

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 7**

**7.31 Salinometers**

**R7.31** The Contractor shall purchase and correctly install 2 nos. salinometers.

These shall be installed (connected to electrical power supplies and attached to the structures with substantial portable attachments allowing for removal, maintenance and replacement) in the Salinometer Room.

**EXEMPLAR:** Guildline Autosal model 8400B. Guildline Instruments Limited. 21 Gilroy Street, Smiths Falls, Ontario, Canada K7A 4S."

**7.32 Uncontaminated Sea Water Sampling Systems**

**R7.32** The Contractor shall design, supply, and fit an uncontaminated sea water distribution system for scientific analysis purposes.

A means of flushing the system through shall be required employing a pump and connection next to the ship side valve whereby fresh water treated with a cleansing agent can be injected and flushed through the whole system including all outlets.

The system shall provide uncontaminated seawater to the following laboratories and external spaces:

- Controlled Temperature Cool Specimen Laboratory
- Core & Sample Chill Store
- Clean Laboratory
- Uncontaminated Seawater Laboratory
- Atmospheric Science Laboratory
- Aerosol Laboratory
- Science Laboratory /Store
- Deck Laboratory
- Main Laboratory
- Salinometer Room
- Dark / Photo Room
- Laboratory Container Service (7 nos. outlets)
- Aft Deck (2 nos. outlets)
- Science Hangar (4 nos. outlets)
- Starboard Working Deck (2 nos. outlets)

In the laboratories the system should be presented as a double tap outlet at each sink.

The taps shall be fitted with hose connectors and shall be strongly supported to minimise the stress on the plastic material.

Uncontaminated Seawater Sampling System piping shall be insulated ABS plastic.

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 7**

NOTE: Special care shall be taken in fitting the jointing between flanges so that it is flush and does not protrude into the bore of the pipe, so collecting particles present in the sea water sample, to possible contaminate later samples.

**7.33 Water Purification Systems**

**R7.33** The Contractor shall purchase and correctly install and test reverse osmosis (RO) water purification systems, with polishing units, a selection of laboratories as detailed below.

The detail of each system requirement is as follows:

Volume Requirement –	200 litres per day (typical usage 150 – 200 litres per day)
Water Quality –	Type II, Analytical Grade water and Type I, Ultrapure Water @ 18.2 megOhm.cm resistivity.
Water Specification –	Conductivity 18.2 megOhm.cm resistivity, TOC <5ppb
Points of Use –	5 nos. RO and Ultrapure Water dispensers:
Location of units –	Deck Laboratory (1 no. Ultrapure Dispenser), Clean Laboratory (1 no. Ultrapure Dispenser), Controlled Environment Laboratory (1 no. Ultrapure Dispenser), Main Laboratory (1 no. Ultrapure Dispenser) Science Lab / Stores (1 no. Ultrapure Dispenser). Atmospheric Laboratory (1 no. Ultrapure Dispenser)
Distribution of water –	the system utilises a continuous uninterrupted loop with a water velocity of 1.5m/s.

**EXAMPLAR:** Millipore Corporation products Elix10 Systems Advantage Ultrapure Water Systems Q-Pod Remote Dispensers

**7.34 Transducer Cofferdams**

**R7.34** The Contractor shall provide two cofferdams which will allow the subsequent installation of acoustic transducers. The transducers are not within the scope of supply.

Two nos. cofferdam arrangements need shall be created with an oval manhole cover-plate that includes a steel pylon for attachment of the array. The cofferdam space shall be filled with an anti-freeze mixture to achieve acoustic coupling into the sea. The array is approximately 450mm (l) x 370mm (w) x 400mm (h) in size. The design needs to incorporate a method for routing underwater cables.

Signal cabling within the vessel is allowed for within R7.26.

### **7.35 Scientific Common Earth System**

**R7.35** The Contractor shall purchase and correctly install an inter-laboratory and working deck scientific common earth system which shall be tested during trials. A common earth system shall be installed based upon a star arrangement from a hull steel grounding point at about midships. A single 25mm<sup>2</sup> earth wire shall be run from the grounding point to each of the laboratories, gravimeter room, server room and the Container Laboratory service points.

In the laboratories a copper earth bar, 30mm wide x 5mm thick mounted on insulated pillars, shall be fitted along the bulkheads at the back of all bench tops and at the deckheads above all island or peninsular bench tops.

*Since the only electrical earth available on a ship is its steel hull, and this can be subject to stray variable potentials due to earth faults etc., it is necessary to ensure that all scientific equipment is kept at a consistent earth potential relative to each other regardless of location of the equipment within the laboratories and workspaces.  
Inspection and Testing by voltmeter to NERC satisfaction.*

### **7.36 Spark Free Refrigerator Units**

**R7.36** The Contractor shall purchase and correctly install 10 spark free refrigerator units which shall be fully tested.

The units shall be: 150L upright under-bench laboratory refrigerator with auto-defrost and lock capable of maintaining temperatures from 2 to 8°C

These shall be installed (connected to electrical power supplies and attached to the structures with substantial portable attachments allowing for maintenance and replacement) in the following laboratories:

- Deck Laboratory (2 nos.)
- Clean Laboratory (1 no.)
- Controlled Environment Laboratory (1 no.)
- Main Laboratory (3 nos.)
- Science Laboratory / Stores (2 nos.)
- Atmospheric Science Laboratory (1 no.)

**EXAMPLAR:** The spark free type unit shall be a LEC LSR151UK spark free (230V 50-60Hz 277L) (available from: Fisher Scientific, [www.fisher.co.uk](http://www.fisher.co.uk)) or similar unit which is directly equivalent, this equivalence having been proved satisfactorily by use on vessels undertaking similar tasks

*Units shall be tested for 24 hours continuous operation at lowest temperature to NERC satisfaction.*

### **7.37 Freezer Units -20°C and -86°C**

**R7.37** The Contractor shall purchase and correctly install 7 nos. -20°C and 4 nos. -86°C spark-free freezer units which shall be fully tested.

The units shall be:

- 150L upright under-bench laboratory freezers with auto-defrost and lock capable of freezing down to -20°C.
- 426L biomedical type chest laboratory freezer with auto-defrost and lock capable of freezing down to -20°C.

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 7**

- 728L upright laboratory freezer with lock capable of controlled freezing of the contents to any temperature between -50°C and -86°C, this unit shall have a temperature recorder.

These shall be installed (connected to electrical power supplies and attached to the structures with substantial portable attachments allowing for maintenance and replacement) in the following laboratories:

- Deck Laboratory (1 no. 426L -20°C unit)
- Clean Laboratory (1 no. 150L -20°C unit)
- Controlled Environment Laboratory (1 no. 150L -20°C unit)
- Main Laboratory (2 nos. 150L -20°C units)
- Science Lab / Stores (1 no. 150L -20°C; 4 nos. 728L -86°C units)
- Atmospheric Science lab (1 no. 150L -20°C unit)

**EXAMPLAR:** The -20° type upright units shall be LEC LSF151UK or similar units which are directly equivalent, this equivalence having been proved satisfactorily by use on vessels undertaking similar tasks

**EXAMPLAR:** The -20° type chest unit shall be Sanyo (Biomedical) MDF-436 or similar units which are directly equivalent, this equivalence having been proved satisfactorily by use on vessels undertaking similar tasks

**EXAMPLAR:** The -86°C type unit shall be a Panasonic Ultra-Low Freezers MDF-U700VX-PE or a similar unit which is directly equivalent, this equivalence having been proved satisfactorily by use on vessels undertaking similar tasks.

*Units shall be tested for 24 hours continuous operation at lowest temperature to NERC satisfaction.*

### **7.38 Liquid Nitrogen Generator**

**R7.38** The Contractor shall purchase and correctly install a liquid nitrogen generator.

The equipment shall be located (connected to electrical power supplies and attached to the structures with substantial portable attachments allowing for maintenance and replacement) in a suitable location in close proximity to the science laboratories and where the instrument can be used safely by operators.

The contractor shall ensure safe use of the equipment and handling of liquid nitrogen, especially with respect to the low temperature of liquid nitrogen and prevention of oxygen depletion in the vicinity of the instrument due to release of nitrogen gas. Liquid nitrogen generator location shall be fitted with appropriate ventilation and alarms interfaced to the vessels VMS system to monitor of nitrogen

The contractor shall ensure that vessel structure and fittings are protected against spillage of liquid nitrogen from a Dewar or the generator and as associated low temperatures.

A 230V power outlet is required in close proximity.

Provision shall be made for the fitting of a second Liquid Nitrogen Generator.

**EXAMPLAR:** Khione LN2 Model LN20, Noblegen Products, Wirac Automation LTD, 5 Parker Court, Gateshead, Tyne & Wear, NE11 9EW, UK., or similar units which are directly equivalent, this equivalence having been proved satisfactorily by use on vessels undertaking similar tasks

**7.39 Laminar Flow Cabinet**

**R7.39** The Contractor shall purchase and correctly install a benchtop laminar flow enclosure with integral lighting and variable fan speed control in the Clean Laboratory, and fully tested. With a further 2 nos. that shall be versatile and movable within and between the Deck, Main and Science / Storage laboratories.

Construction: white painted mild steel with anodised aluminium tubular section and clear acrylic entrainment screen.

Work area: 915mm (w) x 635 (d) x 535 (h)

Overall dims: 965 (w) x 660 (d) x 1015 (h) mm

HEPA filter: H14 99.995% @ MPPS < .0006% penetration

Quality better than Class 5 (100 particles @ 0.5µ)

Additionally the Contractor will supply one portable unit.

**EXAMPLAR:** The Laminar Flow Cabinet shall be a Bassaire (<http://www.bassaire.co.uk/>) Model K3 Vertical or a similar unit which is directly equivalent, this equivalence having been proved satisfactorily by use on vessels undertaking similar tasks.

**7.40 Fume Cupboard**

**R7.40** The Contractor shall purchase and correctly install 2 nos. Fume Cupboards with integral lighting and fully tested.

These shall have ducts to vent to atmosphere but also have the capability to clean extracted air, via optional removable filters, prior to venting.

These shall be installed (connected to electrical power supplies and attached to the structures with substantial portable attachments allowing for maintenance and replacement) in the following laboratories:

- Deck Laboratory
- Main Laboratory

**EXAMPLAR:** The Fume Chamber shall be a Monmouth Ductaire Pro or a similar unit which is directly equivalent, this equivalence having been proved satisfactorily by use on vessels undertaking similar tasks.

**7.41 Fume Hood**

**R7.41** The Contractor shall purchase and correctly install 4 nos. ductless Fume Hoods with integral lighting and fully tested

These shall be versatile and movable within and between laboratories. They shall be installed (connected to electrical power supplies and attached to the structures with substantial portable attachments allowing for maintenance and replacement) in the following laboratories:

- Clean Laboratory
- Controlled Environment Laboratory
- Science Laboratory / Stores
- Atmospheric Science Laboratory

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 7**

**EXAMPLAR:** The Fume Chamber shall be an Astec Monair Plus 1250 or a similar unit which is directly equivalent, this equivalence having been proved satisfactorily by use on vessels undertaking similar tasks

**7.42 Shipborne Wave Recorder (Radar)**

**R7.42** The Contractor shall purchase and correctly install a shipborne wave recorder and commissioned complete with all shipside fittings, power supplies and signal cabling. The system shall be provided complete with data logging capability (PC) and X band radar mounted facing forward. The system shall have oil spill detection capability.

Field of view should be as wide as possible about the bow – manufacturer's recommendation is at least a 220° field of view, ideally 110° either side of bow. The ship's wake region should be avoided since it is unrepresentative of the ambient wave field.

The system must not interfere with the ship's own navigation radar – this is best achieved by maximising vertical separation of the two antennas.

**EXAMPLAR:** The shipborne wave recorder shall be a radar based system such as WAVEX from MIROS, Norway or similar unit which is directly equivalent, this equivalence having been proved satisfactorily by use on vessels undertaking similar tasks.

**7.43 Gravity Meter Unit**

**R7.43** The Contractor shall purchase and correctly install in the Gravity Room a wooden plinth 1200 x 1500 x 150mm thick. The plinth should be positioned to allow comfortable access to at least three sides for servicing of the gravity platform.

EXEMPLAR

[http://www.canadianmicrogravity.com/pdfs\\_new/CMG\\_GT\\_2M\\_frnt.pdf](http://www.canadianmicrogravity.com/pdfs_new/CMG_GT_2M_frnt.pdf)

**7.44 Co-ordinate Reference Point Survey**

**R7.44** The Contractor shall arrange to conduct a co-ordinate reference point survey for a number of items on and within the vessel will need shall be precisely surveyed and presented within a common co-ordinate reference position report.

The following items will require survey:

- Swath bathymetry systems
- Multi-beam Echo Sounder Transducers (as per Equipment Suppliers requirements)
- Sub-bottom Profiler Transducers (as per Equipment Suppliers requirements)
- Position Reference Antenna (multiple systems)
- Attitude Reference Sensors (multiple systems)
- USBL Spars (2 nos.)
- Fixed Points (14 nos.) A set of fixed points on the superstructure of the vessel should be measured and recorded. The distribution of the points should be determined to cover the whole vessel to provide future points of reference to monitor structural change or the installation of temporary systems. There should be points provided at the two starboard mid-ship deployment positions, LARS1 ROV deployment position and the Aft "A" frame deployment position.

The survey provision accuracy should be equal to or better than:

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 7**

- General survey accuracy of reference points  $\pm 2\text{mm}$
- Local survey accuracy  $\pm 1\text{mm}$ .
- Survey accuracy for the Attitude Reference Sensors  $\pm 0.1$  degree
- Survey accuracy for heading, roll, pitch of echo sounders  $\pm 0.05$  degree. or to the accuracy stipulated in the manufactures specifications, whichever is the smallest.

*Testing will be by inspection to NERC satisfaction and acceptance by the Multi-beam Supplier.*

**7.45 PAR Sensors on Science Mast**

**R7.45** Contractor shall provide and correctly install a Photosynthetically Active Radiation (PAR) sensor to be mounted high, and as clear of shadowing effects of other ship structures as possible. Duplicate systems shall be fitted on the foremast and above crow's nest. Sensors should be mounted on gimbals to maintain a near-vertical orientation.

**Exemplar:** PQS-1 PAR Quantum Sensor from Kipp & Zonen B.V. Delft - The Netherlands

**7.46 Air Temperature & Humidity**

**R7.46** The Contractor shall purchase and correctly install an Air temperature and humidity sensor.

One instrument shall be installed on foremast and another 2 nos. instruments above crow's nest. Sensor head shall be installed in aspirated radiation shield.

- Ideal is for 2 nos. systems above crow's nest and a third unit on foremast to provide redundancy of measurements.

**EXEMPLARS:** Vaisala HMP155 (in ventilated shield) from Vaisala Inc. Bury St Edmunds Office, Unit 2b, Hillside Business Park, Kempson Way, Bury St Edmunds, Suffolk, IP32 7EA

Or

Rotronic MP100A/MP400A (in aspirated shield) from: ROTRONIC Instruments UK Ltd. Crompton Fields, Crompton Way, Crawley, West Sussex, RH10 9EE

**7.47 Small Survey ROV can be used for hull inspections**

**R7.47** The Contractor shall supply and integrate a small ROV for underwater hull inspections deployable through moonpool or, stern or starboard side.

Additional equipment required:

- Manufacturers highest specification resolution cameral,
- A sector scanning sonar (exemplar Tritech Seaprince / Super Seaking),
- A high frequency multibeam (exemplar Blueview),
- V-grip manipulators.
- Five nos. transponders rated to 3000m
- Five nos. transponders rated to 7000m
- Twenty nos. Mini Transponders with twenty frequencies.

**EXEMPLAR** Seatronics Predator II ROV

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 7**

**7.48 Fluorometer**

**R7.48** The Contractor to supply and correctly install a Fluorometer.

**EXEMPLAR:** Chelsea Technologies Group Ltd, 55 Central Avenue, West Molesey, Surrey, KT8 2QZ, UK

**7.49 Fast Repetition Fluorometry (FRRF) under way system, definition from NMF**

**R7.49** The Contractor to supply and correctly install a Fast Repetition Fluorometry system.

**EXEMPLAR:** Chelsea Technologies Group Ltd, 55 Central Avenue, West Molesey, Surrey, KT8 2QZ, UK

**7.50 Multi XBT Launcher**

**R7.50** The Contractor to supply and correctly install as Multi XBT Launcher System,

**EXEMPLAR:** Lockheed Martin Sippican's Mark 21 XBT System (Lockheed Martin Sippican, Inc. 7 Barnabas Road Marion, MA, USA).

**7.51 Expendable Bathythermograph (XBT) Logging System**

**R7.51** A system for deployment of XBTs and logging of XBT data shall be installed.

**7.52 Fibre Optic Gyro**

**R7.52** The Contractor to supply and correctly install Fibre Optic Gyro if not included in the requirement for the Inertial Navigation System R7.2

**7.53 Seapath High Res GPS**

**R7.53** The Contractor to supply and correctly install a High resolution GPS if not included in the requirement for the Swath Bathymetry systems R7.5

**EXEMPLAR:** Seapath High Res GPS

**7.54 Underway CTD**

**R7.54** The Contractor to supply and correctly install an Underway CTD system.

**EXEMPLAR:** Sea Bird Electronics, Sea-Bird Electronics, Inc., 13431 NE 20th Street, Bellevue, Washington 98005 USA

**7.55 Ice Machine**

**R7.55** The Contractor shall purchase and supply 2 nos. laboratory ice machines.

These shall be versatile and movable within and between laboratories. They shall be installed (connected to electrical power supplies and attached to the structures with substantial portable attachments allowing for maintenance and replacement) in the following laboratories:

- Main Laboratory
- Science Laboratory / Stores

**EXEMPLAR:** Scotsman AF 103 Ice Flaker, Scotsman Ice Systems, USA.

**7.56 Transducer & Hydrophones for Moorings**

**R7.56** The Contractor shall purchase and supply a transducer for connecting to science user acoustic communications deck units, as used for seabed mooring releases. It shall be tuned to operate in the range 10 kHz to 12 kHz. Cabling will enable the transducer shall be used from deck units in the Deck Lab.

**EXEMPLAR:** Sonardyne Type 8190-7212 Wideband Mini Transponder (WMT

**7.57 Transmissometer, CO<sub>2</sub>**

**R7.57** The Contractor to supply and correctly install a Transmissometer CO<sub>2</sub>

**EXEMPLAR:** WET Laboratories Inc., PO Box 518, Philomath, OR 97370, USA ([www.wetlabs.com](http://www.wetlabs.com))

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 7**

**7.58 Scintillation Counters**

**R7.58** The Contractor shall purchase and supply 2 nos. liquid scintillation counter to be situated in the Deck Laboratory.

**EXEMPLAR:** Perkin-Elmer Tri-Carb 5110TR Liquid Scintillation Analyzer  
(<http://www.perkinelmer.co.uk/Catalog/Product/ID/A511000>)

**7.59 Not Used**

**R7.59**

**7.60 Solar/IR Radiation:**

**R7.60** The Contractor shall purchase and correctly install a system for Downwelling Solar and Infrared Radiation Fluxes

- Duplicate instruments shall be installed above crow's nest and on foremast. For units above crow's nest, they should be sited as high as possible, and as clear as possible of shadowing by the main mast, radome, funnel etc.
- Sensors should be mounted on gimbals to maintain vertical orientation against ship pitch & roll.
- Collocation of an all-sky camera will allow periods of shadowing shall be identified from archived images.

**EXEMPLARS:**

**Solar radiation - pyranometers:** CMP 22 (research grade) or CMP 21 (reference measurement)

IR radiations: CGR4 pyrgeometer

Both from Kipp & Zonen, UK distributor **Equinox Instruments Limited**

Contact: Mr. Peter Redgrave

PO Box 897

LN5 5AW Lincoln

**7.61 Radiometric SST Measurement**

**R7.61** The Contractor shall purchase and correctly install a system for Infra red measurement of surface temperature.

Provision for correct installation Installed above bridge, angled to view off side of ship, clear of ship wake when underway. Ideal is for duplicate sensors, one either side of ship. Cabling to run to aerosol lab above bridge.

If possible sensors should be located in a sheltered spot to minimise icing problems.

[ NB. There is no simple IR measurement of surface temperature – sensor detects IR radiation, but source temperature depends on emissivity and hence surface type. Water surfaces (or wet ice) will also reflect some IR from sky (cold sky reflection) that will bias measurement (correctable with measurement of downwelling IR radiation). Lens is not 100% transparent in IR, so also some bias proportional to instrument / surface temperature difference, and maybe on absolute instrument temperature.

A robust measurement is only possible with complex retrieval from spectrally resolved multi-wavelength instruments. KT15.85 is a relatively cheap solution applicable to many conditions, but some caution required and good data QC, calibration & bias correction required. ]

**EXEMPLAR:** Heitronics KT15.85 infra red surface temperature measurement: from HEITRONICS Infrarot Messtechnik GmbH, Kreuzberger Ring 40, 65205 Wiesbaden.

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 7**

**7.62 Visibility Sensor:**

**R7.62** The Contractor shall purchase and correctly install above bridge / crow's nest a Visibility Sensor

**EXEMPLAR:** Vaisala FS11P visibility/present weather sensor:

<http://www.vaisala.com/en/maritime/products/presentweather/Pages/FS11P.aspx>

**From** Vaisala Inc. Bury St Edmunds Office, Unit 2b, Hillside Business Park, Kempson Way, Bury St Edmunds, Suffolk, IP32 7EA

**7.63 Ozone**

**R7.63** The Contractor shall purchase and correctly install an Ozone monitoring system and shall be located in atmospheric sciences laboratory (19" rack) with sample line from foremast.

**EXEMPLAR:** Thermo Environmental Instruments TEI49i

**7.64 CO<sub>2</sub>/CH<sub>4</sub>/CO/H<sub>2</sub>O**

**R7.64** The Contractor shall purchase and correctly install a system to monitor and shall be located in atmospheric sciences laboratory (19" rack) with sample line from foremast

**EXEMPLAR:** Picarro G2401 Cavity Ring-Down Spectrometer

**7.65 Black Carbon**

**R7.65** The Contractor shall purchase and correctly install a system to monitor Black Carbon aerosol and shall be located as follows:

Atmospheric Sciences Laboratory (19" rack) with aerosol sample line from foremast  
Or

Aerosol laboratory, above bridge with aerosol sample line from forward / above bridge / crow's nest.

**EXEMPLAR:** Thermo model 5012 MAAP from ThermoScientific

**7.66 Dedicated Sea Surface and Air Measurements of Trace Gases**

**R7.66** The Contractor shall correctly install the systems for clean air and seawater supply. In both Atmospheric Sciences and Aerosol Laboratories for gas and aerosol sampling measurement of DMS, OVOCs, halocarbons, N<sub>2</sub>O monitoring. See 7.16

**7.67 Ceilometer:**

**R7.67** The Contractor shall purchase and correctly install a system of Laser ceilometers for cloud base measurement with full backscatter profile available -> detection of aerosol layers, cloud depth and boundary layer, BL depth

**EXEMPLAR:** Vaisala CL31 laser ceilometers. From Vaisala Inc. Bury St Edmunds Office, Unit 2b, Hillside Business Park, Kempson Way, Bury St Edmunds, Suffolk , IP32 7EA

<http://www.vaisala.com/en/maritime/products/ceilometer/Pages/CL31.aspx>

- Instrument shall be sited up an upper deck, where it is not overlooked (laser is NOT eye safe). Field of view is very narrow, so can be wall mounted.
- Should be forward of ship exhaust so it is not viewing exhaust plume when hove to on station.
- Cabling to aerosol lab above bridge.

**7.68 Precipitation**

**R7.68** The Contractor shall purchase and correctly install a system of Laser Disdrometer - for the measurement and discrimination of precipitation.

**EXEMPLAR:** Thies Clima Laser Disdrometer:

<http://www.thiesclima.com/disdrometer.html>

from: Adolf Thies GmbH & Co. KG, Hauptstraße 76, D-37083 Göttingen

- Install above crow's nest with clear airflow from forward.

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 7**

**7.69 pCO<sub>2</sub> System**

**R7.69** The Contractor shall make provision for the installation of a pCO<sub>2</sub> system.

The requirement comprises the provision of services to the Atmospheric Science Laboratory and the storage for ready use of 12 nos. J size gas bottles (Nitrogen & CO<sub>2</sub>)

The required services are described elsewhere within the SoR Atmospheric Science Laboratory, Aerosol Laboratory See R7.16

pCO<sub>2</sub> system consists of:

- Wall mounted gas equilibrator – mounted above sink – requires water feed from pumped non-toxic sea-water
- 3 nos. 19" rack mounted boxes of valves, electronics, and LICOR IR gas analyzer.
- 6 nos. J-type gas cylinders of synthetic air. Gas feed line from cylinder storage into lab space.
- Air sample line from foremast

The pCO<sub>2</sub> system will be installed post-handover of the vessel to NERC.

**7.70 Shipborne Wave Recorder (Hull)**

**R7.70** Provision shall be made to install a SWR MK4.

The requirement comprises two nos. remotely operated shipside valves in the shell plate located port (1 no.) and starboard (1 no. ). Each shipside valve shall be fitted with a 1½" ball valve complete with a screwed plug.

Easy access to the ball valves will be needed to allow future fitment of transducers.

Cabling (10 tpr + screen) and associated junction boxes will be required between the gate valve locations and the Meteorological Laboratory where a single junction can be used.

The SWR MK4 will be installed post-handover of the vessel to NERC.

SoR – New Polar Research Vessel (NPRV)

# STATEMENT of REQUIREMENTS (SoR) for the DESIGN and BUILD of the NEW POLAR RESEARCH VESSEL (NPRV)

Company Confidential

NERC 2015



## Section 8 – PROVISIONS FOR SCIENTIFIC EQUIPMENT

## **8.0 PROVISION FOR EQUIPMENT**

This section describes equipment which will be deployed on the NPRV. None of this equipment will be provided by the Contractor. The Contractor shall design the vessel to integrate and operate with the following equipment:

### **8.1 ROV Integration**

**R 8.1** The Contractor shall be required to provide fabrications, services for electrical power, cooling water and data/control signals between various points on the vessel to facilitate mobilisation and integration of an existing ROV facility.

The ROV system consists of a number of portable units (ROV, LARS, Hydraulic Power Pack, Umbilical (conducting cable) Storage Drum, Traction Winch and two laboratory containers which are joined together along the long side to provide a control room). *NERC will provide these system components from the National Marine Equipment Pool.*

The ROV shall be deployed via the Starboard Deck or scientific moonpool using the Midship Scientific Handling Systems.

When using the Starboard Deck or moonpool position the conducting cable will be from the winch (Deep Tow) located in the Winch Room. The Contractor shall design and supply a "bumper frame" for use with the moonpool to enable the use of the ROV in this position.

Contractor shall make provision for matrix points and steel fabrications necessary to attach the LARS, Umbilical Storage Drum, Traction Winch and Hydraulic Power Pack. (NB. The dimensions required for these fitments are US measures).

CCTV provision should be arranged to cover activities in both positions.

- ISIS Over the side,
- Hybis Moonpool and over the side and insert details.

### **ISIS Deployment System**

#### **General description of current Isis deployment system:**

The Dynacon Docking Head assembly is mounted beneath the cross member of the A-Frame, and is used to secure the vehicle during launch and /or recovery operations associated with movement of the A-Frame. A swing frame mount allows fore and aft movement of the docking head which is dampened by hydraulic cylinders. A 58 inch tread diameter powered sheave mounted in the docking head swing frame assembly fairleads the umbilical from the Winch/Levelwind assembly down through the docking head assembly to the ROV. The powered sheave/cable tugging assembly provides a constant tension from the outboard sheave to the Winch/Levelwind assembly.

A launch/recovery latching mechanism is used to capture the mechanical termination mounted on top of the ROV. As the mechanical termination enters the docking head assembly, the latching mechanism is engaged and mechanical indicators confirm a secure latch. A hydraulic bumper secured to the bottom of the docking head assembly protects the top surface of the vehicle. The launch latch assembly is rotated by a hydraulic motor allowing rotation of the ROV while latched.

#### **Deployment Procedure:**

With the ROV on deck, and the docking head positioned directly above.

1. Head is locked into position (no fore or aft, or thwart ship swing)
2. Latch mechanism is set to the closed position.

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8**

3. The ROV is lifted into the snubber and the docking bullet is pulled through the mechanical latches. The mechanical latch indicators indicate the bullet is fully engaged.
4. Slack umbilical is generated.
5. ROV is rotated for alignment through the "A" frame.
6. Docking head is set to float mode allowing swing only in direction of the "A" frame as it is extended. (thwart ships)
7. Slack umbilical is produced as the "A" frame is extended, preventing the ROV from pulling into the docking head and potentially parting the umbilical.
8. Once the "A" frame is fully extended, the ROV is rotated to its deployment position.
9. Docking head is locked into position.
10. ROV is lifted on the umbilical, taking the load off the latches.
11. Latches are opened
12. ROV is lowered into the water.
13. As soon as the ROV enters the water the cable tugging assembly is engaged, providing a constant tension on the umbilical from the outboard sheave to the traction winch sheaves.
14. The cable tugging remains engaged, whilst the flotation is added to the umbilical, and the vehicle is still on the surface.
15. Once the ROV has reached approx 250m depth, and there is sufficient outboard tension on the umbilical the powered sheave is disengaged.

**Recovery:**

This tends to be the reverse of the deployment procedure.

**Breakdown of Docking Head Assembly:**

*Sheave:*

- Sheave Tread Diameter 1473mm. (58 in)
- Grooved for 0.681 in OD Cable.
- Powered sheave and tugging assembly.
  - ❖ To maintain a constant umbilical tension between sheave and the traction winch.
  - ❖ To be able to cope with the winch veering at a line speed of approx 25 to 30m/min when in operation.
  - ❖ To be able to operate when the winch is hauling.
  - ❖ Tugging jockey wheel to be easily replaced, currently manufactured from polypropylene. (we found the rubber tread on the original steel wheel to have a short life span and costly to replace)
  - ❖ Ref dwgs 0767-6003-00 sheets 1 to 3
- Instrumented for Line tension.

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8**

**Cushion Assembly:**

- Snubber Ring Dia 50 in.
- Approx 6 in cushion travel.
- Hydraulically activated once the ROV is latched creating a firm fit between the snubber ring and the ROV top. This is not necessarily required providing the ROV cannot spin freely once it is latched.

**Catch and Latch Assembly:**

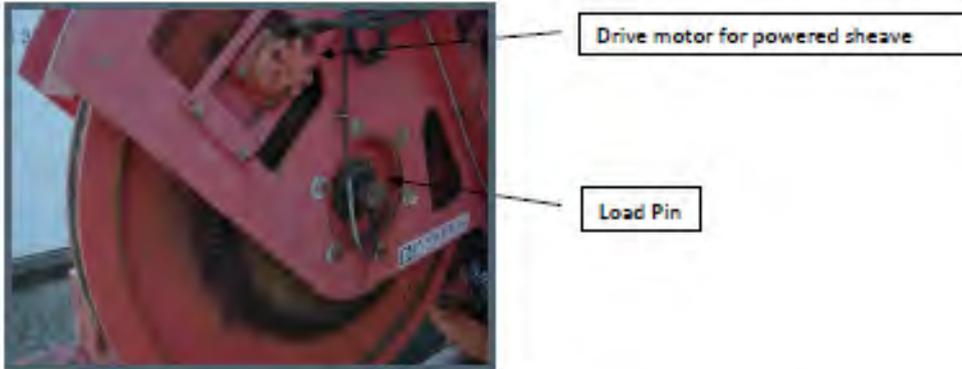
- 4 nos. latches
- Latches are in the closed position when the docking bullet is pulled through.
- Latches remain locked, even if operated to the open position, when the vehicle load is still applied.
- 4 nos. mechanical latch indicators for clear conformation of latch status.
- Ref dwg 0767-6006-02 sheets 2 of 2
- Docking bullet clearances. From the top of ROV to the underside of the bullet head where the latches locate is 215/220mm. (ref Docking bullet detail dwg) Note: I would like to confirm this exact dim once we have the bullet assembly built into the vehicle.

**Docking Head Assembly:**

- Approx 315 deg rotation.
- Able to hydraulically move and lock head movement in line with "A" frame. Also set in float mode to allow swing in line with "A" frame for deployment and recovery. This amount of movement may be a reduced requirement on a boom deployment system. (ship motion)

New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8

Powered Sheave and Tugger Assembly:



Cushion Assembly:



New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8



Latches 4 off



Docking Bullet entry housing, shown with latches open.

Mechanical latch indicators 4 off

Docking Head Assembly:



Slewing Ring

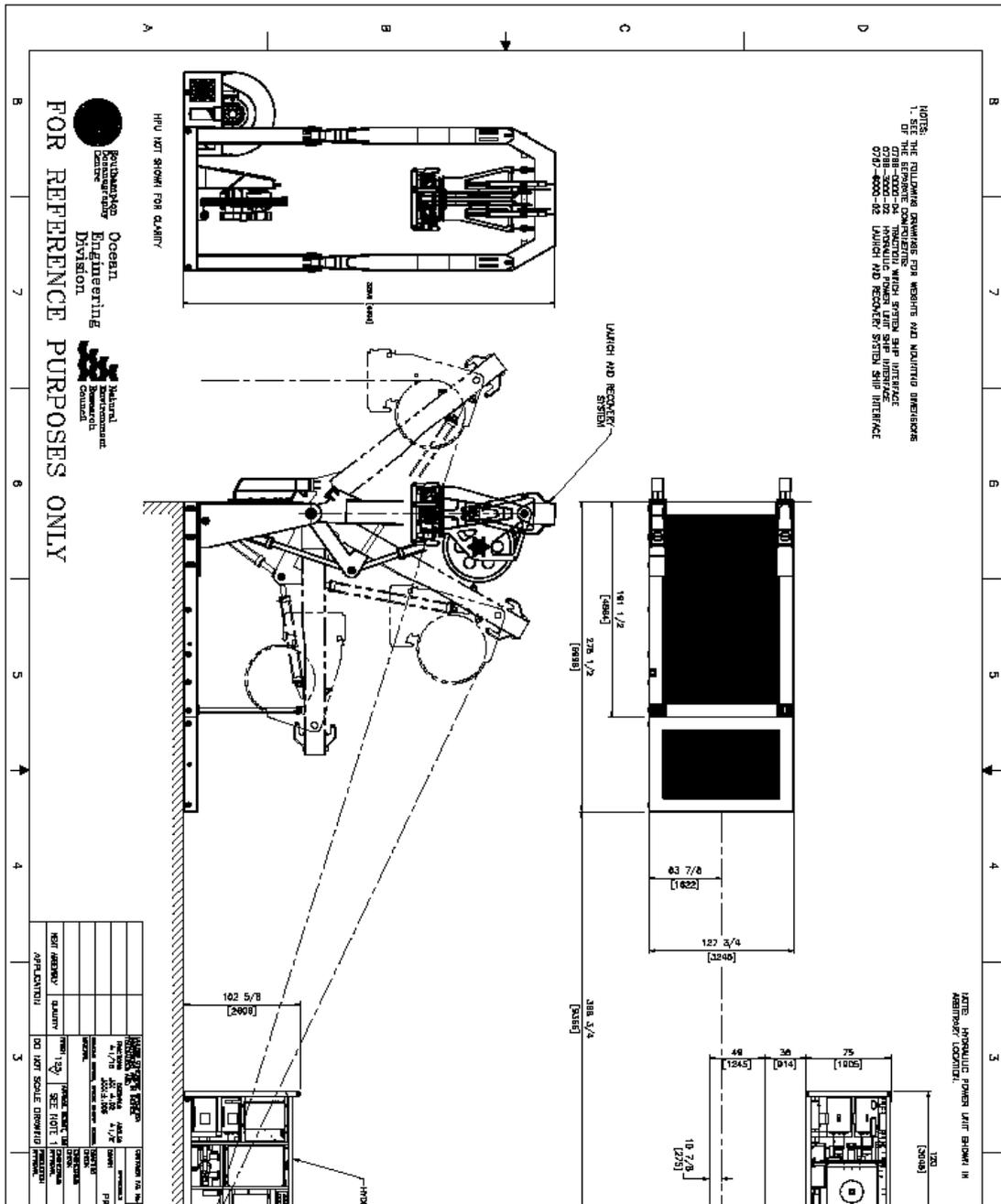






# New Polar Research Vessel (NPRV) Statement of Requirements (SoR) Section 8

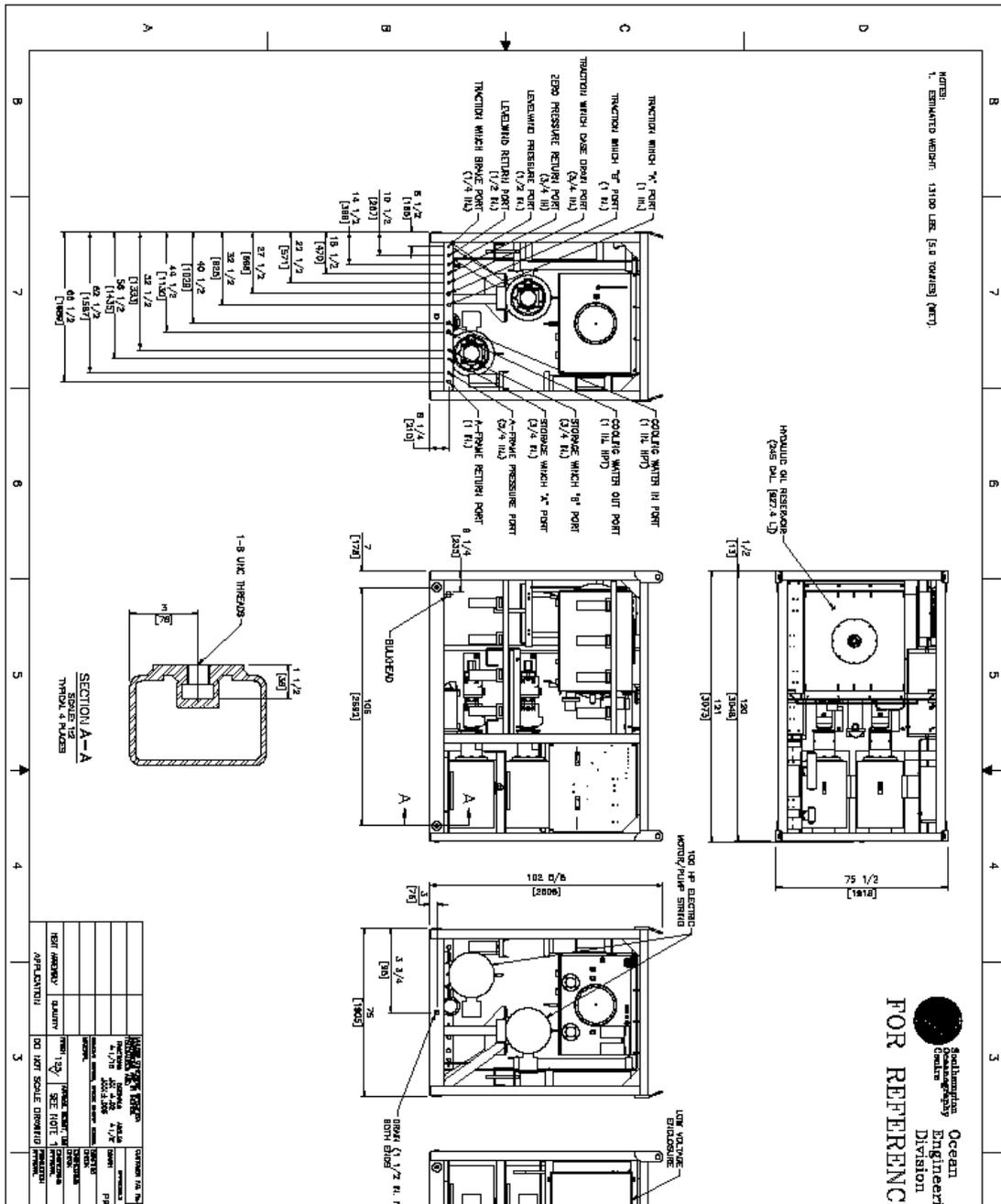
## Tension Winch



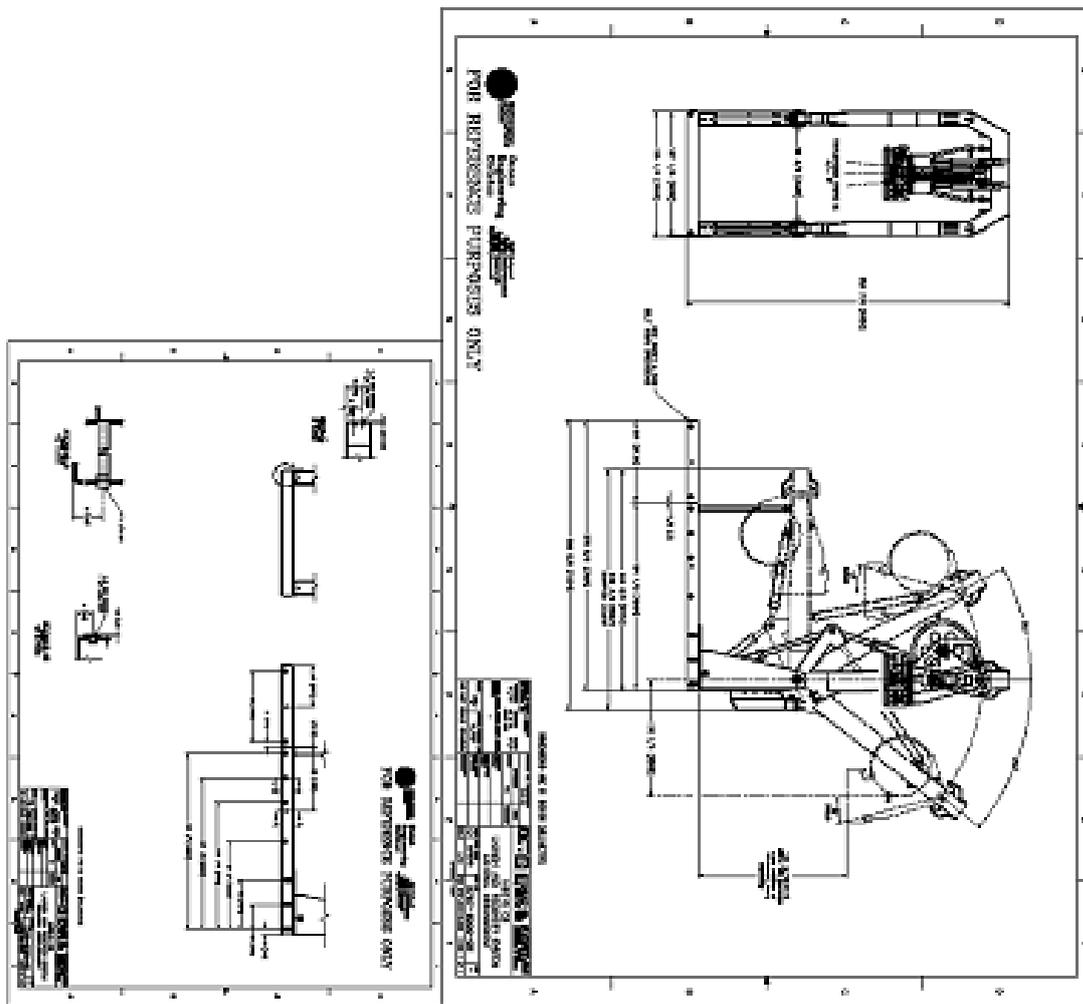


# New Polar Research Vessel (NPRV) Statement of Requirements (SoR) Section 8

## Traction Winch Hydraulics



## LARS System



*Further details on the requirement will be discussed with the Contractor. FAT, HAT, and sea trials shall be carried out to NERC satisfaction.*

### 8.2 Autosub Installation

**R8.2** The Contractor shall be required to provide fabrications, services for electrical power, cooling water and data/control signals between various points on the vessel to facilitate mobilisation and integration of an existing Autosub facility as follows:

#### Main Gantry:

- Weight.
- Gantry weight 5.75 tons.
- Combined weight of gantry plus sub 8.2 tons.
- Vertical centre of gravity of gantry plus sub approx 2 metres above deck height.
- Fixing down:
  - ❖ This requires a metre matrix bed to bolt on to.

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8**

- ❖ The final outboard fixing to be within 250mm of any overhang on the stern.
- ❖ Gantry designed for 24mm deck fixing points.
- ❖ On launch max upward force shown on table 1.

**Hydraulic power:**

- Gantry is an open loop system.
- Max flow required 140 litres per min.
- Max pressure required 210 Bar.

**Autosub Garage System:**

It is preferred to run Autosub with its garage system.

The garage is two modified standard 20 foot containers mounted to the back of the gantry and forms a "T" arrangement;

The present container mounting system requires a flat deck.

Weight of garage 8 tons.

**Garage connections:**

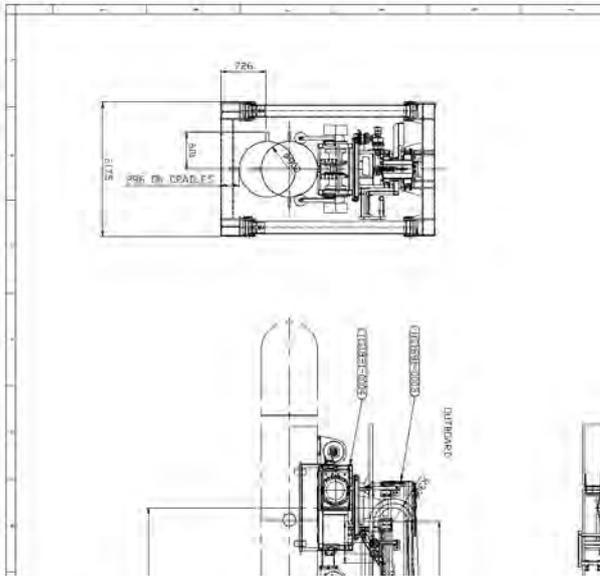
- 24V DC supply for emergency lighting supply.
- 32A 230V AC clean supply for computers/power tool etc.
- 64A 230V AC dirty supply for heating/crane.
- Smoke detector.
- Ships PA speaker cable.
- Computer network cable.
- Ship's telephone.

**Supplements**

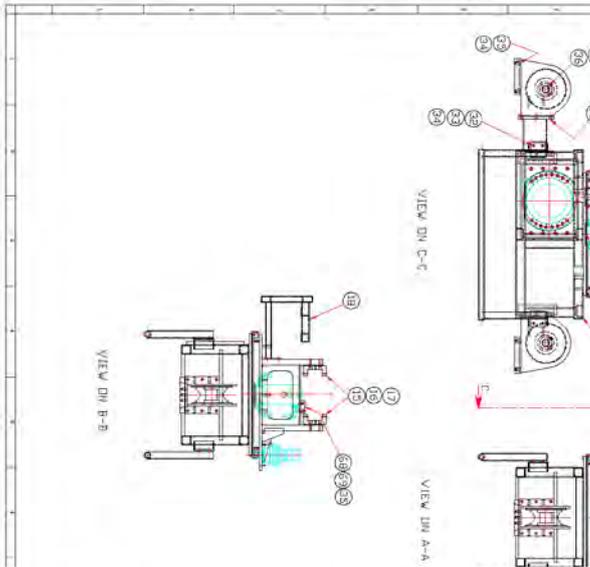
The present Autosub runs on primary alkaline cells, which require replacement when flat. A cruise would typically use 6 nos. complete battery packs all of which need to be dry stored (complete pack approx 600kg). At present new and old battery packs are stored in wooden crates each weighing 400kg. Two complete crates are required to be placed into Autosub garage when a battery change is required.

New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8

General Arrangement



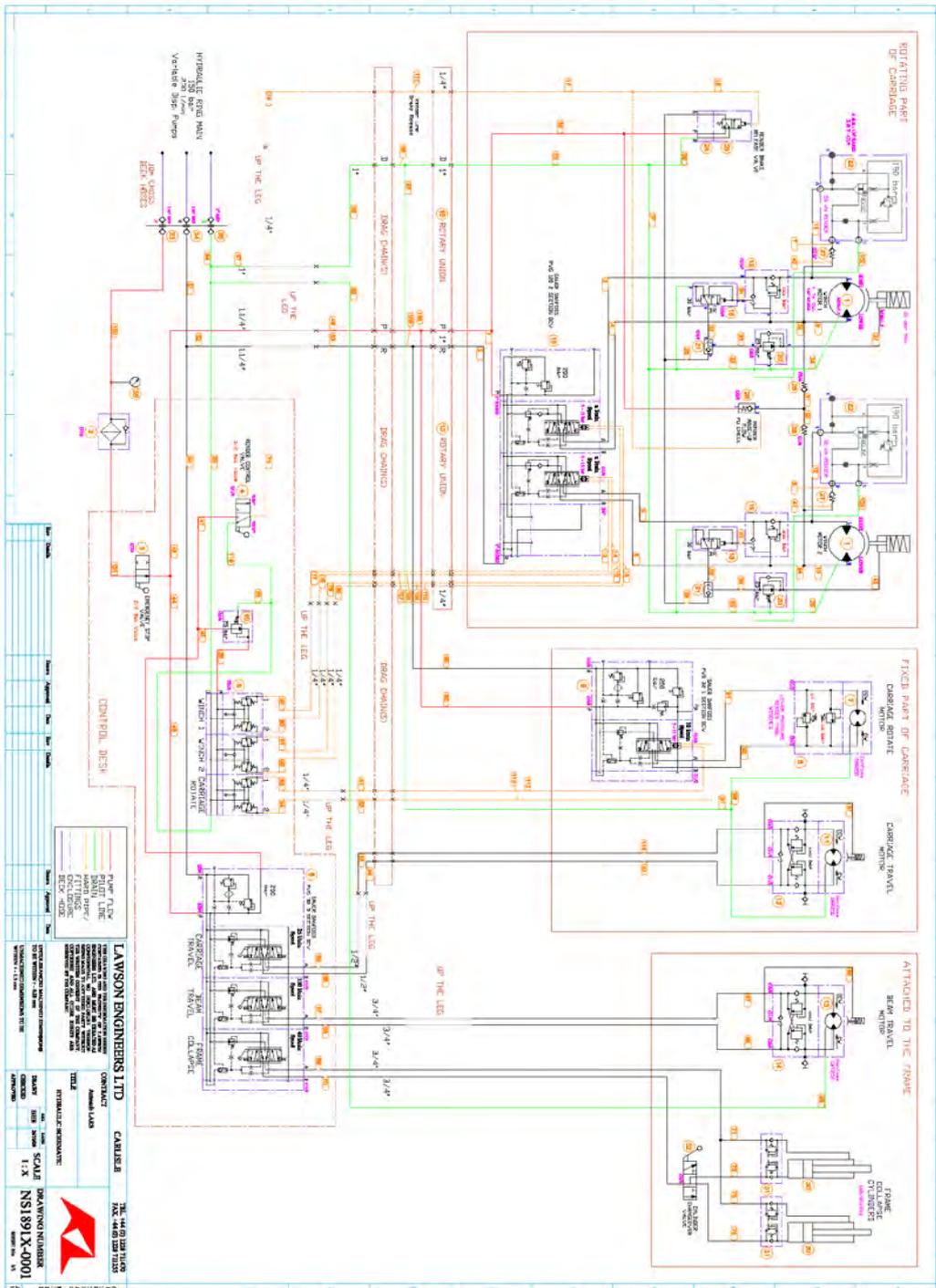
Carriage Assembly





# New Polar Research Vessel (NPRV) Statement of Requirements (SoR) Section 8

## Hydraulic Schematic



### **8.3 DASI Equipment Support Systems**

**R8.3** The Contractor shall provide power supplies and data wiring systems for this portable equipment.

A suitable breaker shall be arranged at the main switchboard and a supply cable run from the board to an isolator located just inside the aft end of the superstructure as close as possible to the aft working deck.

*DASI 3 requires a 3 phase 415V supply rated at 125kW.*

*Transient starting loads can approach 250kW.*

*DASI 3, as a unit shall be handled, currently weighs about 3.5 tonnes in air at deployment.*

***Testing shall be conducted as part of Electrical Acceptance.***

### **8.4 Quadcopters and Fixed Wing UAV for Science and Ice Reconnaissance**

**R8.4** The Contractor shall make provision for Quadcopters and Fixed Wing UAV operations which shall fulfil the following:

Airborne robotic platforms, (here referred to as Remotely Piloted Aircraft Systems, RPAS

- To ensure acceptable risk to personal and science mission, such units require a flight team of four: two for aircraft, one for science mission, one for sensor systems.
- The RPAS requires pre-flight prep area, heated and covered. The hanger decks are likely to be suitable but **see Batteries in specific notes below**
- The RPAS must be delivered from the prep area to launch area without dismantling. The helicopter elevator appears ideal for this.
- Take off would require a 5m x 5m area with unobstructed fetch to launch. The helicopter deck is ideal for this.
- Landing.
- Access is required to good visibility (i.e. a flight control tower), the ship's bridge is likely to be suitable for this
- Uncluttered telemetry from aircraft and communications with the helideck is required. Crow's nest antennae and UHF communications are likely to be suitable.

#### **UAV**

Fixed wing UAV will be launched by 5 m long catapult rail (helideck) and landed by soft runway (helideck) or net (adjacent to helideck). Size is limited to < 5 m wing span. Weight will be <20kg.

#### **Quadcopters**

Rotary wing quadcopters will also be <20kg weight and <5m diameter.

### **Landing**

UAVs have landed on ships, using a variety of techniques, including near-ship water landing and capture nets. These usually require pilot skill. Recent advances in very accurate positioning now enables autonomous landing of ~5m wing span RPAS on a helideck. These systems are known as Real Time Kinematic Global Navigation Satellite Systems, RTK GNSS see:

<http://www.novatel.com/an-introduction-to-gnss/chapter-4-advanced-gnss-concepts/real-time-kinematic-rtk/>

By the time the NPRV is launched, RTK will be standard on all RPAS > 7 kg. However, technology can always fail and safety of crew and ship must be paramount. The ship must be able to take risk of error, that is, to ensure personnel are clear of the helideck and local structure, but the RPAS flight crew still have control of the platform. These issues are likely to be similar to helicopter operations (e.g. the issues of safety to personnel when operating manned helicopters).

### **Batteries.**

Stored electrical power is likely to be RPAS fuel for the future: simple to control, non-polluting for air chemistry studies, reliable. Power density is likely to increase, so there is a need for safe recharging and storage of batteries. This is likely to be needed for many other systems on ship, e.g. static autonomous platforms and marine robotics.

### **Beacons**

ADS-B and similar semi-active beacons to the ship's radar.

## **8.5 Moving Vessel Profiler (MVP)**

**R8.5** The Contractor shall make provision for the installation of a Moving Vessel Profiler (MVP)

EXEMPLAR: Brook-Ocean (Rolls-Royce/ODIM) MVP1700.

[http://www.brooke-ocean.com/mvp\\_main.html](http://www.brooke-ocean.com/mvp_main.html)

In order to future-proof the vessel, it should be capable of taking the largest MVP, which currently is the MVP800-5000, which has a similar footprint to the 300-3400.

## **8.6 Underway (VMP) Vertical Microstructure Profiler**

**R8.6** The Contractor shall make provision for the installation of a Vertical Microstructure Profiler (VMP).

This instrument must be deployed overside, untethered from the ship, because vibration from a tethering wire contaminates the very high-frequency data collection. The cylindrical instrument is of order 3.0 metres length and 100kg in air, so it requires mechanical handling. A deployment consists of gently placing the VMP in the water, a free-fall mission of several hours, and when it returns to the surface, it must be snagged from deck and hoisted on board. Recovery has many similar aspects to mooring recovery.

The VMP launch system includes a straight section of railway track that can be bolted to the deck matrix, to enable a carriage cradle to be moved from inside the hangar, out to the stbd rail. A suitable deck matrix in the hangar and on deck is required. The deck and hangar door arrangements must be level and free of obstructions. There must be sufficient clear unobstructed space inside the hangar to store and maintain the VMP, and no permanent sills as obstructions. It is acceptable for the railway track to have a removable section, so that a cill can be raised and the hangar doors can be properly secured in severe weather.

For launch, the cradle is moved outboard on its track from the hangar to the deck.

## New Polar Research Vessel (NPRV) Statement of Requirements (SoR) Section 8

When the cradle arrives end-on to the starboard rail, outboard of the hangar, it meets the forks on a small articulating gantry. The gantry raises the cradle to the vertical, and slightly outboard of the ship side. A rope integral to the gantry then lowers the instrument to the water line, where a no-load release sets it into free-fall. Recovery is the reverse procedure. When the gantry is installed for a cruise, there must be a gap in the rail, either a removable section of the bulwark, or opening gates. The gap in the bulwark must be flush with the deck. No sills or obstructions. The track and deck matrix must be aligned with the hangar doors and the opening in the bulwark.

VMP operation may occur simultaneously with CTD operations, ie, VMP deployed part way through a CTD station, with VMP recovery after CTD recovery, to make efficient use of time. Therefore the VMP installation must use a different part of the rail than standard CTDs.

The entire VMP launch system must be able to be removed from the ship superstructure when not required on a research cruise.



## New Polar Research Vessel (NPRV) Statement of Requirements (SoR) Section 8

The Vertical Microstructure Profiler (VMP): This is not an "underway" instrument, but it is free-fall. Not tethered to the ship.

The instrument comes with its own launching cradle and track.

The requirements in the ship design are as follows:

- Removable bulwark
- Straight run from bulwark opening to hangar, with bolt-down matrix so the track can be installed.

### 8.7 Research Vessel Data Acquisition System / Scientific Computer System

**R8.7** The Contractor shall make provision for the installation **see Section 6.8**

### 8.8 Incubators

**R8.8** The Contractor shall make provision for the installation of 10 nos. deck incubation tanks/tubes for incubation of water samples in natural sunlight. Ability to deploy and anchor (via straps or ropes) up to 10 nos. plastic deck tanks (approximately 1m (l) x 1m (w) x 0.3m (h) or tubes (2m long x 0.3m diameter) held on wood frames on an area of deck which is as clear as possible of overhead obstructions blocking sunlight (see attached picture). Helideck would be ideal. Tank/tube need shall be secured to a safe and accessible area of deck and supplied with a continuous flow of sea-water pumped from just below the sea surface. They should also have a standard (waterproof – aquarium type) electrical supply nearby. The incubator location shall be fitted with a 1m x 1m M12 bolting down matrix.



### 8.9 Onboard CTD

**R8.98** The Contractor shall make provision for the installation

### 8.10 LADCP Onboard (4 nos.)

**R8.10** The Contractor shall make provision for the installation

### 8.11 STCM (Onboard Fixed Magnetometer)

**R8.11** The Contractor shall make provision for the installation

### 8.12 Aquarium Container

**R8.12** The Contractor shall make provision for the installation and the necessary sea water supplies. Other services are specified in Section 6.3.14

### 8.13 Aquarium Transport Container

**R8.13** The Contractor shall make provision for the installation and the necessary sea water supplies. Other services are specified in Section 6.3.14

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8**

**8.14 Piston Corer 42m+ capability**

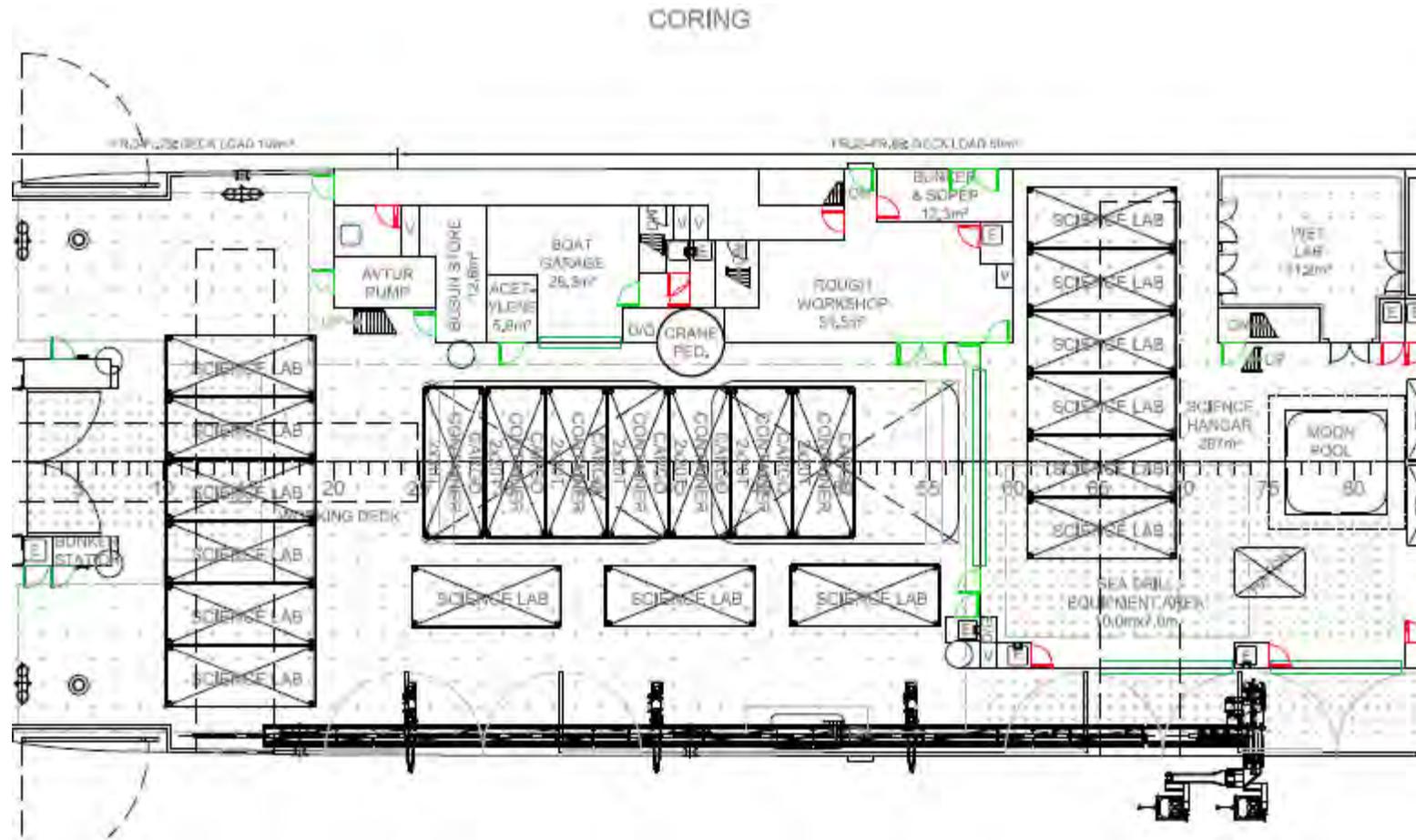
**R8.14.** The Contractor shall make provision for the installation and for the deployment of a 42m+ long piston corer from the starboard side of the vessel. This core length is a specific request from the geological community. The corer should be capable of coring soft sediments to full ocean depth (appropriate wires for coring in 6000m of water) with variable weight coring head to allow cores with lengths from 45-60m shall be acquired. This will be a 'for but not with' item shall be mobilised and deployed during dedicated coring cruises.

**EXEMPLAR:** OSIL (Ocean Scientific International Ltd.) Giant Piston Corer  
See Below photographs of actual equipment



New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8

Conceptual Giant Piston Corer Arrangements



### **8.15 Dredging Equipment**

**R8.15** The Contractor shall make provision for the deployment of dredging equipment from the ship's stern in order to collect loose rocks from the seafloor at full ocean depth. A dredge comprises a chain-link bag with large metal-jawed opening and attached cylindrical pipe dredge. An acoustic pinger is typically secured to the trawling wire 100-200 m from the dredge. The dredging equipment will be a 'for but not with item' shall be mobilised and deployed during geoscience cruises with a dredging component.

### **8.16 Atmospheric Pressure:**

**R8.16** The Contractor shall make provision for Atmospheric static pressure measurement system to be installed above bridge and fitted with static pressure head to minimise wind induced dynamic pressure bias at the sampling point. Static pressure port location should be free of major regions of bias resulting from dynamic pressure perturbations induced by airflow over the ship.

**EXEMPLAR:** Vaisala BAROCAP PTB330 with static pressure head SPH10-20: from Vaisala Inc. Bury St Edmunds Office, Unit 2b, Hillside Business Park, Kempson Way, Bury St Edmunds, Suffolk , IP32 7EA

### **8.17 Winds:**

**R8.17** The Contractor shall make provision for installation of 3 nos. sonic anemometers on both foremast and above crow's nest.

**EXEMPLAR:** Gill R3 sonic anemometer from Gill Instruments Limited, Saltmarsh Park, 67 Gosport Street, Lymington, Hampshire, UK, SO41 9EG. Model with de-icing heaters for sensing head strongly preferred.

#### **Detailed requirements:**

- One no. anemometer shall be mounted on foremast. Cabling to connect to meteorological laboratory. Mounted as high and far forward as possible
  - ❖ Typical sonic anemometer weight ~2kg.
  - ❖ Anemometer measurement head typical located 2-3m above foremast platform.
- Two nos. anemometers shall be mounted above crow's nest – as high and far forward as possible, one to port and one to starboard to ensure one always clear of blocking by ship exhaust stack, etc. Cabling to connect to meteorological laboratory or 'aerosol laboratory' above bridge.
- Installation sites shall be informed by CFD modelling of flow distortion over ship.
- De-iced 3D sonic anemometer currently only available from Metek. Gill Instruments are investigating production of one.
- 2D sonic anemometer should be avoided if possible because of the issue of flow distortion over superstructure – need to resolve vertical component of wind as well as horizontal components to estimate true wind upstream. A de-iced 2D as backup might however be worth while

#### **Flow distortion requirements(foremast)**

- Flow distortion at anemometer sensing head should result in a mean wind speed bias of < 1% for bow on flow.
- Bias with angle of flow relative to ship should be characterised by CFD modelling

### **8.18 Freezing Rain and Detection of Icing Conditions**

**R8.18** The Contractor shall make provision for installation of detection of freezing rain/icing conditions

Exemplar: Campbell 0871h1 freezing rain detector  
<https://www.campbellsci.co.uk/0871h1>

### **8.19 Dew Point**

**R8.19** The Contractor shall make provision for installation of precision reference measurements of atmospheric humidity

**EXEMPLAR:** Michell instruments Chilled Mirror Hygrometer:  
<http://www.michell.com/uk/products/optidew.htm>

### **8.20 All sky Camera**

**R8.21** The Contractor shall make provision for installation of All sky camera – timed image of full 180 dome of sky.

e.g. Oculus all sky camera: <http://www.sxccd.com/oculus-all-sky-camera>  
Image capture at ~1 image per minute provides a valuable reference of cloud cover and – if sited next to solar radiometers a reference for when the radiometer is shaded by ship mast.

### **8.22 Turbulent Flux System on Foremast**

**R8.23** The Contractor shall make provision for installation of Turbulent flux system (typical installation):

- Sonic anemometer, mounted with sensing head as high above platform as possible (2-3 m)
- 6-axis Motion sensing pack mounted at base of sonic anemometer
- Licor gas analyzer (H<sub>2</sub>O/CO<sub>2</sub>). Sensing head mounted ~1m forward of sonic anemometer. Electronic interface box mounted on rail close to sensor (cable to sensing head limited to 3m length)
  - ❖ Open path Licor (LI7500) as above
  - ❖ Closed path LI7200 has additional pump box to mount on rail nearby.

Additional sensors may include hi-rate aerosol probe (CLASP), mounted at base of sonic anemometer.

- Flow distortion should be characterised via CFD for both mean wind speed bias as a function of relative direction with respect to ship and extent of lifting of the streamline. At the measurement location the ideal is a mean speed bias of <1% for bow-on flow.
- Foremast and instrumentation should be able to cope with any likely sea-state and winds – we need shall be able to make measurements in winds in excess of 30 m/s (60kts).
- Foremast should be rigid and move with the ship – excessive vibration (as found on arm of crane for example) will contaminate measurements of turbulent fluxes.

#### **Provision for Other Instrumentation on Foremast**

- For specific cruises other instrumentation may be required shall be installed on the foremast. Examples from recent cruises:
  - ❖ Camera in enclosure (5kg)

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8**

- ❖ Laser range-finder for wave measurement (in security camera type enclosure)(5-8kg)
- ❖ Duplicate sets of sonic anemometer/Licor/motion packs
- ❖ Gas sample inlets – for some cases heated inlets may be required to prevent condensation within the sample line – these may weigh ~1kg or so per m, and require running back to the meteorological laboratory
- ❖ In addition to the instruments themselves, brackets and support arms weighing up to several 10s of kg may be required.

#### **8.24 Lidars**

**R8.24** The Contractor shall make provision for installation of Lidars

Various user provided lidar systems may be required on a per-cruise basis. Requirements depend on type.

- Simplest are vertically pointing – can locate anywhere provided a bolt down matrix available with a clear vertical view – though aerosol backscatter lidar best located forward of exhaust to minimise periods where they would image the ship exhaust plume. Example locations are: above bridge or crow's nest..
- Wind profiling lidars require a clear view of a conical space about the vertical over the lidar – typical angle of cone off vertical is ~30 degrees.
- Scanning lidar may require a wider field of view forward or sideways.

Best location depends on measurement application, but foredeck probably most frequent requirement.

Some systems may benefit from mounting within a motion-stabilised platform to keep them level against ship-roll. Existing system (Leeds University) is 2 x 1.5 x 1m – requires strapping to deck matrix or similar fixings (roof of shipping container).

Requires space for control and logging system within 25m cable run.

NB. Some lidars are not eye-safe and would require locating where not overlooked, or have an exclusion zone enforced during operation.

#### **8.25 Microwave Radiometers**

**R8.25** The Contractor shall make provision for installation of Microwave Radiometers

- Can be sited anywhere with a clear view for a scan from horizon to vertical – off side of ship from an upper deck or container on aft deck is ideal.

#### **8.26 Cloud Radar:**

**R8.26** The Contractor shall make provision for installation of a Cloud Radar

- Radars currently available to UK atmospheric science community are large, self-contained, trailer-based instruments (~2(w) x 5(l) x 3(h) m). Feasible to secure to deck matrix.
- Other units likely shall be installed in purpose adapted shipping containers. Can be located anywhere with clear vertical view.

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8**

**8.27 Precipitation Radar:**

**R8.27** The Contractor shall make provision for installation of Precipitation Radar

- Small (satellite TV size) antenna and electronic box. Mounted on short ~50mm diameter pole. Any convenient point on an upper deck.
- Requires mains power and network connection.

**8.28 Whole Air Sampler (WAS)**

**R8.28** The Contractor shall make provision for installation of Whole Air Sampler (WAS) which consists of an automated sampling of WAS bottles (glass) for volatile organic compounds (VOCs) which would be rack mountable in a standard 19 inch instrument rack, connected to the main sample manifold. There should be flexibility in the number of bottles/racks and the frequency of sampling.

**8.29 Radisondes**

**R8.29** The Contractor shall make provision for required services for Radisondes (Weather Balloons) as follows:

- Launch of radiosondes requires a reasonably clear deck area from which the balloon (with sonde suspended below) shall be launched without risk of striking ship's antennas, radar, etc. Helideck is ideal provided wind is off the bow. Aft deck also usable with care.
- Filling of balloon with helium is easier if a filling cradle is used – a frame with fabric cover to hold balloon while filling. Frame is ~2m diameter, 1.5m tall. Can be tied down to deck matrix or railings.
- Require accessible storage for L-type helium cylinders, with hose run to filling cradle. 1 cylinder will fill 8 balloons (typically 2 days launches).
- Radiosonde receiving station requires a small (1m) antenna shall be mounted at a convenient high location (above crow's nest, and cable shall be run to receiver and laptop (max 30m run)). Aerosol lab above bridge would be a good location.

**8.30 Bulk Aerosol Filter Sampler**

**R8.30** The Contractor shall make provision for installation of an Aerosol filter sampler which shall be located on accessible level platform (above crow's nest) facing forward into headwind.

- Footprint ~0.4 x 0.4m, need more space between units if multiple installed.
- Location should be forward of ship's exhaust, and ideally free of local contamination (e.g. Lifeboats – engines run frequently, smoking areas on deck etc)
- Should accessible in all weather
- Should be able to safely lift samplers (~45kg) into place
- Require fixed points for securing the samplers – rails OK.
- Standard mains power supply required nearby (multiple weather proof sockets)
- Space nearby to secure rain-sample bottles
- Ideally nearby storage space for empty sample bottles.

**8.31 Sealed Microbial Culture Incubators.**

**R8.31** The Contractor shall make provision for installation of laboratory cabinets for incubation of sealed microbial culture vessels. Dry indoor deck space accessible by scientists (e.g. main deck or upper tween deck) for temporary storage of up to three “refrigerator style” laboratory incubation cabinets (each approx. 2m height x 1.5m wide x 0.5 m deep with door – e.g. LEEC Model PL33 Plant Growth / Germination Cabinets – see attached picture). They should have standard electrical supply and be able to be secured to deck via straps/ropes with space for front doors to open.



**8.32 Rockdrill Integration**

R8.32 The Contractor shall be required to provide fabrications, services for electrical power, cooling water and data/control signals between various points on the vessel to facilitate mobilisation and integration of an existing drilling facility both over the side or stern and moonpool.

For deployment through moonpool special arrangements shall be designed to put into place and secure the Rockdrill unit over the moonpool and a dedicated snubber unit shall be designed for deployment through moonpool.

For deployment over side or stern then the rock drill LARS shall be used.

**BGS RD2 Remote Seabed Rockdrill**

**Rockdrill Specifications**

Capable of coring up to 50m below the sea bed in a maximum of 4000m of water.

The unit is containerised and comes complete with launch & recovery system (LARS).

Downhole Logging:

Combined - 360 deg optical, acoustic and spectral gamma. Other tools in development.

**Overall dimensions:** 4.5m high with 3m span at the extremities of its legs

**Weight in air:** 6.0 tonnes

**Core barrel:** HQ with steel inner tube, 1.7m effective core lengths

**Core size:** 62 mm

**Core bit types:** TC, surface set diamond, PDC, and impregnated diamond

**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8**

**Core bit RPM:** 0–405, infinitely variable

**Shipping:** 5 nos. 20ft x 8ft 6” ISO containers, (Control Container, Workshop Container,

Drill Container, Drill Tools container and Spares container).

1 no. 20ft x 9ft 6” LARS Container (Not required if deployed through moonpool)

1 no. 20ft Winch Container (Possibly not required if deployed through moonpool)

Total shipping weight approximately 80 tonnes(30tonnes if deployed through moonpool)

**Power requirements:**

Control container has a 415VAC, 3 phase, 50/60 Hz, 500 Amp distribution system for all drill subsystems.:

- Drill: 415VAC, 3 phase, 50/60Hz 125 Amps
- LARS and winch 2 nos 415VAC, 3 Phase 50/60Hz 125 Amp Possibly not required if deployed through moonpool)
- Control Container Internal systems, 415VAC, 3 Phase 50/60Hz 63 Amp
- Workshop Container, 415VAC, 3 Phase 50/60Hz 63 Amp

**Operational Requirements**

The Rockdrill requires a vessel or platform with good position keeping (DP or moorings), adequate clear deck space of 5m x 10m for the LARS(if required),

Drill and winch and an additional space for up to 4 nos 20ft ISO containers, for control, workshop, drill tools and spares containers.

Current umbilicals allows operations in water depths to 2000m and 4000m.

**LARS and Winch specifications and requirements**

The LARS is electro-hydraulically operated from its own power pack and is operated by a remote control box.

**LARS base dimension:** 5m x 10m

**LARS weight:** 32 tonnes

**Minimum Deck Strength:** 5 tonnes per square metre

**Power pack dimension:** 2.5m x 1 m x 2.9 m high

**LARS Shipping:** LARS and power pack are assembled into a 20ft high cube ISO container

**Winch Weight:** 17.5 tonnes (2000m) and 30 tonnes (4000m)

**Contact:** [enquires@bgs.ac.uk](mailto:enquires@bgs.ac.uk) **Quote:** BGS Marine Operations

New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8

**BGS Seabed Drill and LARS**

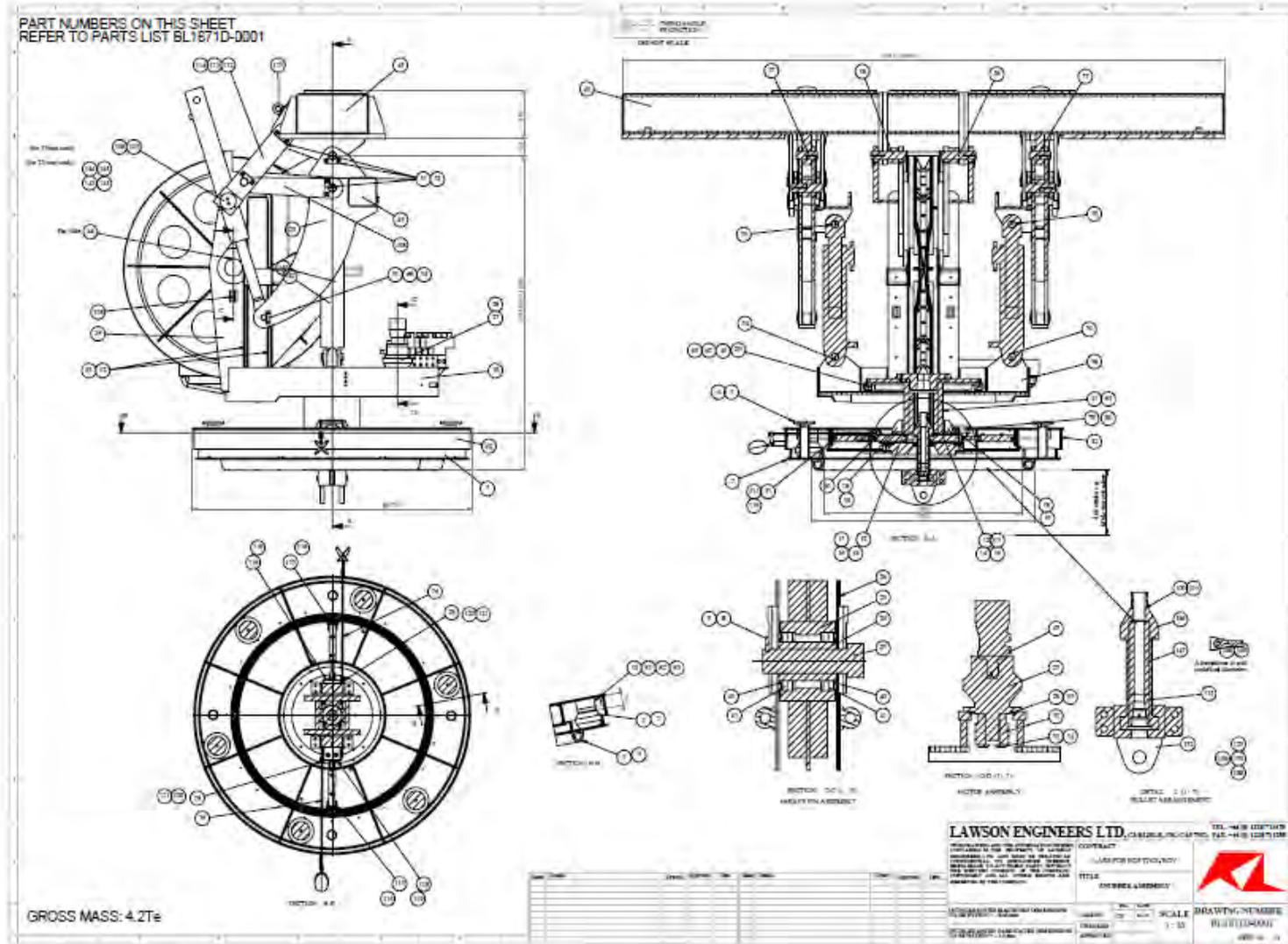


**EXEMPLAR:** Contact: [enquires@bgs.ac.uk](mailto:enquires@bgs.ac.uk)



New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8

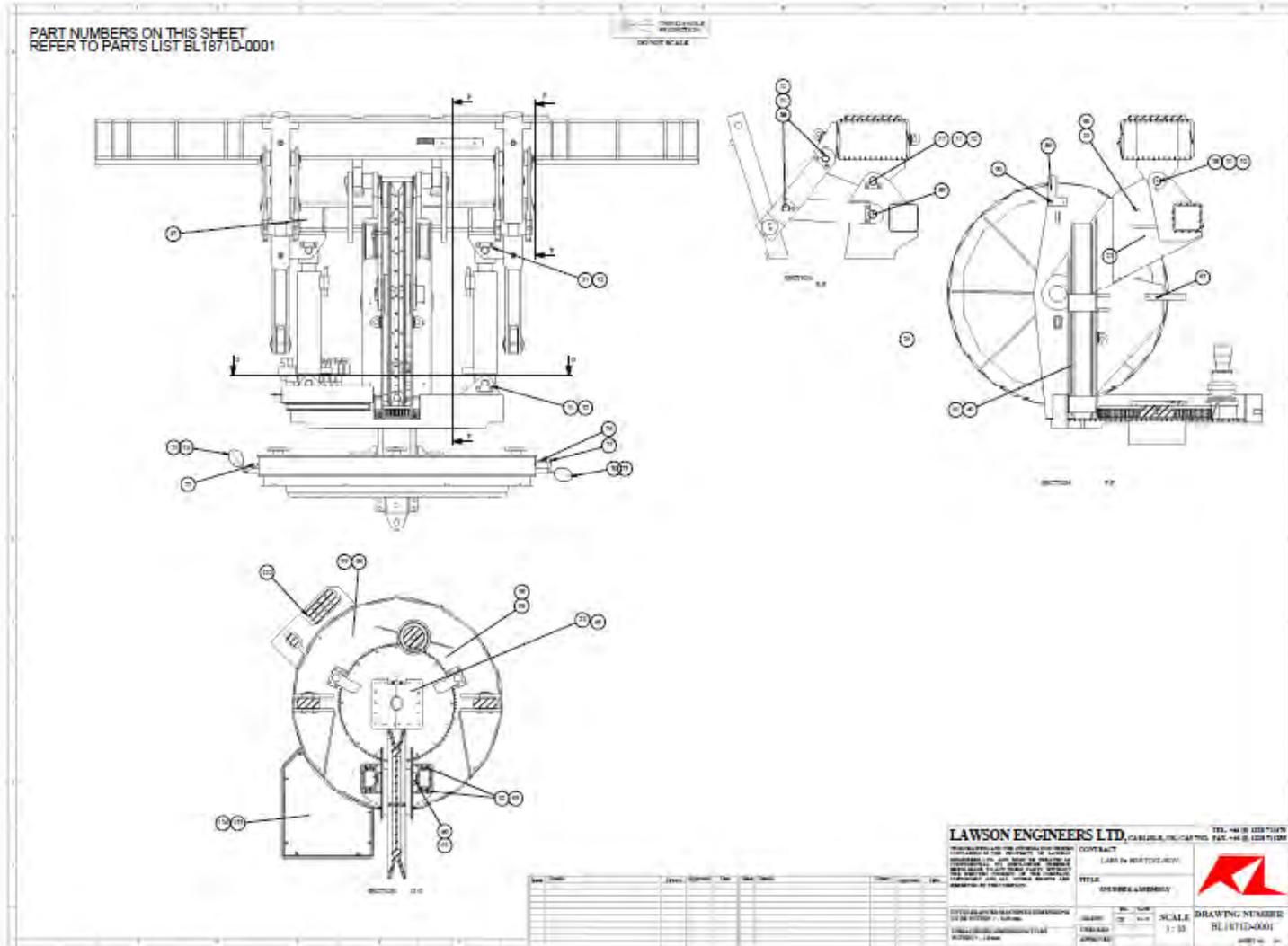
Snubber Assembly 1



1

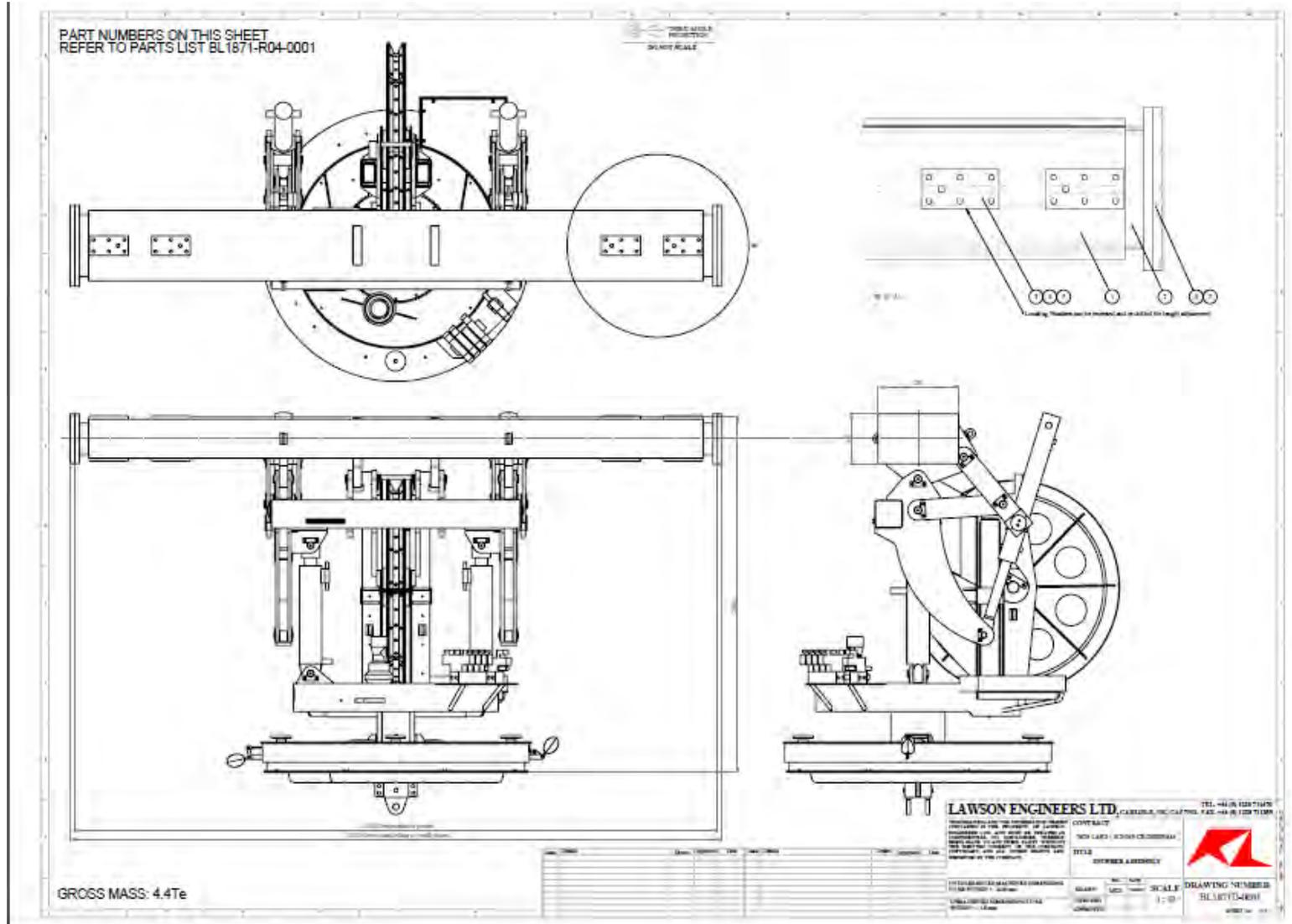
New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8

Snubber Assembly 2



New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8

Snubber 3

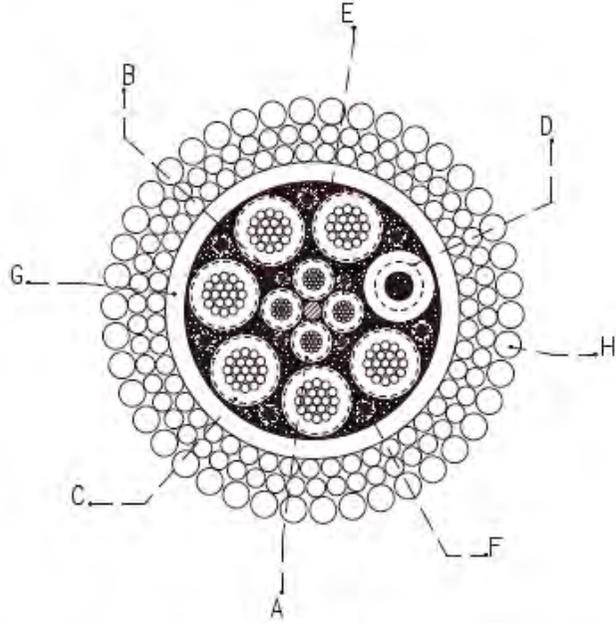


**New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8**

**Rock Drill Cable**

	© This drawing is the exclusive property of Cortland Fibron BX Ltd and must not be copied or reproduced in any way whatsoever without the express consent, in writing, of Cortland Fibron BX Ltd. The drawing is to be used for the purpose for which it is supplied and must be returned on demand. The contents of the drawing must not be treated as strictly confidential and must not be disclosed to any third party without the express consent, in writing, of Cortland Fibron BX Ltd.	REVISIONS HISTORY		
		DO	INITIAL RELEASE	30/10/13



Assembly Detail:

- A) 4 off cross-linked polyethylene insulated 1.2 mm<sup>2</sup> plain copper power conductors, (Uo/U = 1.9/3.3 kVrms max).
- B) Inter-layer screen comprising copper/polyester laminate tape and semi-conductive coated drain wires.
- C) 6 off cross-linked polyethylene insulated 5 mm<sup>2</sup> plain copper power conductors, (Uo/U = 1.9/3.3 kVrms max).
- D) 1 off jacketed, gel filled stainless steel tube containing 4 x single-mode and 2 x 50/125/250 µm multi-mode optical fibres.
- E) Assembly voids filled with silicone rubber compound.
- F) Inter-layer screen comprising copper/polyester laminate tape and semi-conductive coated drain wires (2.7 mm<sup>2</sup> total).
- G) High density polyethylene sheath, (1.5 mm nominal thickness).
- H) Three layers of dressed high tensile galvanised steel wire armour.

<p><u>Nominal Mechanical Characteristics -</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 35%;">Finished diameter:</td> <td>27.6 mm ± 0.5 mm.</td> </tr> <tr> <td>Weight in air:</td> <td>2,600 kg/km.</td> </tr> <tr> <td>Weight in sea-water:</td> <td>1,950 kg/km, (note 1)</td> </tr> <tr> <td>Minimum bend radius:</td> <td>380 mm, (static).</td> </tr> <tr> <td>Minimum bend radius:</td> <td>420 mm, (dynamic).</td> </tr> <tr> <td>Minimum breaking load:</td> <td>440 kN.</td> </tr> </table> <p>Note 1: Assumed sea-water density = 1,026 kg/m<sup>3</sup>.</p>	Finished diameter:	27.6 mm ± 0.5 mm.	Weight in air:	2,600 kg/km.	Weight in sea-water:	1,950 kg/km, (note 1)	Minimum bend radius:	380 mm, (static).	Minimum bend radius:	420 mm, (dynamic).	Minimum breaking load:	440 kN.	<table border="1" style="width: 100%; border-collapse: collapse; font-size: 8px;"> <tr> <td style="text-align: center;">Unless otherwise specified, all dimensions are in mm.</td> <td rowspan="3" style="text-align: center; vertical-align: middle;"> <b>Cortland Fibron BX Ltd.</b>                      Unit C, RD Park,                      Stephenson Close,                      Hoddesdon, Herts, EN11 0BW                       Tel: +44 (0) 182 47144                      Fax: +44 (0) 800 47 630                      www.fibronbx.com                 </td> </tr> <tr> <td style="text-align: center;">All values nominal</td> </tr> <tr> <td style="text-align: center;">Drawing No: <b>RM0019</b></td> </tr> <tr> <td style="text-align: center;">Description: <b>ROCK DRILL CABLE</b></td> <td style="text-align: center; vertical-align: middle;">Rev: <b>00</b></td> </tr> <tr> <td style="font-size: 7px;">Scale: N.T.S.</td> <td style="font-size: 7px;">Date: 30th Oct, 2013</td> <td style="font-size: 7px;">Sheet: 1 of 1</td> </tr> <tr> <td style="font-size: 7px;">Drawn: S.McQ.</td> <td style="font-size: 7px;">Approved:</td> <td> </td> </tr> </table>	Unless otherwise specified, all dimensions are in mm.	<b>Cortland Fibron BX Ltd.</b> Unit C, RD Park, Stephenson Close, Hoddesdon, Herts, EN11 0BW  Tel: +44 (0) 182 47144 Fax: +44 (0) 800 47 630 www.fibronbx.com	All values nominal	Drawing No: <b>RM0019</b>	Description: <b>ROCK DRILL CABLE</b>	Rev: <b>00</b>	Scale: N.T.S.	Date: 30th Oct, 2013	Sheet: 1 of 1	Drawn: S.McQ.	Approved:	
Finished diameter:	27.6 mm ± 0.5 mm.																								
Weight in air:	2,600 kg/km.																								
Weight in sea-water:	1,950 kg/km, (note 1)																								
Minimum bend radius:	380 mm, (static).																								
Minimum bend radius:	420 mm, (dynamic).																								
Minimum breaking load:	440 kN.																								
Unless otherwise specified, all dimensions are in mm.	<b>Cortland Fibron BX Ltd.</b> Unit C, RD Park, Stephenson Close, Hoddesdon, Herts, EN11 0BW  Tel: +44 (0) 182 47144 Fax: +44 (0) 800 47 630 www.fibronbx.com																								
All values nominal																									
Drawing No: <b>RM0019</b>																									
Description: <b>ROCK DRILL CABLE</b>	Rev: <b>00</b>																								
Scale: N.T.S.	Date: 30th Oct, 2013	Sheet: 1 of 1																							
Drawn: S.McQ.	Approved:																								

**Winch**



New Polar Research Vessel (NPRV)  
Statement of Requirements (SoR) Section 8

Winch

