SeaBat 8150 / 8111 ER / Edgetech 3300
Installation Report
R/V “Akademik Nicolaj Strakov”

Prepared for:

GINRAS

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Prepared by:
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Contents

Document Review

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1. Introduction

This document details the installation of RESON multibeam echosounder and related equipment onboard R/V “Akademik Nikolaj Strakhov” for the Geological Institute of the Russian Academy of Science (GINRAS). The installation took place in, Kaliningrad, Russia. All equipment was installed in accordance with RESON’s Standard Operating procedures.

The installation began on Monday 7th November 2005 and was completed on Friday 25th November 2005.

1.1. Personnel

The RESON personnel involved in the installation are listed in the following table:

Name	Title
Daniel Wake	RESON Project Surveyor
David Firth	RESON Engineer
Jørgen Viuff	RESON Mechanical Engineer
Jørgen Hansen	RESON Engineer
Michael Palmus	RESON Engineer
Natalia Becker	RESON Administrative Co-ordinator
Kim Kuyl Jensen	RESON Sales Manager

2. Description of Vessel

R/V "Akademik Nikolaj Strakhov" is an academic research vessel owned by GINRAS. The main function of the vessel is for research in oceanography, geology and hydrography.

The vessel has an overall length of 75.5m, breadth of 14.7m, a design draft of 4.5m and a displacement of 2,600 GRT. The vessel is classified under the Russian Register. Normal operational crew for the vessel is 23 with 17 officers and 30 scientists. She was built in 1985 and is registered in Kaliningrad.

Figure 1 - R/V "Akademik Nikolaj Strakhov"

3. Wet End Installation

3.1. Gondola Installation

The wet end installation design incorporates a transducer mounting gondola on the hull from which cables are fed though three hull penetrations into three cable pipes. The cable pipes terminate in the survey room where all dry end equipment is installed.

The diagram below shows a general schematic of the gondola.

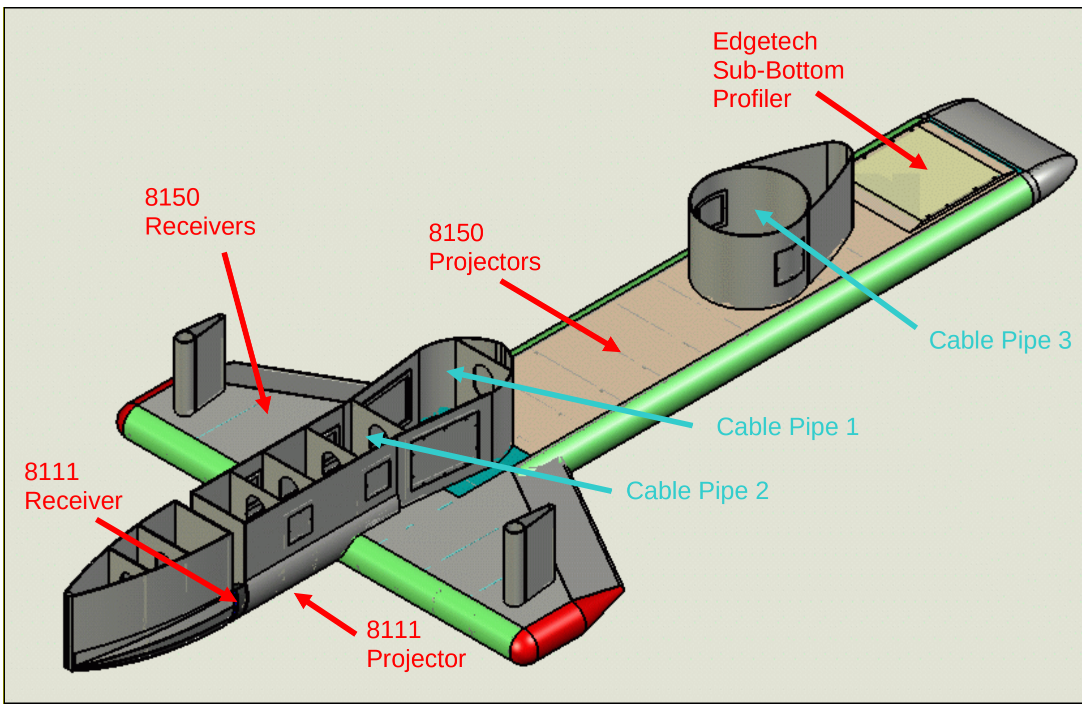


Figure 2 – Gondola Schematic

The gondola arrived at the shipyard in four pieces, and was constructed in the dry dock prior to the vessel entering. After the vessel entered the dry dock the gondola was raised and welded to the hull. Subsequently the "nose" fairing was installed. Figures 3 and 4 below show the gondola being installed.

Figure 3 – Main Gondola Installation

Figure 4 – "Nose" Fairing Installation

3.2. Cable Installation

The three cable pipes used for the installation were already installed from a previous system. On arrival the penetrations in the hull had been welded up and the tops of the pipes had been blanked off with blind flanges as shown below.

Figure 5 – Cable Pipes Prior to Installation

The blind flanges on the cable pipes were opened up and collars were installed to allow the cables to pass through using Roxtec seals. The smallest cable pipe on the right was not used in the installation. The cable pipes were opened up at the hull and pre-prepared plates with collars were welded in place to allow the cables to pass into the pipes from outside the hull.

All cables were fed upwards from the gondola. The cables contained within the used cable pipes are shown below in figure 6:

Figure 6 – Cable Routing

Cable Routing	
Cable Pipe No.	**Cables Used**
1	16 x 8150 Receiver
2	2 x 8150 Receiver, 1 x 8111 Transmitter, 1 x 8111 Receiver
3	6 x 8150 Transmitter, 2 x SVP 70, 1 x Edgetech SBP

Figure 7a – Cable Pipe No. 1

Figure 7b – Cable Pipe No. 2

Figure 7c – Cable Pipe No. 3

Roxtec seals were installed at both ends of the cable pipes. Figures 7a-c show the external Roxtec seals after installation of the cables. Refer to Figure 2 for the location of these seals within the gondola.

3.3. SeaBat 8150 Installation

The six SeaBat 8150 receivers are installed port/starboard the gondola, each held by four M16 bolts as shown in Figure 8a. Each receiver has three 2m cables moulded to it which are terminated with subcon connectors to which the receiver cables are attached. The receivers are designed to be removed and installed without removing the cables penetrating the hull.

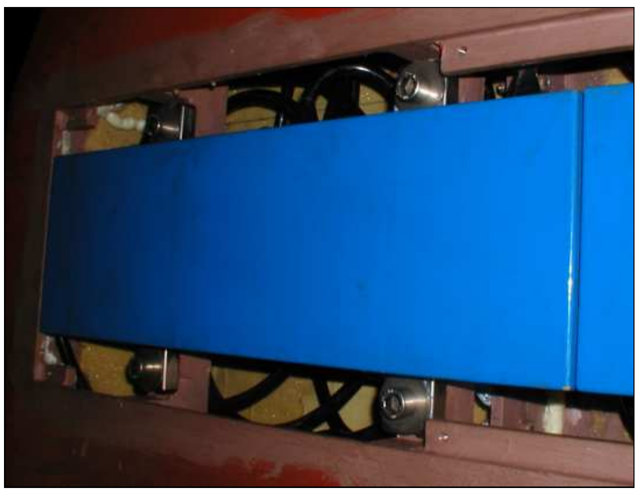


Figure 8a – 8150 Receiver Mounting

Figure 8b – 8150 Receiver Sealing

When all six receivers were installed, blind plates were fitted at either side and any remaining small gaps were filled with sealant as shown in Figure 8b.

The six SeaBat 8150 transmitters are installed fore/aft in the gondola and mounted in the same way as the receivers. Each transmitter has one 2m cable moulded to it which is terminated with a subcon connector to which the transmitter cable is attached. The transmitters are designed to be removed and installed without removing the cables penetrating the hull.

When all six transmitters were installed the small gaps between were filled with sealant as shown below in Figure 9.

Figure 9 – SeaBat 8150 Transmitter Installation and Sealing

On completion of the physical installation the system the transmit section was tested using the scan test routine. The scan test verified that 48 sequential pings were audible from the transmit section from fore to aft.

Following the scan test, a rub test was performed along the full length of the receive arrays. This verified that all channels were functioning and wired in the correct sequence.

3.4. SeaBat 8111 Installation

The 8111 receiver is attached behind the "nose" fairing to the main gondola using four M8 bolts as shown in Figure 10a. The bolt holes on the receiver are threaded to receive the M8 bolts. When the receiver was installed, blind plates, baffling and sealant were used to fill any gaps and minimise turbulence over the receiver.

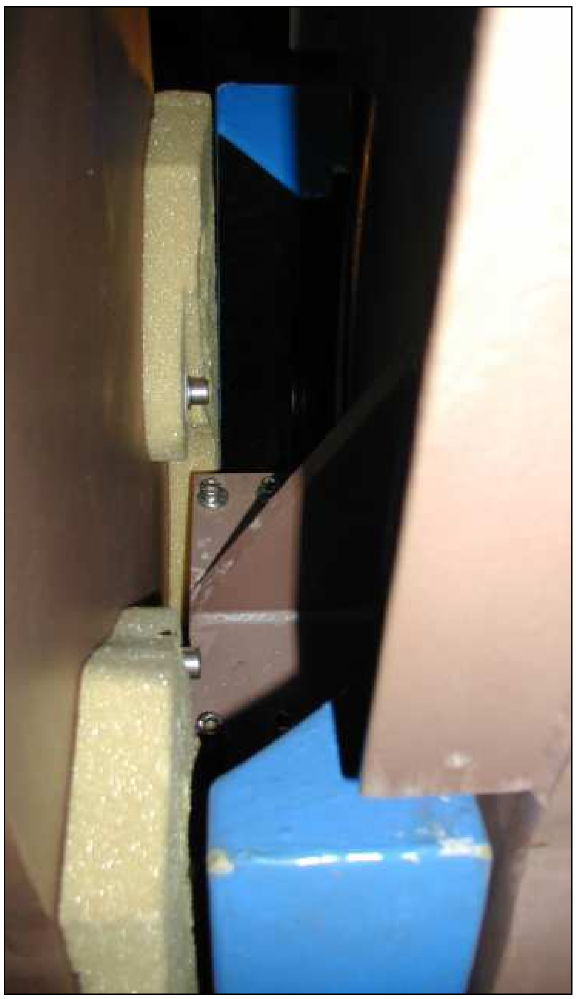


Figure 10a – 8111 Receiver Installation

Figure 10b – 8111 Receiver Sealing

The SeaBat 8111 transmitter is installed aft of the receiver and fixed by four M8 bolts as shown in Figure 11a below. When the transmitter was installed the small gaps between the ends and the gondola were filled with sealant.

Figure 11a – 8111 Transmitter Installation

Figure 11b – SeaBat 8111 Transmitter Installation

3.5. Edgetech 3300 Installation

The 5x5 Edgetech 3300 transducer array is installed in the aft section of the gondola. Each transducer bracket, which holds 5 transducers, is bolted to the gondola. The transducers are held in the brackets using jubilee clips as shown in Figure 12a.

Figure 12a – Edgetech Array from above

Figure 12b – Edgetech Array from below

The Edgetech array sea chest was installed with baffling, an acoustic window and a cover plate in order to minimise noise and thus maximise system performance. Figure 13 below shows the closed Edgetech sea chest.

Figure 13 – Edgetech Array closed

3.6. RESON SVP-70

The RESON SVP-70 sound velocity probe is installed aft of the transmit array on the port side. It is held in by two clips using M6 bolts and a cover plate using M8 bolts. The measurement protrudes from the gondola for accuracy in measuring true sound velocity at the transducer face.

The SVP-70 is designed to be removable under water using a Birns subconnector. A spare SVP cable was installed in the event that the primary cable is damaged.

Figure 14 – RESON SVP-70

4. Dry End Installation

4.1. 19" Racks

Installation of the dry end equipment commenced with the construction of the two 19" system racks in order to form housing for the dry end sensors. The various dry end sensor control units were installed prior to completion of the cable runs. When all cable runs were complete, a complete functional test of each system was performed.

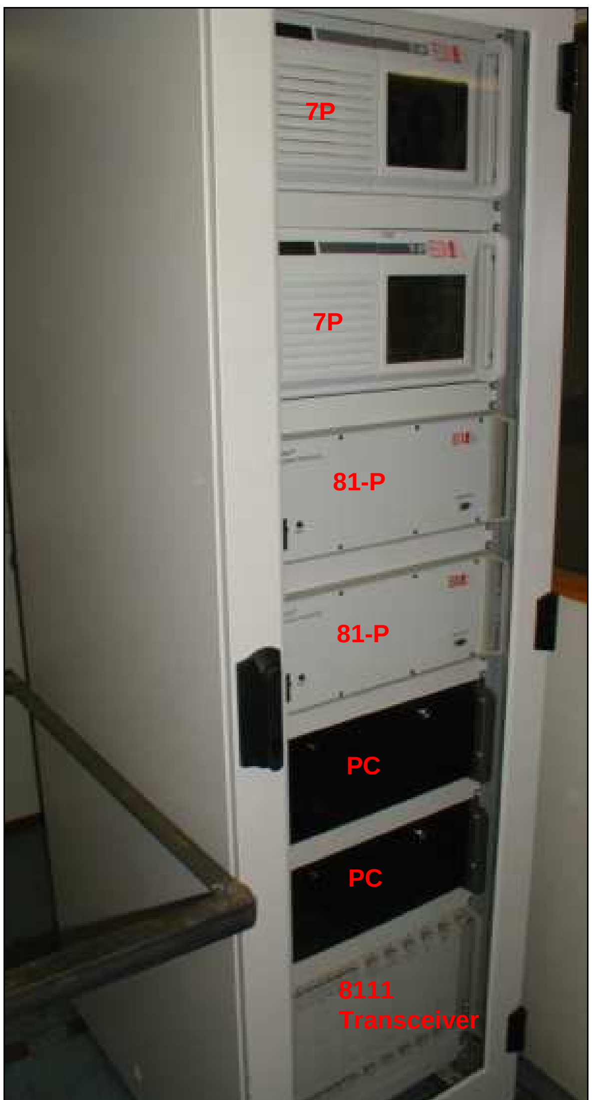


Figure 15a – RESON Rack

Figure 15b – Edgetech Rack

Power for the two 19" racks was taken from the ship's "No Break" supply. A power cable existed in the survey room but it was not terminated on arrival. As a result, RESON installed a switchboard with two slow blow 16A fuses, one for each 19" rack.

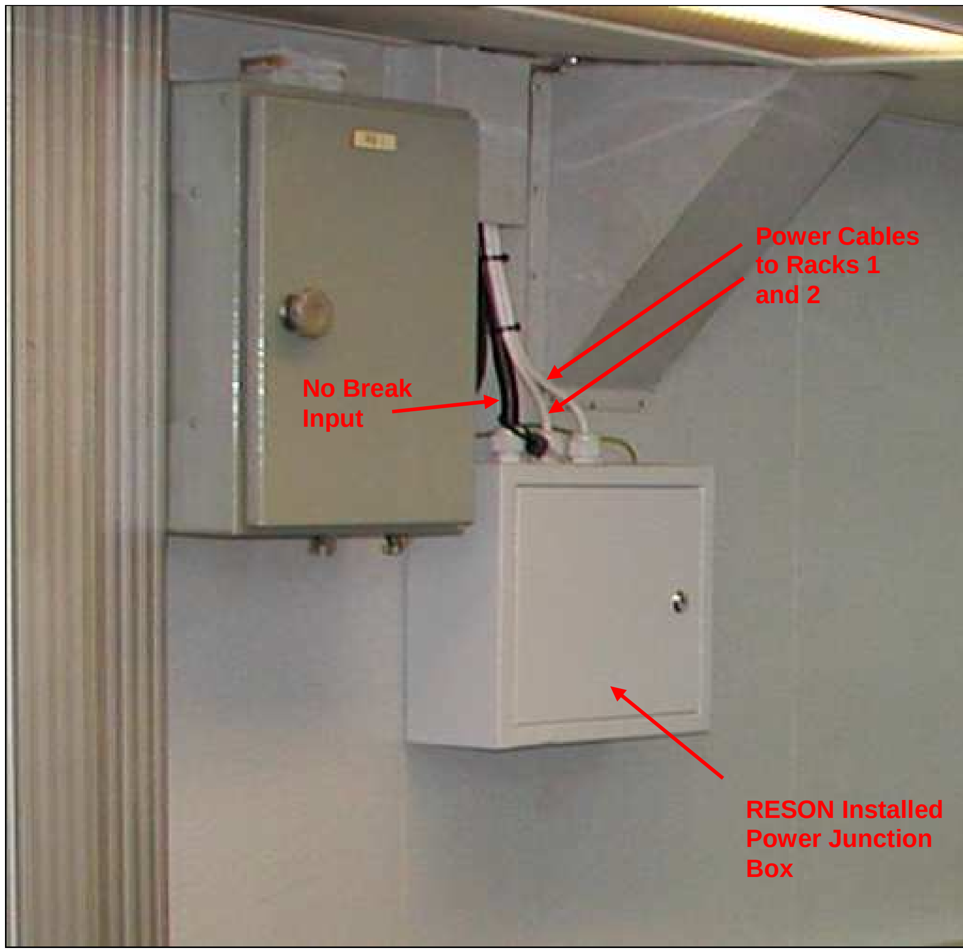


Figure 16 – RESON Power Junction Box

4.2. SeaBat 8150 Transceiver

The transceiver was installed next to the cable pipes in the survey room. A metal bracket was welded to the wall and deck in order to form support for the transceiver. The bracket and transceiver mounting is shown below:

Figure 17a – Transceiver Bracket

Figure 17b – Transceiver Installation

Power for the SeaBat 8150 transceiver was taken from an existing switchboard in the survey room, not connected to the "No Break" supply. It is located in LAB10 next to MCB0.

Figure 18 – SeaBat 8150 Transceiver Power Supply

4.3. Main Console and A3 Laser Printer

In order to accommodate the 7 monitors required to operate each system installed, a table was constructed by the shipyard which was welded to existing metal bars on the floor. The HP LaserJet 5500 printer was installed opposite the Main Console and interfaced to the network switch in the main RESON rack.

Figure 19 – Main Console and A3 Laser Printer

An additional monitor was installed on the bridge for the helmsman. It is connected to a VGA splitter box in the survey room which splits the signal to the right hand acquisition PC monitor.

4.4. GPS Antenna Installation

The main mast of "R/V Akademik Nikolaj Strakhov" had an existing Trimble antenna installed. The client stated that this antenna was no longer in use and that the easiest means of installing the new Trimble system was by replacing the old one and using the existing cable.

Figure 20 – GPS Antenna Installation

The new antenna was installed in place of the old one using 5/8 thread and nut through the existing bolt hole. Loctite was used to secure the thread.

The existing cable run for the Trimble system terminates in the laboratory aft of the bridge on bridge deck. The Trimble DSM132 receiver was installed here in order to avoid having to extend the cable run to the survey room. The data is transmitted via MCB 5 junction box to the survey room using RS232 protocol.

A spare GPS output was presented at client request for use on a PC next to the receiver.

The Trimble may be configured remotely using the AgRemote software installed on the Acquisition PC, however, in doing so the communication protocol is set to TSIP and NMEA settings are lost. It is recommended that the physical display be used for configuration.

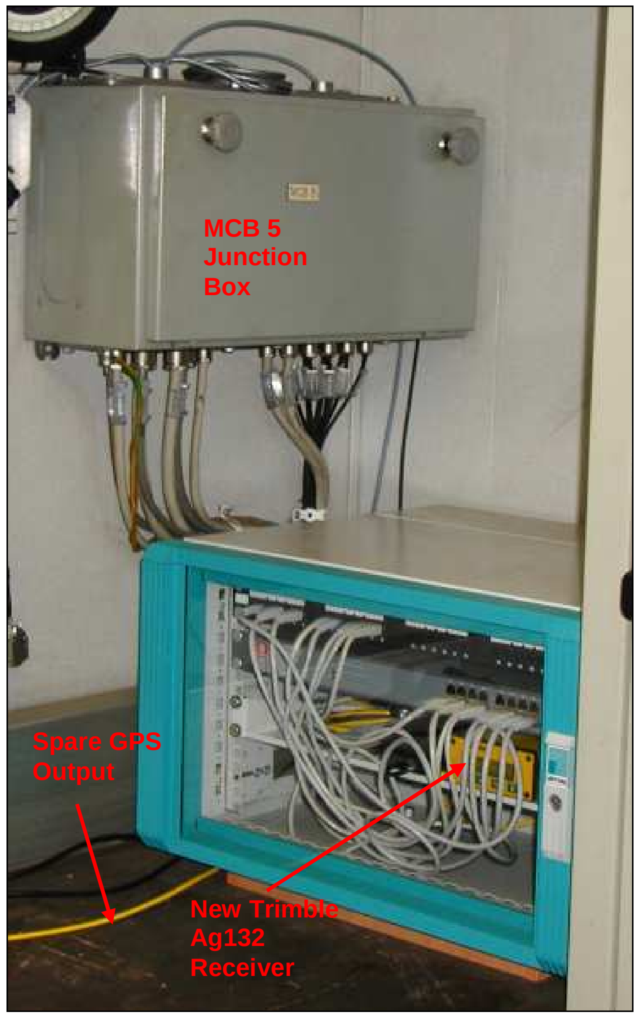


Figure 21 – GPS Antenna Installation

4.5. IXSEA Octans III

Initially it was planned to install the Ixsea Octans III in the existing gyrocompass room and send the data to the survey room using either RS232 or RS422 protocol. As with any motion sensor, best performance is achieved when the sensor is installed as close as possible to the point of least movement (centre of rotation). On examination of vessel drawings it became apparent that the survey room itself offered closer proximity to the assumed vessel centre of rotation than the gyrocompass room. For this reason it was decided that the best place to install the Octans was in the survey room next to the main equipment rack.

A metal plate was machined perfectly flat by the shipyard which was then bolted to the metal floor mountings in the survey room. This offered complete rigidity in the installation of the Octans. A plexi-glass plate was installed between the metal plate and the Octans as IXSEA recommend that the unit is isolated from the ship.

The alignment of the Octans with respect to the centre line of the ship was determined using land survey techniques which are described in section 6 of this report.

Figure 22 – IXSEA Octans III Installation

The Octans is powered from a dedicated 24V power supply installed in the main rack. It is connected to COM1 of the acquisition PC for RS232 configuration using the IXSEA repeater software.

4.6. Edgetech Sub-Bottom Profiler

The Edgetech Sub-Bottom Profiler is installed in the smaller of the 19" racks as shown below. It consists of a PC unit and a 4kW power amplifier.

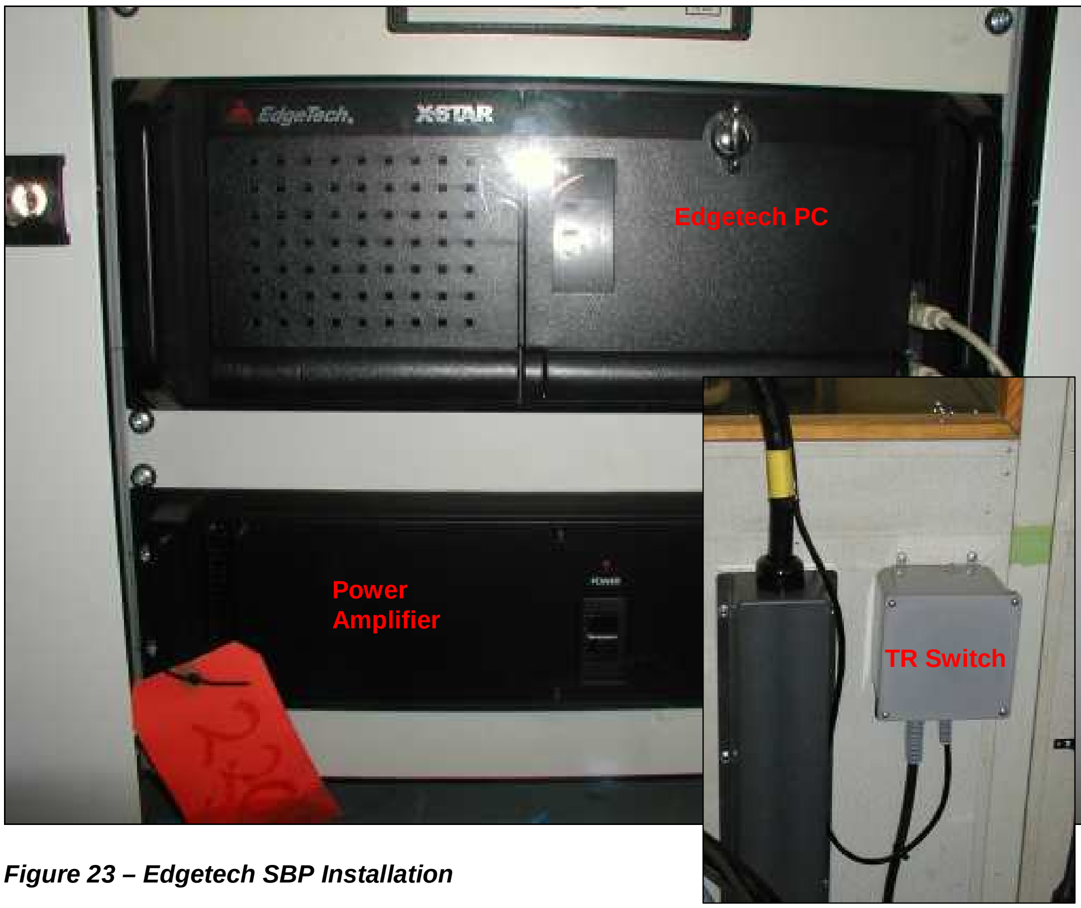


Figure 23 – Edgetech SBP Installation

A 75m deck cable connects the amplifier to a Transmit/Receive switch located next to the cable pipes in the survey room. The TR switch is connected to the transducer array through the cable pipe.

4.7. SSU-100

The SSU-100 is used to trigger the Sub-Bottom Profiler from either of the two multibeam systems. The 81-Ps generate a trigger on the TRIG IN/OUT connector that is sent to the EXT TRIG port of the SSU-100 using coaxial cable. This trigger is used to generate pulses on any of the 8 channels available on the SSU-100. Currently only channel 1 is configured on the SSU-100 for the Edgetech. The SSU-100 manual contains information on the commands to enable or disable pulses on the channels. The SSU-100 is connected to COM3 of the Edgetech PC for configuration using Hyperterminal (icon available on desktop). A file exists in C:\SSU-100 to give an example of the commands used to configure the SSU-100.

Only one multibeam system can be used at a time to trigger the SSU, therefore, the coaxial cable must be swapped between the TRIG IN/OUT ports on the 81-Ps depending on whether the 8111 or the 8150 is being used.

The Sub-Bottom Profiler software must be configured to receive an external trigger. This is done on the main sonar control page by choosing “External”.

There is a drawback to triggering the Sub-Bottom Profiler externally and that is that is disables the multiping function of the Sub-Bottom Profiler. This means that the ping rate drops considerably. Tests have shown that the 9 pings/second is the maximum that the Sub-Bottom Profiler can generate when triggered externally.

4.8. Valeport MIDAS

The Valeport MIDAS was delivered during a visit to Helsingor, Denmark. The sensors comprising the MIDAS are listed as follows:

- Sound Velocity
- Turbidity
- Pressure
- Temperature
- Dissolved Oxygen
- Conductivity
- Water Bottle Sampler
- Fluorometer
- PH
- Redox

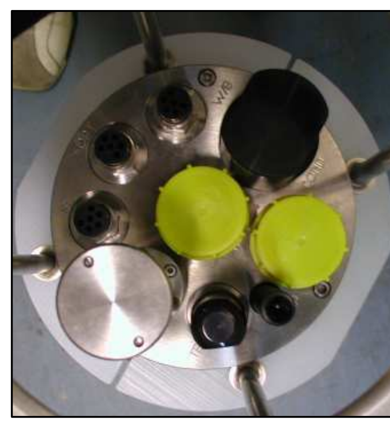


Figure 24a – Valeport MIDAS

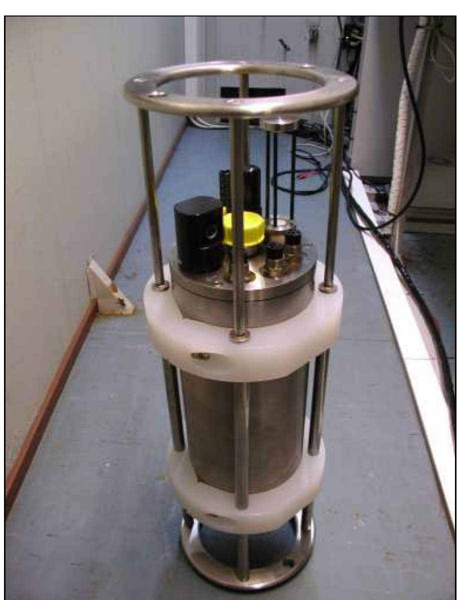


Fig24b – Valeport MIDAS

Fig24c – Valeport MIDAS

Data is recorded internally and exported to ASCII format using the Datalog 400 software installed on the processing PC. The 3m Y-splice is used to connect the sensor to a 9-way COM port. For the purposes of the deck test COM1 of the Processing PC was used.

4.9. Software Installed

The following software was installed on the vessel prior to departure for sea trials:

System	Software / Firmware
SeaBat 8150	8150-L210-897B Dry 8150-L100-B1CA Wet
SeaBat 8111	8111-E208-3F66 Dry 8111-E101-AFAA Wet
Acquisition PC	PDS2000 v2.3.3.20 AgRemote v1.22 TSIP Talker v2.00 iXRepeater Octans 3452-645
Processing PC	PDS2000 v2.3.3.20 Datalog 400
Edgetech SBP	Discover Sub-Bottom v3.36 Sonar.exe

Both the Acquisition and Processing PCs have a directory called C:\Install which contains all the install files necessary to re-install any of the software listed above. The CDs supplied with each sensor are copied into the Install folder.

5. Hardware Interfacing

5.1. Data Connections

	From	To	Data	Protocol
1	81-P processor	Survey Software	Bathy Data	Ethernet
2	81-P processor	Survey Software	Snippets Data	Ethernet
3	81-P processor	Survey Software	Bathy Data	Ethernet
4	81-P processor	Survey Software	Snippets Data	Ethernet
5	Trimble GPS	Acquisition DDU	Pos/Time/Speed	Serial, RS232
6	Acquisition DDU	Survey Software	Position	Serial, RS232
7	Acquisition DDU	Survey Software	Time	Serial, RS232
8	Acquisition DDU	IXSEA Octans III	Position/Speed	Serial, RS232
9	IXSEA Octans III	Acquisition DDU	Heading/P/R/H	Serial, RS232
10	Acquisition DDU	Survey Software	Heading/P/R/H	Serial, RS232
11	IXSEA Octans III	Acquisition DDU	P/R/H	Serial, RS232
12	Acquisition DDU	81-P Processor	P/R/H	Serial, RS232
13	Acquisition DDU	81-P Processor	P/R/H	Serial, RS232
14	SVP-70	Acquisition DDU	Sound Velocity	Serial, RS232
15	Acquisition DDU	81-P Processor	Sound Velocity	Serial, RS232
16	Acquisition DDU	81-P Processor	Sound Velocity	Serial, RS232
17	Survey Software	81-P Processor	Time	Serial, RS232
18	Survey Software	81-P Processor	Time	Serial, RS232
19	Survey Software	Edgetech SBP	Position	Serial, RS232
20	IXSEA Octans III	GINRAS System	Heading/P/R/H	Serial, RS232

5.2. Communication Parameters

	Data	Message	From Port	To Port	I.O. Settings	Freq.
1	Bathy Data	R Theta	1032	N/A	IP 10.0.10.1	Var
2	Snippets Data	RESON Snippets	1038	N/A	IP 10.0.10.1	Var
3	Bathy Data	R Theta	1040	N/A	IP 10.0.10.2	Var
4	Snippets Data	RESON Snippets	1046	N/A	IP 10.0.10.2	Var
5	Pos/Time/Speed	GGA/ZDA/VTG	Port A	DDU1	9600,8,N,1	Var
6	Position	GGA	DDU2	MOXA1	9600,8,N,1	1Hz
7	Time	ZDA	DDU3	MOXA2	9600,8,N,1	1Hz
8	Position/Speed	GGA/VTG	DDU4	Octans A	9600,8,N,1	1Hz
9	Heading/P/R/H	SIMRAD EM	Octans A	DDU 6	19200,8,N,1	50Hz
10	Heading/P/R/H	SIMRAD EM	DDU6	MOXA3	19200,8,N,1	50Hz
11	P/R/H	Octans STD1	Octans A	DDU9	115200,8,N,1	50Hz
12	P/R/H	Octans STD1	DDU10	81-P Port 3	115200,8,N,1	50Hz
13	P/R/H	Octans STD1	DDU10	81-P Port 3	115200,8,N,1	50Hz
14	Sound Velocity	AML	RS232	DDU13	115200,8,N,1	1Hz
15	Sound Velocity	AML	DDU14	81-P DnLk	9600,8,N,1	1Hz
16	Sound Velocity	AML	DDU15	81-P DnLk	9600,8,N,1	1Hz
17	Time	RESON UTC	MOXA4	81-P Port 1	115200	1Hz
18	Time	RESON UTC	MOXA4	81-P Port 1	115200	1Hz
19	Position	GGA	MOXA5	Nav	9600,8,N,1	1Hz
20	Heading/P/R/H	GINRAS System	Octans B	MCB 0	9600,8,N,1	5Hz

5.3. Power Schematic

The following diagram shows the power schematic for all systems installed by RESON onboard R/V "Akademik Nikolaj Strakhov".

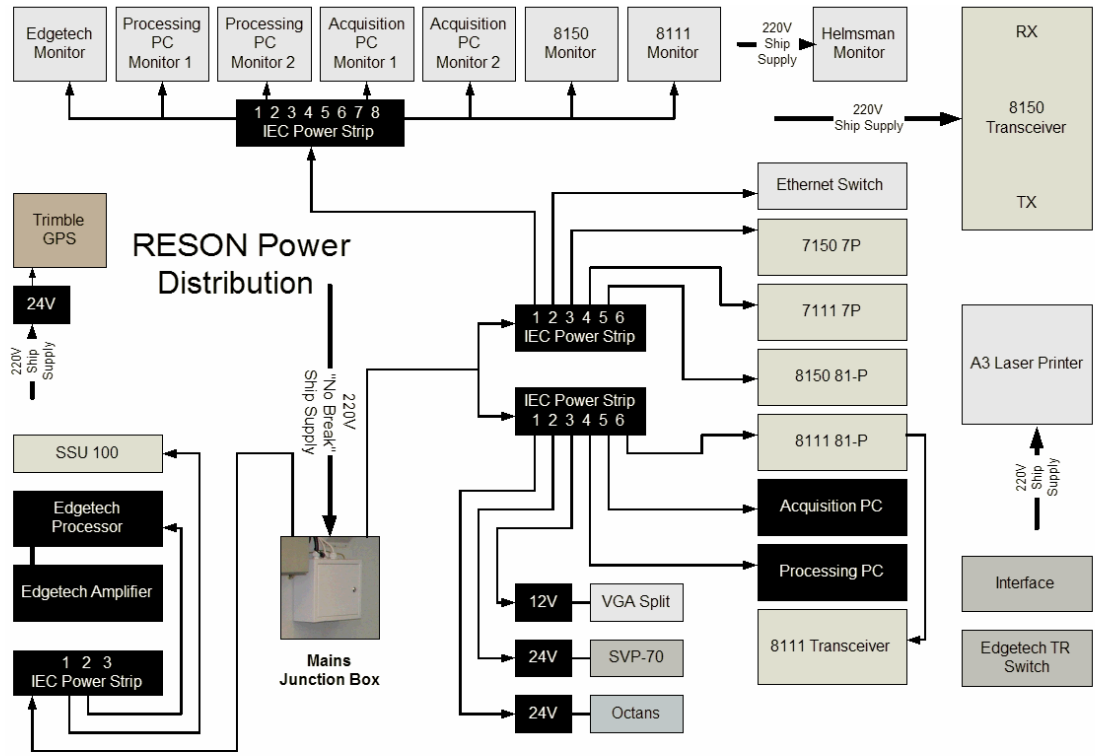


Figure 25 – Power Distribution

5.4. Data Interfacing

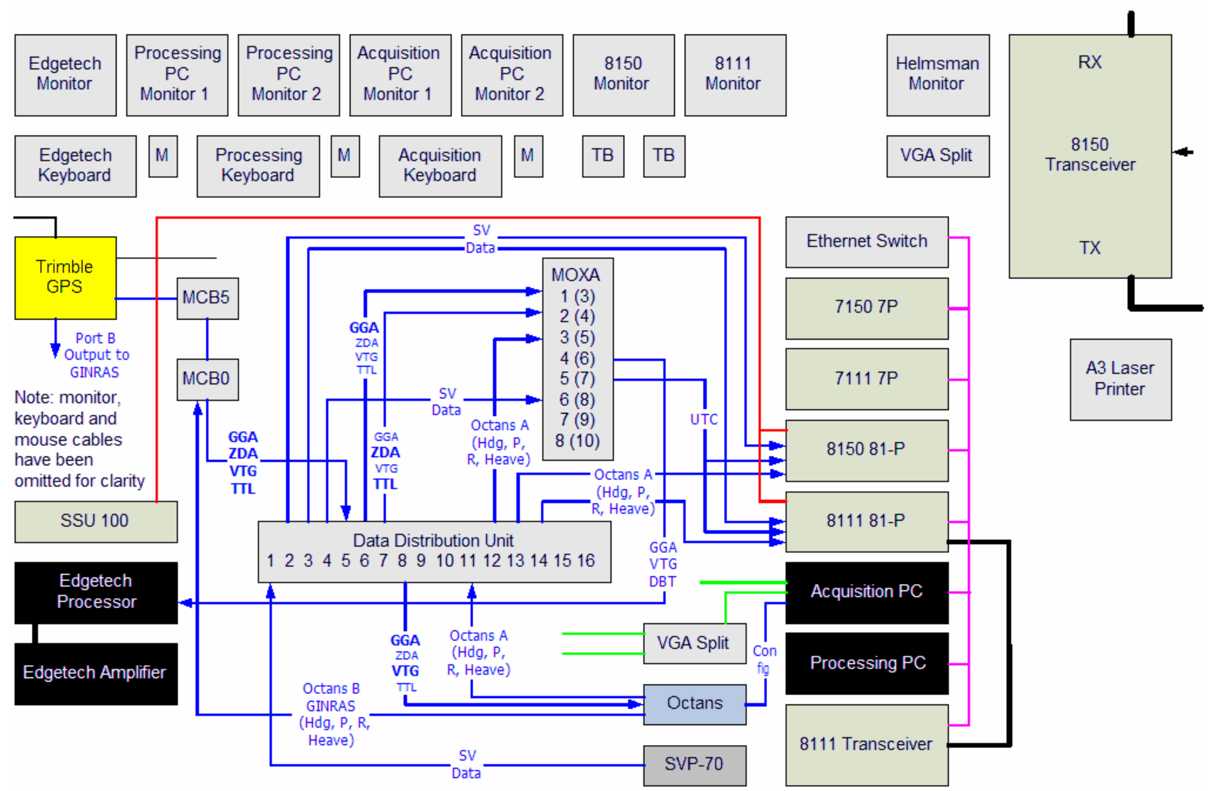
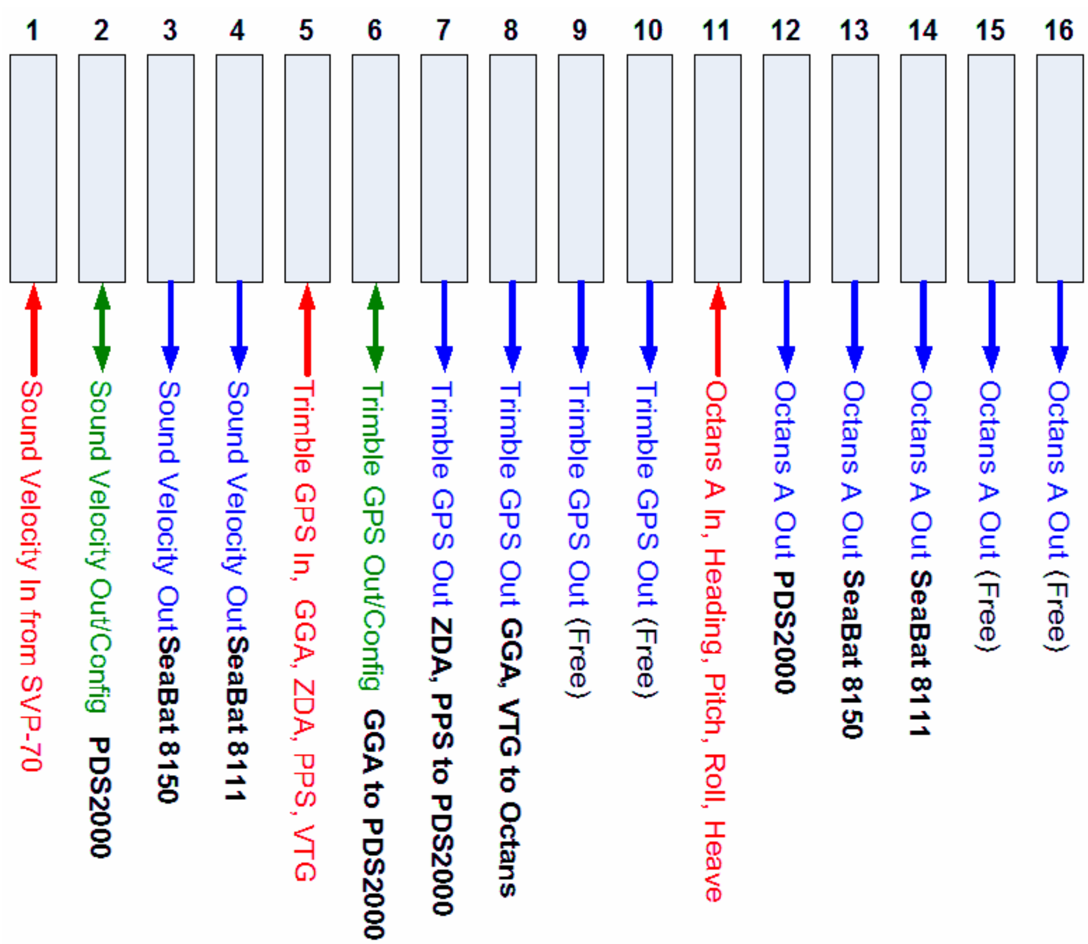


Figure 26 – Data Interfacing

5.5. Data Distribution Unit

The following diagrams show the data interfacing to/from the data distribution board.



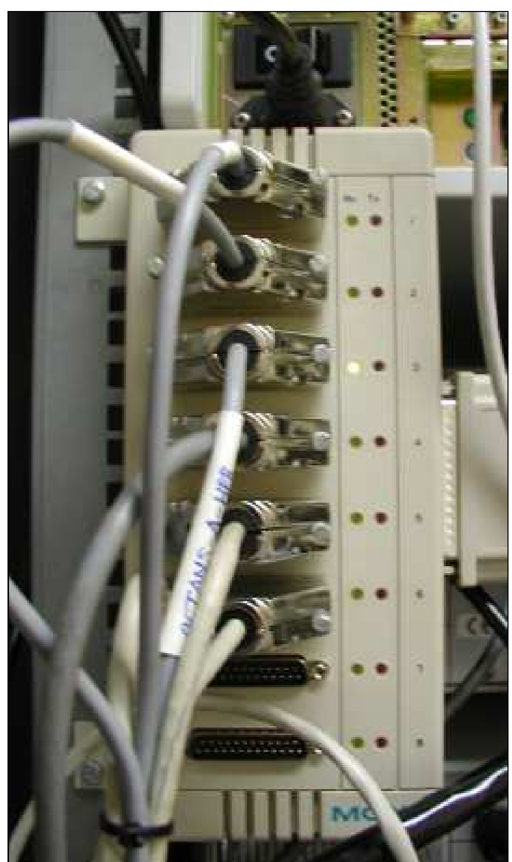
The pin wiring of the DDU is as follows:

For all outputs (female connectors) data is transmitted on pin 3 and ground is on pin 7. For the Trimble GPS outputs pin 8 is wired to carry the TTL signal. The first output in the sequence for Sound Velocity and GPS (indicated in green) has pin 2 connected in order to be used for configuring the sensors.

5.6. MOXA Connections

The following diagrams show the data interfacing to/from the MOXA board.

1	←	GGA from Trimble to PDS2000
2	←	ZDA, PPS from Trimble to PDS2000
3	←	Octans Heading, Pitch, Roll, Heave to PDS2000
4	→	GGA, VTG, DBT from PDS2000 to Edgetech SBP
5	→	UTC from PDS2000 to SeaBat 8111/8150
6	→	Sound Velocity from SVP-70 to PDS2000
7	↔	Free
8	↔	Free



6. Sensor Offsets and Orientations

Whilst the vessel was in dry dock during the installation, land survey techniques were used to establish the orientation of the vessel reference frame and the sensor offset locations within this frame. The sensor orientations with respect to the vessel reference frame were observed also.

As stated in section 3.5 of this report the IXSEA Octans III was installed as close as practically possible to what is assumed to be the vessel’s centre of rotation. For simplicity, the installed position of the Octans was taken to be the common reference point for sensor offsets.

The PDS2000 convention for offset measurements is adopted.

X axis is positive to Starboard
Y axis is positive to Bow
Z axis is positive Up

6.1. Sensor Offsets

Sensor offsets from CRP (metres)			
From CRP to…	**X (m)**	**Y (m)**	**Z (m)**
Octans	0.00	0.00	0.00
Trimble GPS Antenna	0.97	5.40	19.58
SeaBat 8150	1.60	2.36	-5.78
SeaBat 8111	1.60	6.62	-5.46
Edgetch SBP	1.60	-0.87	-5.73

6.2. Sensor Orientations

The alignment of the vessel reference frame was determined by land survey measurements to prisms located on the centre line at the bow and stern of the vessel.

The alignment of the SeaBat 8150 with respect to the vessel centre line was determined by using land survey techniques to measure the positions in X, Y and Z of the receiver and transmitter mounting bolt holes.

The heading of the vessel reference frame was determined by computing a bearing from two known positions: the Trimble GPS for the vessel position and a lighthouse 3.5km west on the channel approaches to Kaliningrad. Confidence in the positions is considered to be ±3m, typical for GPS and for geographical co-ordinates quoted to 3 decimals in minutes i.e. dd mm.mmm. This results in confidence in the baseline orientation of 0.1º assuming the lighthouse co-ordinates are correct.

Sensor Orientations			
	Heading	**Pitch**	**Roll**
Vessel Ref Frame	88.84º	0.11º (bu)	-0.15º (su)
SeaBat 8150	88.82º	0.32º (bu)	-0.16º (su)
SeaBat 8111	Assumed 0º	Assumed 0º	Assumed 0º
Octans	89.72º	0.03º	-0.15º (su)

Sensor Misalignments with respect to Vessel Frame			
	Heading	**Pitch**	**Roll**
SeaBat 8150	-0.02º	0.21º	-0.01º
SeaBat 8111	Assumed 0º	Assumed 0º	Assumed 0º
Octans	0.86º	-0.08º	0.00º

The alignment of the SeaBat 8111 was not observed due to the fact that the curved array cannot be measured accurately. As with both multibeam systems, the final misalignments will be determined by the patch tests to be carried out during the sea acceptance tests. The patch tests shall be used to verify the computed misalignment between Octans and SeaBat 8150. When this has been computed, the misalignment between Octans and SeaBat 8150 shall be entered in the Octans using the IXSEA repeater software in order to remove any potential cross-talk between pitch and roll.