator. This time value controls the rate, at which ASD data is transferred from the control unit to the ATLAS PARASTORE client. A wait time of zero means acquisition of data at maximum rate.