KONGSBERG

TOPAS SERVICE REPORT

CUSTOMER:	VESSEL/FACTORY/SITE:	SYSTEM TYPE:
University of Alaska Fairbanks	R/V SIKULIAQ	TOPAS PS 18
LOCATION:	SERVICE ENGINEER:	START DATE:
San Juan, Puerto Rico, At Sea	Johnny Dybedal	11/09/2014
SYSTEM MAINTENANCE ID:	ACCOUNT/JOB NO:	STOP DATE:
		21/09/2014

Travel

Travelling from Trondheim, Norway to San Juan, Puerto Rico on the 11th of September. Returning to Norway 20 September.

Reason for visit

Perform TOPAS PS 18 SAT.

Customer Fault description

NA

System status at arrival

Operational

System status on departure

Operational with updated software (Version 2.1.1).

Supply voltage for the transceiver was in the lower range; 211 - 214 VAC. The problem was due to wrong UPS configuration; fixed and currently voltage is 238 VAC.

Broadband noise bursts are present at 8.33 ms intervals in the data trace. The level seems to depend on operation of other systems on the vessel like propulsion, etc.

A 2.5 kHz tone is also present from time to time.

Work due for next visit

NA

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Technical report

Before the SAT was started, TOPAS MMI software was updated to version 2.1.1.

The SAT was performed North-Northeast of San Juan, Puerto Rico, in water depths from around 900 to around 1,200 meters. The system was later on tested in water depths to around 7,000 meters.

The system settings used for the SAT were as follows:

Ping interval: 1,700 ms
Trace length: 400 ms
Signal format: LFM
Frequency, start - stop/duration: 2 - 6 kHz / 10 ms

The survey line, which was followed during the operational test, is shown as the yellow horizontal line in Figure 1 below. Unfortunately, the area contained several steep slopes that are seen in the figure, which results in poor sub-bottom profiles with limited penetration.

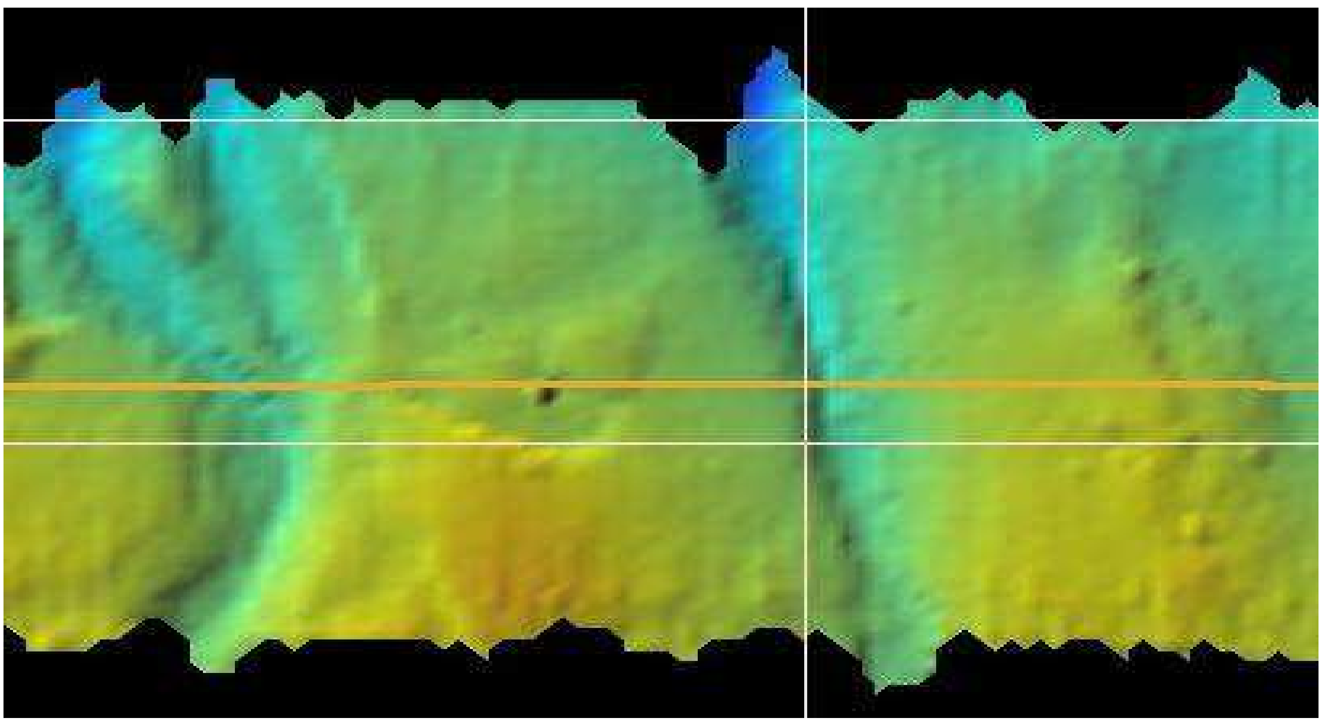

Figure 1 Bathymetry of the area where SAT was performed.

The TOPAS sub-bottom profile along the line is shown in Figure 2.

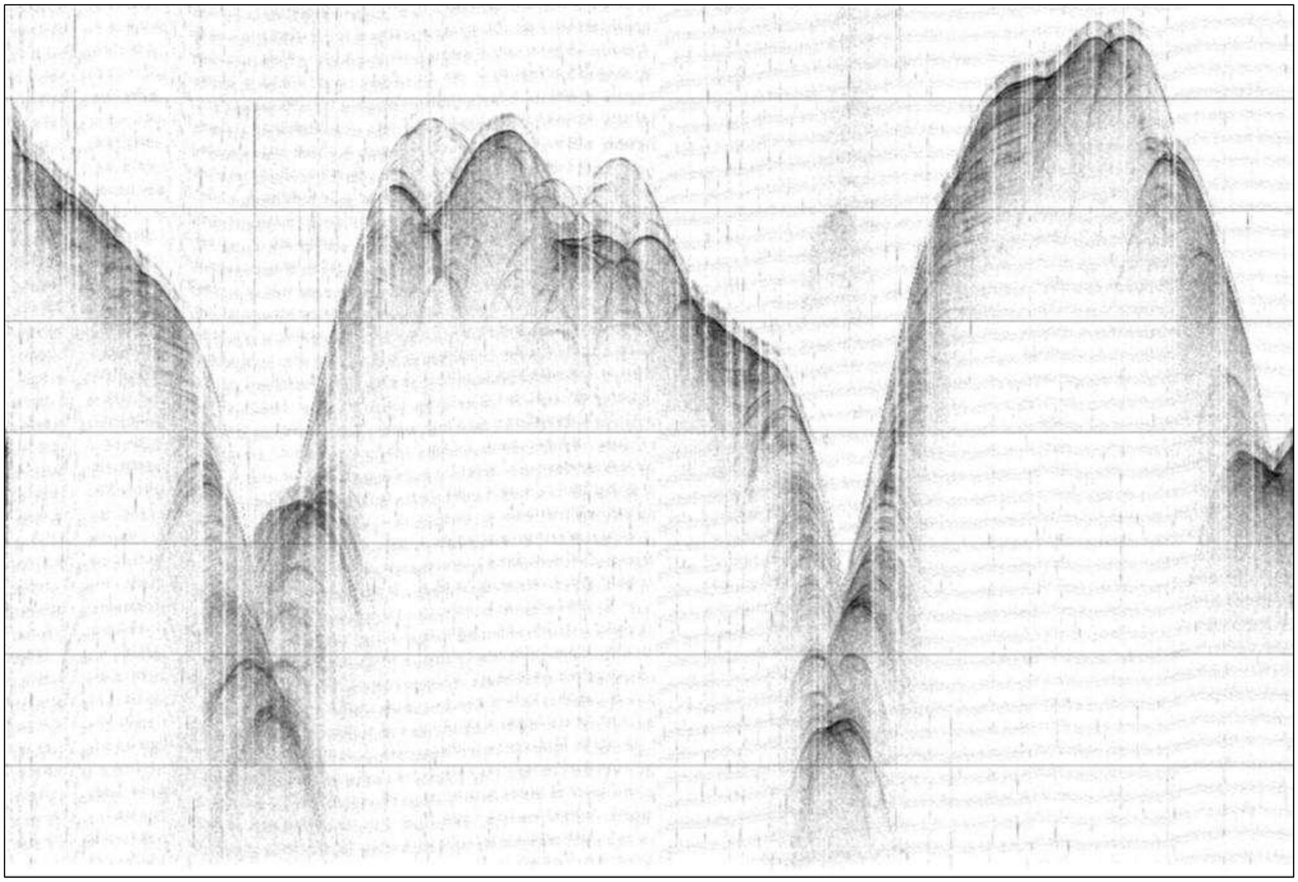

Figure 2 TOPAS data from the line.

Some weak parallel lines are seen in the figure. These lines are caused by noise bursts repeated at 8.33 ms intervals. They seem to be dependent on the status of other electrical systems on board the vessel because they are not always present.

In the noise tests performed later on, there are indications that the noise bursts is a function of engine thrust.

In the power spectral density displays of noise at 90% thrust shown in Figure 3, these noise lines are shown as spectral lines with spacing of 120 Hz.

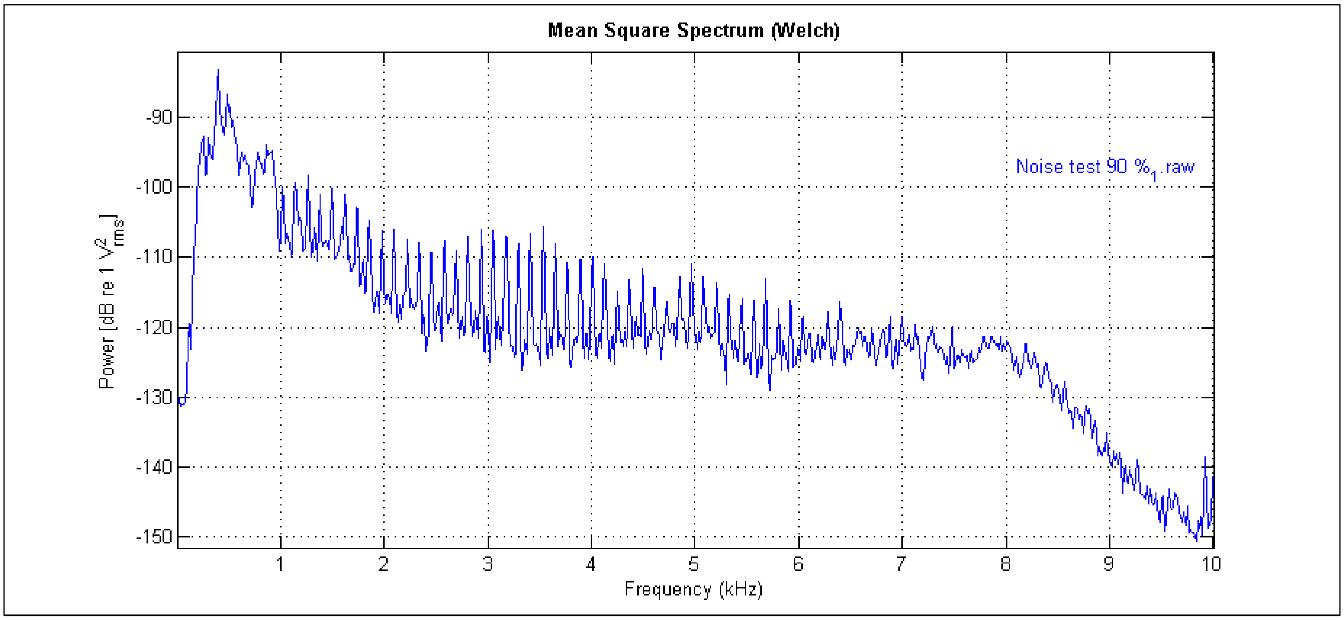

Figure 3 Power Spectral Density for noise input showing spectral lines spaced by 120 Hz.

Due to the good weather conditions, heave compensation was difficult to demonstrate during the SAT survey line. However, later on data was recorded in a flat area where it was possible to verify heave compensation. In Figure 4 heave compensation has been disabled on the right hand side (red circle) and it is evident that the heave movement of the vessel (or more correctly of the TOPAS transducer) influences data here.

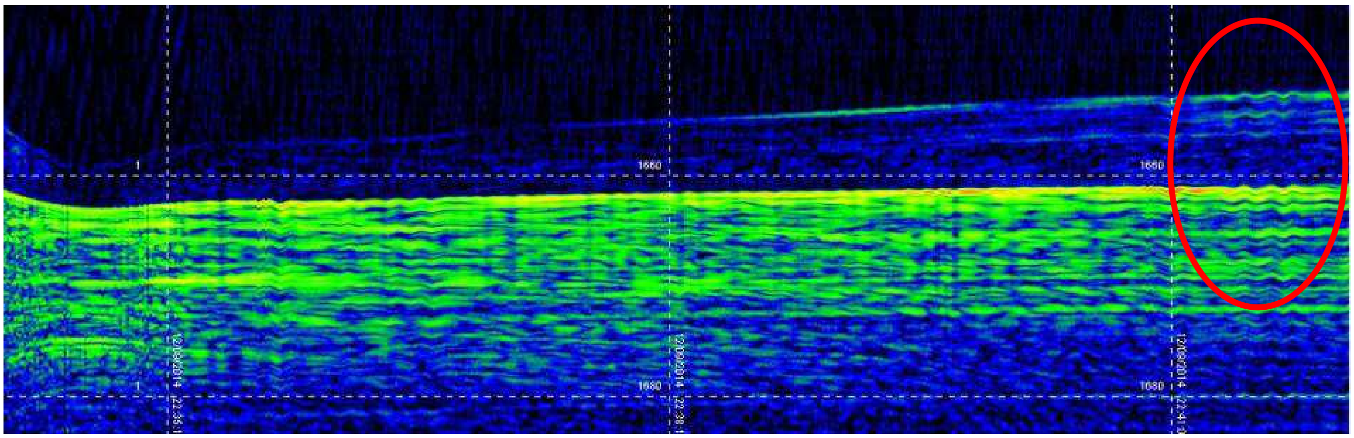

Figure 4 Result of disabling heave compensation is shown within the red circle.

The following Figure 5 shows example of data from 6,800 meters water depth recorded during winch tests. The vertical scale is 15 meters per division assuming sound speed in the sediment of 1,500 m/s.

The transmitted signal used was a LFM pulse, 2 to 6 kHz and duration of 20 ms.

Penetration seems to be up to ~100 meters.

Air bubbles degraded the data several times; signal strength received varied along lines depending on vessel speed and heading relative to direction of swell. Increasing sea state will also degrade the data quality.

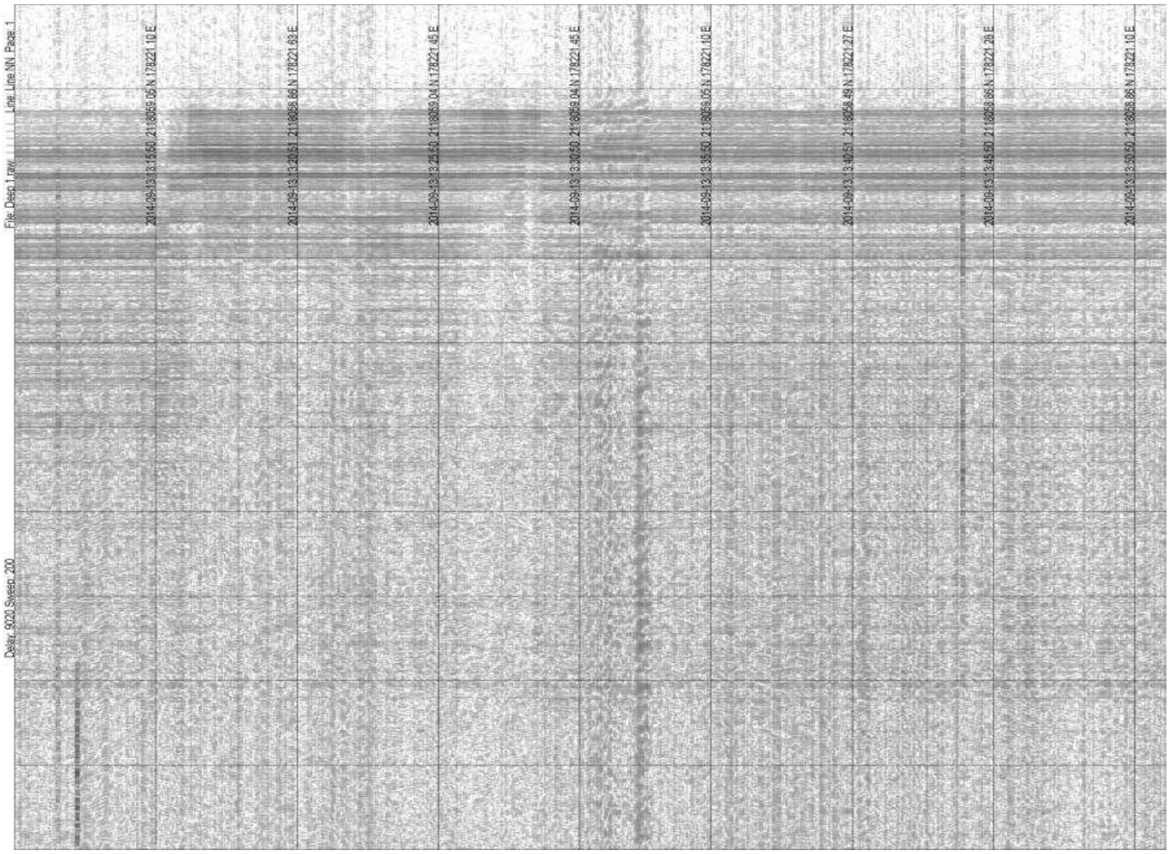

Figure 5 Data examples from deep water.

Noise issues.

In order to find optimum operating conditions for TOPAS, noise measurements were performed at different vessel speeds/engine thrust. Measurements were logged for the following values:

Thrust [%]	Speed [knots]	Comments
0	<0.5	Drifting
40	~5.4	
50	~6.8	Good survey speed
60	~8.4	Good survey speed
70	~9.8	Starts getting noisy
80	~11.0	
90	~12.2	

The power spectral density (PSD) curves are plotted in Figure 6 for thrusts from 0% to 90%.

The data traces analyzed are 400 ms long and sampled at 30 kHz. The analogue high pass filter on receiver board is set to 0.5 kHz during recording.

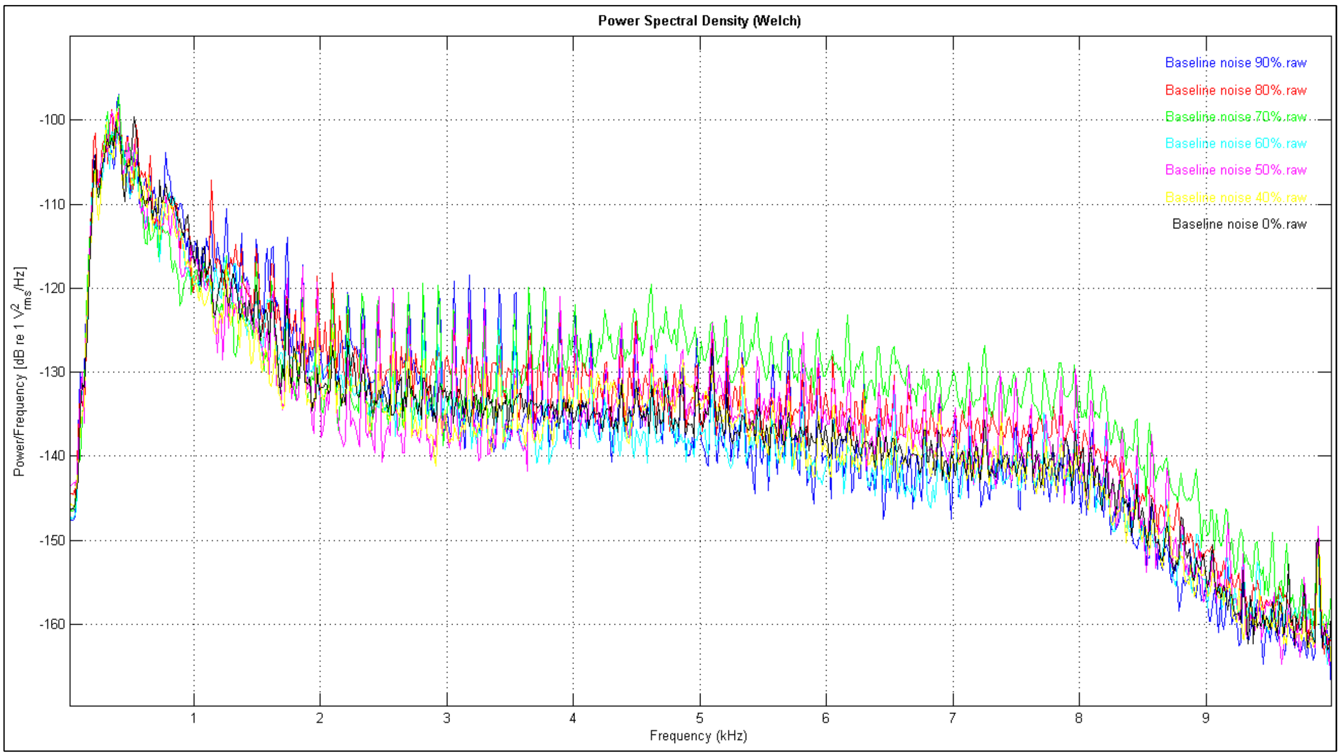

Figure 6 Power spectral density of received noise from 0% to 90% thrust.

The spectral noise density increases by more than 30 dB for frequencies from 2.5 kHz down to 0.5 kHz. Therefore, the recommended frequency range to be used for sub-bottom profiling is from ~2 kHz and up to 6 kHz.

Based on the results from noise measurements versus vessel thrust, it turns out that the best operational conditions are achieved for thrusts between 50% and 60%, which is equivalent to a vessel speed of 7 to 9 knots.

The PSD curves also show strong spectral lines at 120 Hz intervals as noted previously. It seems that these lines become stronger as the thrust is increased. At zero thrust, they were very low during the noise tests (black line in the PSD display). However, the lines have been observed occasionally at 0 % thrust as well.

Figure 7 shows an expanded section of the PSD shown on Figure 6. The lines are up to 15 dB higher a 90% thrust compared to 0 % thrust.

These noise bursts are observed as line pattern in the TOPAS MMI display.

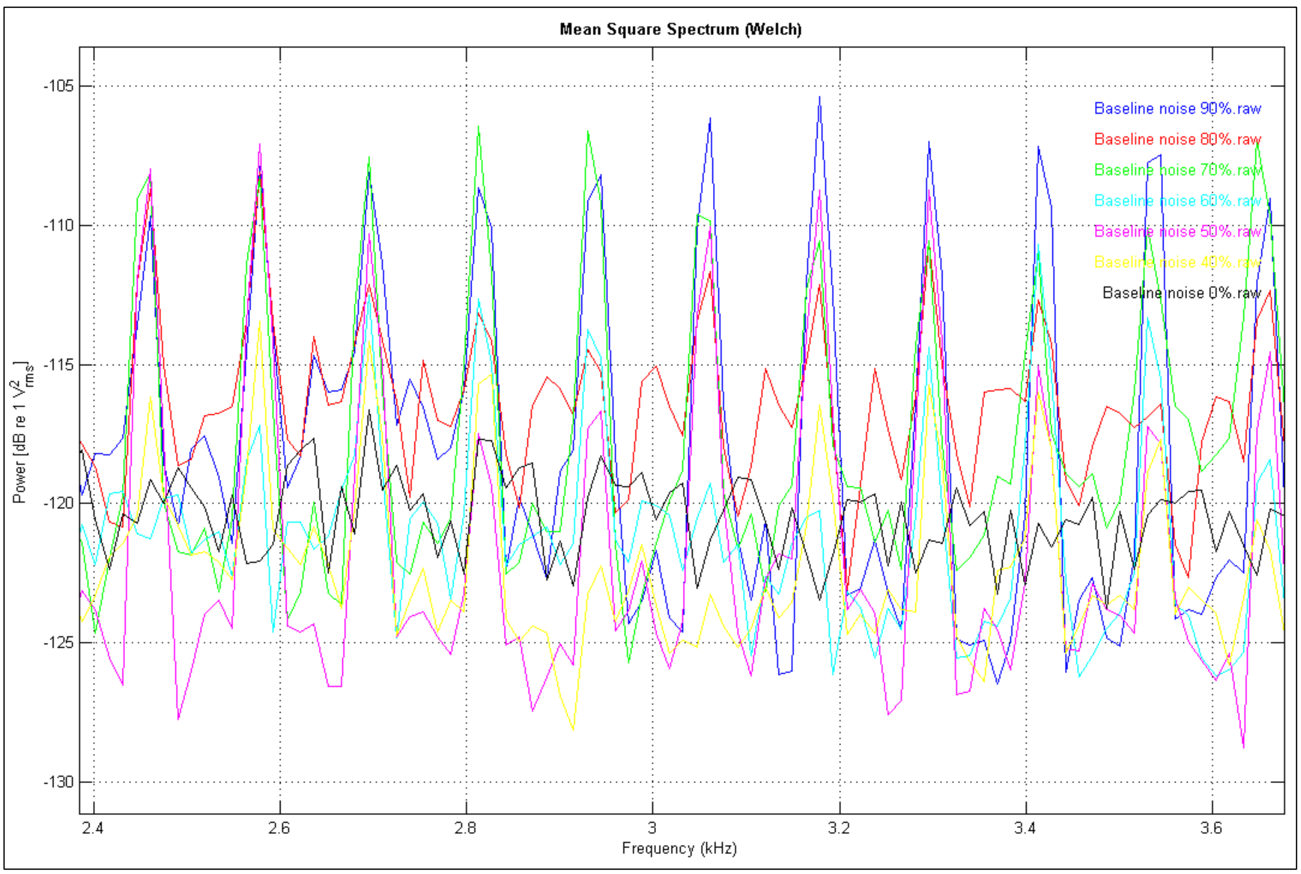

Figure 7 Details of power spectral density of received noise from 0% to 90% thrust

Figure 8 shows short time sequences of data traces for three situations: noise recording at 0% thrust, 90% thrust and part of a survey line. The gain and filter settings are the same for all three displayed results.

The noise bursts are seen in all traces, but the level varies much: for 0% thrust, the level of the bursts varies in the trace, for 90% the level are high for all bursts but in the current survey line the bursts are considerably lower.

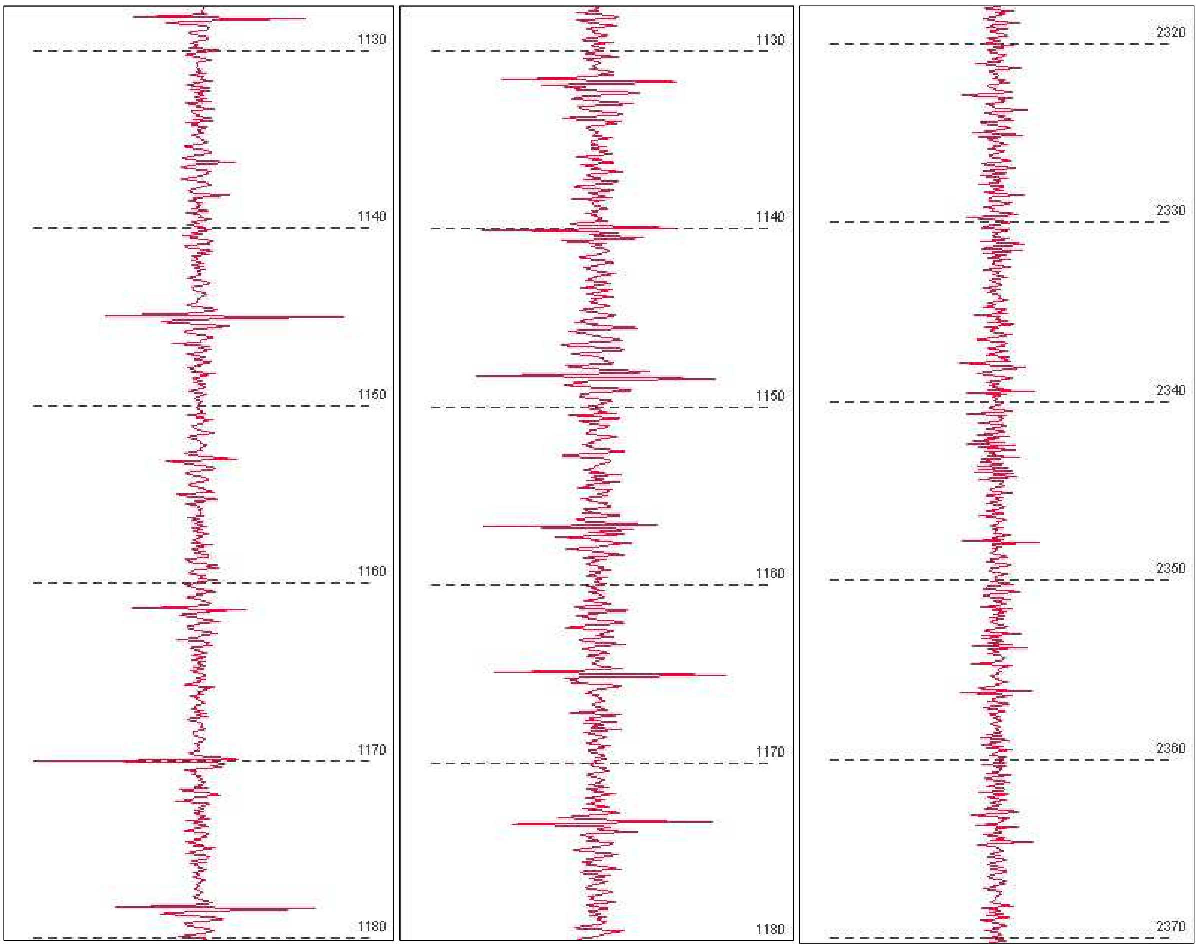

Figure 8 50 ms time traces showing 8.33 ms spaced noise bursts for the following recordings: 0% thrust, 90% thrust and part of survey line, from left to right, respectively.

During some periods, probably depending on other activities on the vessel (thruster, winch operation etc.), a frequency line at ~2.5 kHz and harmonics at 5 kHz and 10 kHz are present in the spectrum. The level at 2.5 kHz is approximately 20 dB higher than what was expected in the same frequency band, see Figure 9.

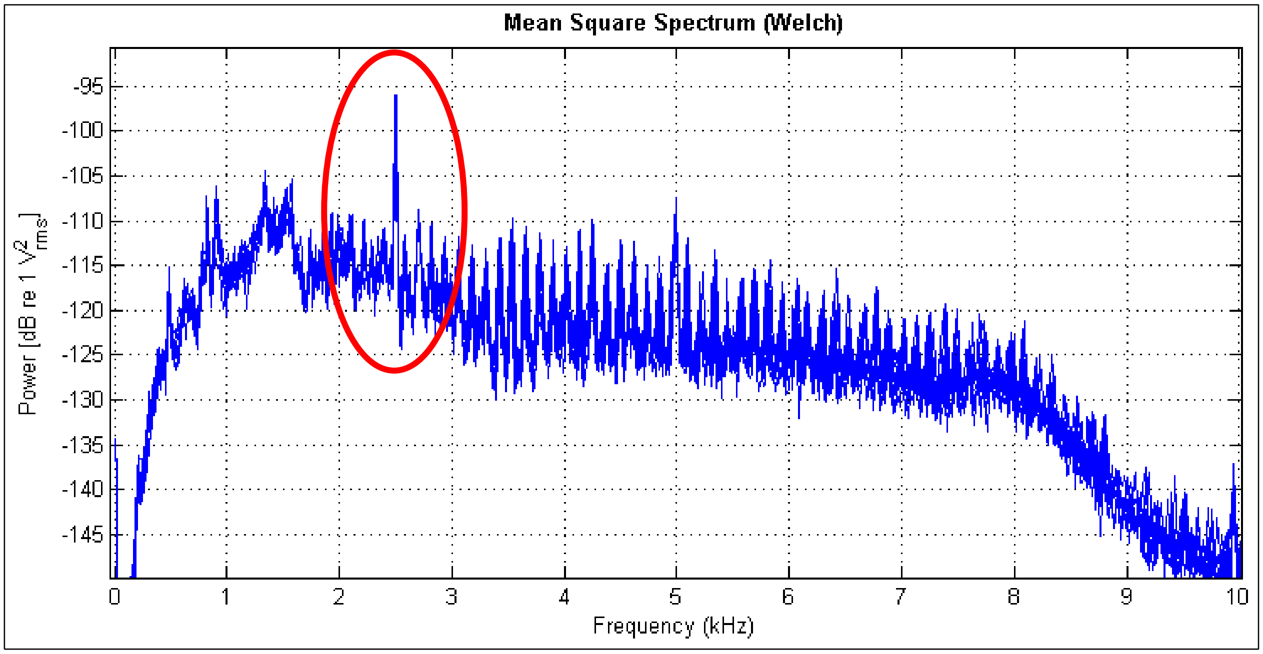

Figure 9 Spectral line at ~2.5 kHz.

Noise recording on the TOPAS system was also done during noise test of bow thruster. F shows PSD of the noise level at 0%, 25, 50%, 75% and 100% thrust, respectively.

Noise level at 25% will not influence the TOPAS data quality significantly. However, higher thrusts will degrade the data and even mask the data completely!

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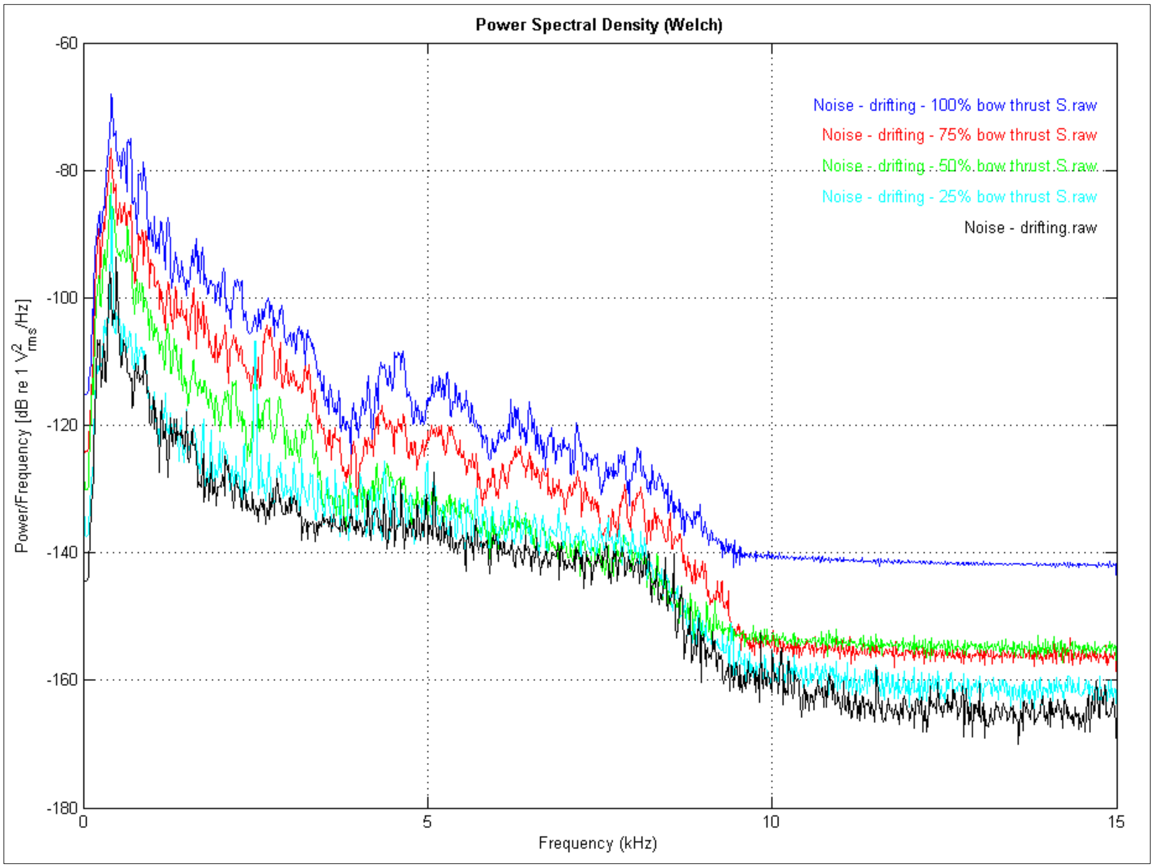

Figure 10 PSD of noise level at different bow thruster levels.

Power supply issues.

The main power to the TOPAS and EM system is supplied from a 10 kVA UPS unit with battery backup, see Figure 11. The unit is configured to supply 240 VAC at 60 Hz. However, the LCD display shows that the output voltage at one time was only 212 VAC, see Figure 12. The average output power was ~1.5 kVA and peak currents indicated was up to 11 Amps.

Level seems to vary between 211 and 214 VAC.

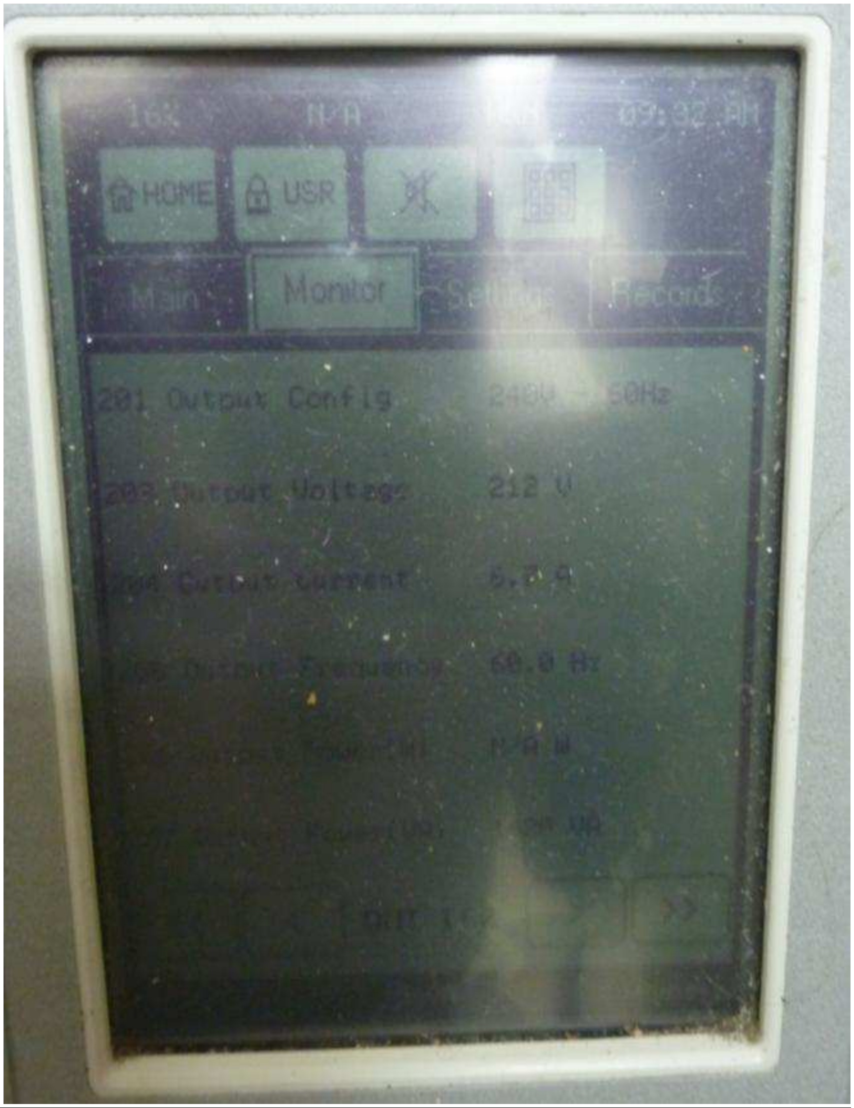

Figure 12 LCD display on UPS showing configuration and status.

During inspection of the TOPAS transceiver, the built-in meter showed 211 VAC, see **Figure 13**. At the same time, the display on the UPS unit also indicated an output voltage of 211 VAC.

This level is very low and the reason for this should be investigated.

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Figure 13 Input AC voltage meter (top) in TOPAS transceiver.

Concluding remarks.

First, Figure 14 shows a nice example of a profile crossing a slump during transit to deeper waters is shown. The length of the slump is approximately 335 meters and the maximum thickness is about 13 meters assuming sound speed of 1,500 m/s. Water depth is 250 meters.

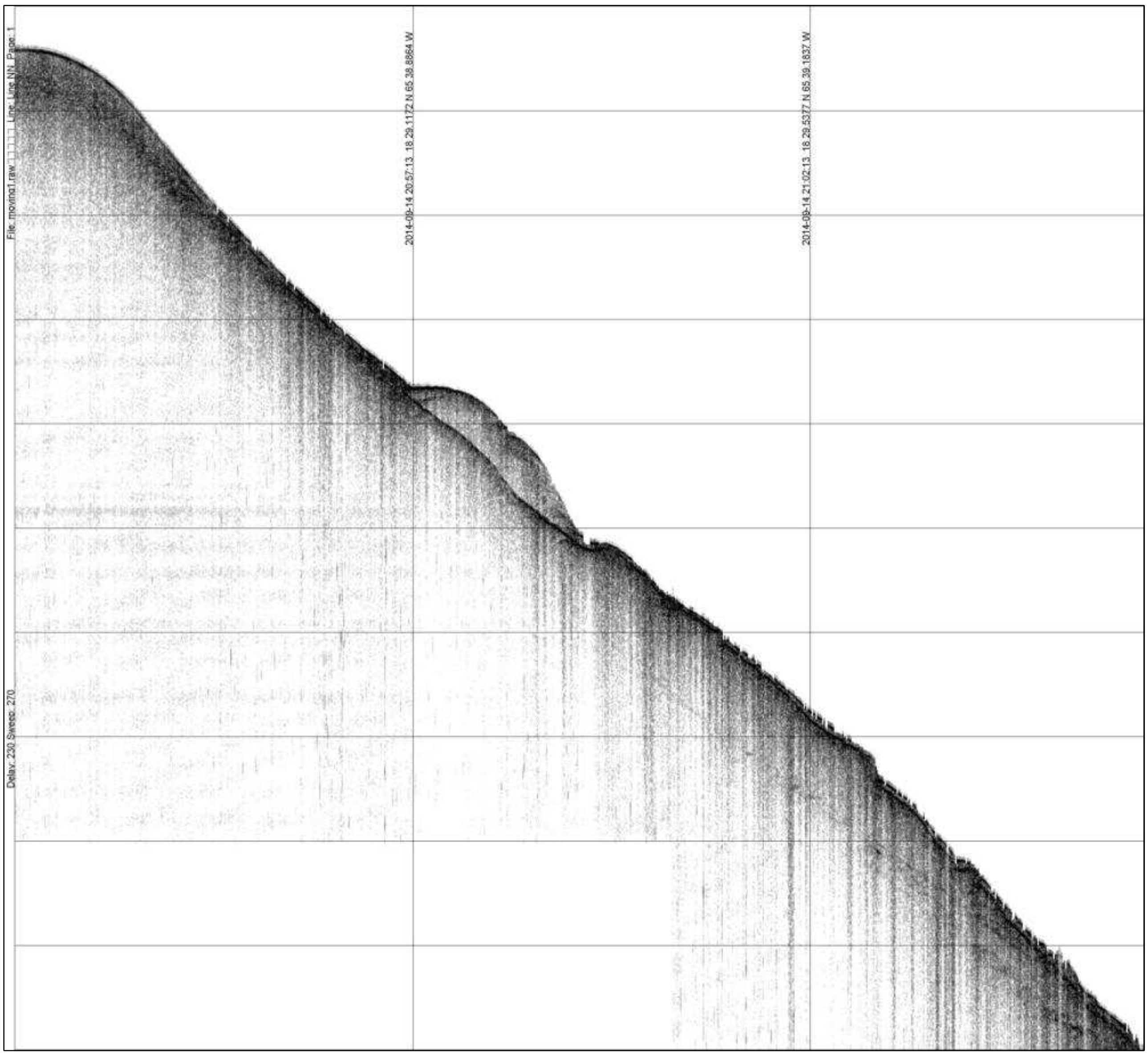

Figure 14 Example of slump. Vertical scale is ~20 meter per division.

Based on the observations made during the cruise, it seems that external noise has a negative impact on the system performance. The noise bursts repeated at 8.33 ms will mask weak return signals and therefore reduce the achievable penetration. If the source of the noise is found, measures may be taken to reduce the problem.

The 2.5 kHz tone observed during operation of winches is also a source for degrading the results.

It is recommended to operate the system with LFM or HFM signal types as they result in suppression of noise when processed.

Using CW or Ricker pulses is not recommended in deeper water due to the present noise level.

Air bubbles under the transducer tends to reduce data quality depending on sea state, vessel heading relative to swell and speed.

The general environmental conditions around the transceiver are acceptable, however, a lower ambient temperature is recommended.

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Software versions

	Version:
Topas MMI version:	2.1.1
Power Amplifier PLD version:	-
CTRL DSP Version:	1.3.0
Windows 7 – OPU Version:	-
Windows XP - SBC Version:	-

System parameters

OPU Host Name:	Topas
OPU Host Id:	192.168.70.1
SBC Host Name:	RxTopas
SBC Host Id:	192.168.70.2
RS232/Ethernet converter Host Name:	NA
RS232/Ethernet converter Host Id:	192.168 70.3

Other remarks

NA

Date	KDA Representative	Customer Representative
18/09/2014		