R/V Pelican UHDAS Installation Report

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LUMCON's R/V Pelican has 3 ADCPs – two Workhorse (1200kHz, 300kHz) and an Ocean Surveyor (75kHz). The following ancillary data are logged:

Instrument	**Data Type**	**Messages**	**Baud Rate**	**serial port**
Trimble DMS232 GPS	Position	$GPGGA	4800	ttyUSB3
Sperry Navigat Gyro	Heading	$HEHDT	4800	ttyUSB4
Furuno SC-50 GPS Compass	Position, Heading	'$GPGGA', '$HEHDT', '$HETHS'	9600	ttyUSB5
TSS DMS-05	Pitch, Roll	tss standard	9600	ttyUSB7

Processing raw ADCP data (generating ocean velocities) requires accurate position and heading data. Positions are set to come from the Trimble, headings from the Sperry.

Comments about the installation:

- In order to support users of the TSS for Ultra-Short Baseline Navigation, UHDAS was configured to accept the 'tss' standard message rather than the $PRDID message, which was required by VmDAS. TSS can only output one of these messages at a time, and $PRDID has no quality indicator, whereas the standard tss message does include a status field.
- The Furuno data stream was originally riddled with serial errors, but quick action by the ship techs to switch the data stream from RS232 serial to RS422 serial (using B&B converters at each end) resulted in a clean feed.
- The headings reputedly coming from the Furuno and the Sperry are suspiciously similar. It does not look like we are getting independent gps-based headings from the Furuno. This is under investigation.
- We do not have any examples of a Furuno providing sufficiently accurate headings, even though it is a gps-based heading device – it is (in our limited experience) not accurate enough.
- The transducer wells are filled with water of unknown salinity, resulting in a required scale factor of about 0.983 for WH1200 and WH300. A scale factor (or proper treatment of soundspeed in the well) is necessary for fixed-transducer systems when the acquisition system is unable to calculate soundspeed accurately. To maintain transparency (not bury the settings) and consistency with other

installations, the acquisition settings for the instrument have been left with a nominal salinity of 35PSU and the scale factor has been built into the processing parameters.

- The WH1200 only works well when the ship is moving, but not moving too fast. The default settings have it pinging slightly faster than the WH300, in order to keep the data rate reasonable. It is capable of pinging more quickly, but then produces prodigious volumes of data. The averaging interval is the same as the WH300. If someone wants to change the ping rate, they should make sure the time between pings is not a multiple of the time between pings for the other instruments. For example 0.3sec works well.

Comments about the data quality:

At this point, the largest remaining problem is the accuracy of the heading device. Accurate heading is required for high-quality ADCP ocean velocities because any errors in heading manifest as errors in ocean velocity in the cross-track direction, and these errors are proportional to ship speed and heading error. The rule of thumb is:

At 10kts, a 1degree heading error results in a 10cm/s cross-track error in ocean velocity.

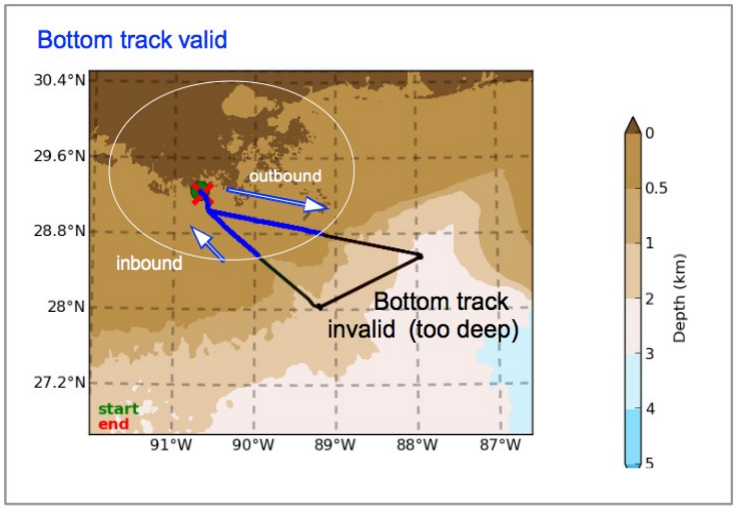

Figure 1: Bottom Track is only good at the beginning and end of the criuise, where the water is shallow enough for the instrument to get a bottom return.

Note that typical open ocean speeds are 10-20cm/s. The Gulf of Mexico has stronger currents than this, but there are still regions with weak currents.

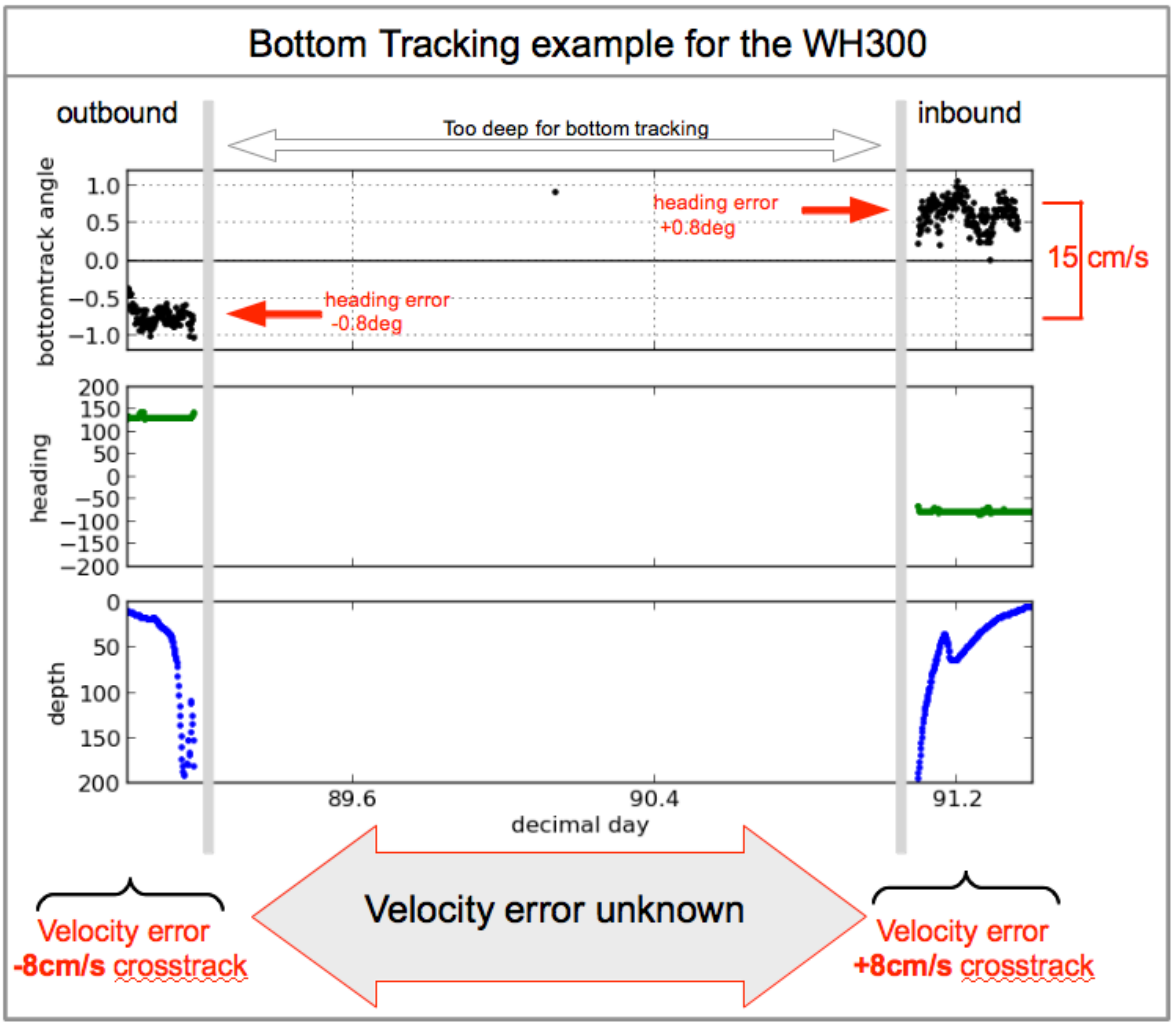

Figure 2: Heading error determined by WH300 bottom track calibration for the outbound and inbound legs. On the outbound leg, the heading is off by about -0.8deg and on the inbound leg, the heading error is in the opposite direction (about +0.8deg). In both cases, the bottom track calibration shows wobbles of 0.2-0.4deg (more indications of heading inaccuracy).

The Holy Grail of ADCP error levels is 1cm/s. The level of error captured in this small data sample shows that the errors due to heading are much greater than that. There are situations when the present error level will not be a great concern, such as "on station" or working at slow speeds, or calculations involving shear (not velocity), or if the currents are very strong and the interest is qualitative (not quantitative). The only thing standing between the present Pelican ADCP data and high quality Pelican ADCP data is an accurate heading device. Everything else seems to be reasonable.

It would be highly beneficial to obtain an accurate heading device, such as Ashtech ADU800 or ADU5. These are sometimes finicky, but are far cheaper than other options (such as POSMV or Seapath).