



**British
Antarctic Survey**
NATURAL ENVIRONMENT RESEARCH COUNCIL

SHIPBUILDING AGREEMENT

NUMBER: PR140016

**FOR THE DESIGN AND CONSTRUCTION OF A
NEW POLAR RESEARCH VESSEL**



**SHIPBUILDING AGREEMENT FOR THE DESIGN AND
CONSTRUCTION OF A NEW POLAR RESEARCH
VESSEL**

BETWEEN

**CAMMELL LAIRD SHIPREPAIRERS AND
SHIPBUILDERS LTD AS BUILDER**

AND

**THE NATURAL ENVIRONMENT RESEARCH COUNCIL
AS OWNER**

Dated: 20 November 2015

Yard No: REDACTED – FOI Act Section 43

SHIPBUILDING CONTRACT

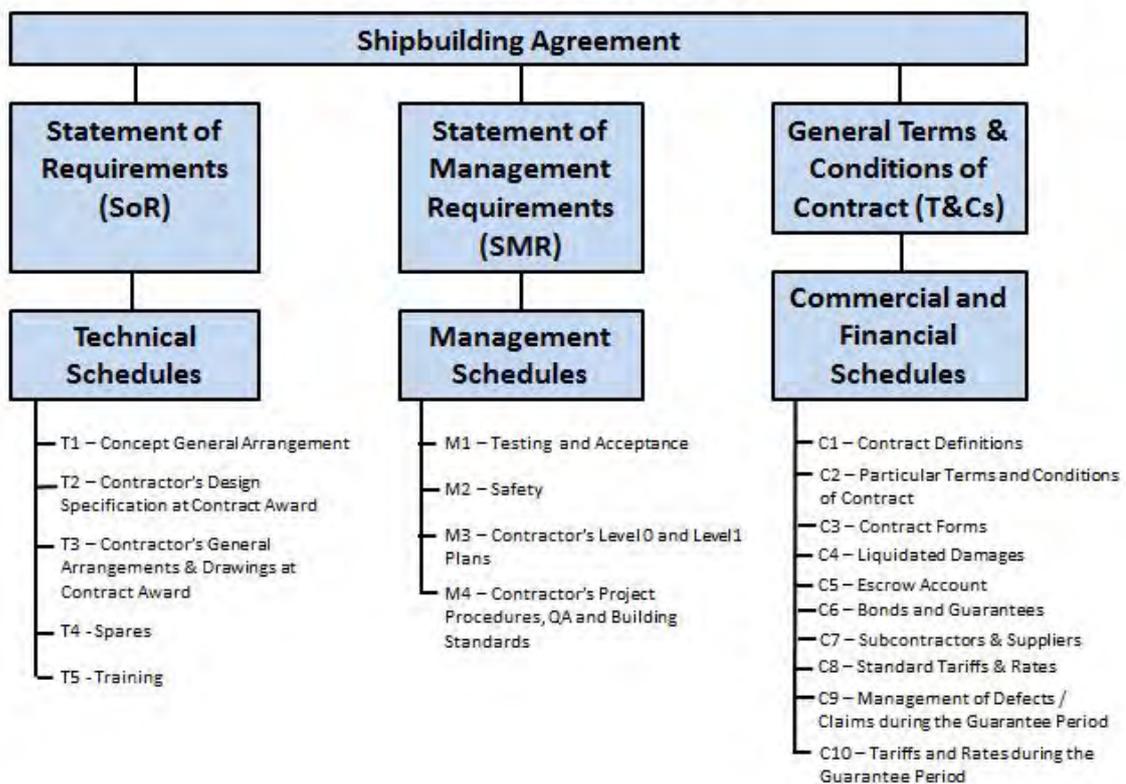
DATED:- 20 November 2015

PARTIES:-

- 1) **CAMMELL LAIRD SHIPREPAIRERS AND SHIPBUILDERS LTD** of Campbeltown Road, Birkenhead, Merseyside, CH41 9BP (Reg No. 4211637) ("the Contractor")
- 2) **THE NATURAL ENVIRONMENT RESEARCH COUNCIL** of Polaris House, North Star Avenue, Swindon, Wiltshire, SN2 IEU, United Kingdom ("the Council")

This Agreement is executed in two originals in 17 pages and the following documents which together form the Contract for the construction of the vessel.

Contract Framework



OFFICIAL – SENSITIVE (COMMERCIAL)

TERMS AGREED:-

Order of Precedence

All general language or requirements embodied in the Contract are intended to amplify, explain and implement the requirements of this Contract. The SoR, the Contractor's Design Specification and GA are also intended to explain each other, and anything shown on the GA and not stipulated in the SoR and the Contractor's Design Specification or stipulated in the SoR and Contractor's Design Specification and not shown on the GA shall be deemed and considered as if embodied in each of them. In the event of any conflict between the SoR and the Contractor's Design Specification, the SoR shall prevail and govern, and in the event of any conflict between the Contractor's Design Specification and the GA, the Contractor's Design Specification shall prevail and govern. In the event of any conflict between the Contract and the SoR or the Contractor's Design Specifications, the Contract shall prevail and govern.

1. Definitions

In this Contract and all other documents forming part of the Contract, the terms as defined in Schedule C1 shall each have the meaning thereby assigned to it, except where the context requires otherwise.

2. Agreement to Build

- 2.1 The Contractor shall with due care and diligence design, build and commission the Vessel in compliance with the Statement of Requirements and Statement of Management Requirements.
- 2.2 The design of the Vessel shall in all respects be consistent with the SoR and Design Specification.
- 2.3 The Contractor will be responsible for fulfilling the regulations and requirements of the Classification Society, Registration and Statutory Authority and all other relevant statutory requirements either in force or generally known to be in the process of introduction at the date of contract.
- 2.4 The Contractor shall give effect to any change which by written notice or authorisation the Council may require to be made to the Vessel or the Design Specification but in such event the terms of the Contract relating to Contract Price, Contract Acceptance date and the Performance Characteristics shall be amended only if necessary in such manner as described in the Contract.
- 2.5 The Contract price covers for any departures from the General Arrangement, Drawings included in the Design Specification which may become necessary during the development of the design in order to meet the SoR except for those which are extras, additions or alterations as authorised by the Council and as provided for in the General Conditions. If at any time it becomes clear that a specified characteristic cannot be attained, or that to attain it will lead to penalties in any other aspect of the Vessel's specification, characteristics or performance, then the Contractor shall inform the Council of the circumstances immediately.

OFFICIAL – SENSITIVE (COMMERCIAL)

- 2.6 The utmost care is to be taken in the design and preparation of the working drawings and during the fitting out of the vessel to ensure that they take account of the need for efficient and effective survey, maintenance and support. It is equally important that all parts of the machinery and equipment should be accessible for operation, inspection, repair and replacement.
- 2.7 The Contractor will manage the Contract in accordance with the Statement of Management Requirements.
- 2.8 The Vessel shall not be assembled or launched other than at the Contractor's nominated yard at CAMMELL LAIRD SHIPREPAIRERS AND SHIPBUILDERS LTD of Campbeltown Road, Birkenhead, Merseyside, CH41 9BP

3. Contract Price

- 3.1 The Fixed and Firm Contract Price (including all or any taxes, levies, duties and the like) for the Vessel to be delivered in accordance with the Statement of Requirements and consistent with the Design Specification agreed on signature of the Contract is £144,000,000 (one hundred and forty four million pounds).
- 3.2 Payments from the Council will be made into an Escrow Account in accordance with Schedule C5 attached hereto.
- 3.3 Payment of the Contract price will be made by instalments in sterling, free of bank charges from the Escrow Account to the Contractor and within 30 days of the following events:-

<u>No. of Instalment</u>	<u>Milestone Date</u>	<u>£k</u>	<u>Event</u>
1	REDACTED – FOI Act Section 43		<p>On Contract signature subject to delivery by the Contractor to the Council of the following:</p> <ul style="list-style-type: none"> • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • preliminary trim and stability calculations. <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the SMR and SoR.</p>
2	REDACTED – FOI Act Section 43	Plus the outstanding balance of	On completion of the following:

OFFICIAL – SENSITIVE (COMMERCIAL)

		contract variations	<ul style="list-style-type: none"> • Powering calculations complete to allow order of main generators; • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the SMR and SoR.</p>
3	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On completion of the following:</p> <ul style="list-style-type: none"> • Engineering design to allow order placement of main propulsion, cranes, overside handling equipment, scientific winches and DP system; • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the SMR and SoR.</p>

OFFICIAL – SENSITIVE (COMMERCIAL)

4	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On completion of the following:</p> <ul style="list-style-type: none"> • model tests and computer simulations; • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract).
5	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On keel laying (or equivalent) including erection at least 200 tonnes of the steel weight erected and fully welded as a single unit plus:</p> <ul style="list-style-type: none"> • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the SMR and SoR.</p>
6	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On completion of the following:</p> <ul style="list-style-type: none"> • Main engines delivered; • 500 tonnes of the total hull steel prefabricated in final block form;

OFFICIAL – SENSITIVE (COMMERCIAL)

			<ul style="list-style-type: none"> • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the SMR and SoR.</p>
7	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On completion of the following:</p> <ul style="list-style-type: none"> • Scientific winches FAT Complete; • All production engineering drawings; • 1500 tonnes of the total hull steel prefabricated in final block form; • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the SMR and SoR.</p>

OFFICIAL – SENSITIVE (COMMERCIAL)

8	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On completion of the following:</p> <ul style="list-style-type: none"> • Hull erected to main deck (excluding block 40Band Units 1000, 1001); • 4000 tonnes of the total hull steel prefabricated in final block form; • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the SMR and SoR.</p>
9	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On completion of the following:</p> <ul style="list-style-type: none"> • All thrusters and propulsion motors installed in vessel. • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as</p>

OFFICIAL – SENSITIVE (COMMERCIAL)

			described in the SMR and SoR.
10	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On completion of the following:</p> <ul style="list-style-type: none"> • Vessel ready to Launch in accordance with the SoR; • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the SMR and SoR.</p>
11	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On completion of the following:</p> <ul style="list-style-type: none"> • All electrical distribution systems commissioned and generators load tested. • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as</p>

OFFICIAL – SENSITIVE (COMMERCIAL)

			described in the SMR and SoR.
12	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On completion of the following:</p> <ul style="list-style-type: none"> • Interim Acceptance of the Vessel; • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the SMR and SoR.</p>
13	REDACTED – FOI Act Section 43	Plus the outstanding balance of contract variations	<p>On completion of the following:</p> <ul style="list-style-type: none"> • Completion of as built documentation and • the Baseline project plan (Level 0 and Level 1) (as set out in Statement of Management Requirements (SMR) of this Contract); • the Drawing Submission programme (as required by the SoR); • test and trials programme including results of any previous tests and trials carried out; • the acceptance review, project review and technical review calendars (as set out in SMR of this Contract). <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the SMR and SoR.</p>

OFFICIAL – SENSITIVE (COMMERCIAL)

14	REDACTED – FOI Act Section 43		<p>Satisfactory completion of deep water science trials plus</p> <ul style="list-style-type: none"> • test and trials programme including results of any previous tests and trials carried out; • Completion and Acceptance of outstanding defects and non-compliances recorded at Interim Acceptance of the Vessel subject to delivery by the Contractor to the Council of all “as fitted” drawings (as required by the SoR); <p>And these shall be deemed by the Council to be consistent with meeting the Councils requirements as described in the Statement of Management Requirements(SMR) and SoR</p>
15	REDACTED – FOI Act Section 43		<p>Completion of twenty four (24) months Guarantee Period and completion and acceptance of all defects and non-compliances arising</p>

NB – ANY OR ALL OF THE INSTALMENTS PAYMENTS DETAILED ABOVE MAY BE WITHHELD BY THE COUNCIL IN ACCORDANCE WITH CONDITION 45 OF THE GENERAL TERMS AND CONDITIONS OF CONTRACT

3.4 All claims for payment shall be forwarded by the Contractor to the Council quoting the reference PR140016 and shall be supported by the Interim Certificate described in Condition 3.5 below.

3.5 The Contractor shall by fourteen days advance notice advise the Council of the date on which each of the said instalments shall become due and payable and shall deliver to the Council an Interim Certificate in the form set out in the Schedule C3 hereof signed on behalf of the Contractor. In respect of instalment number 12 the Contractor shall (when giving notice to the Council that the Vessel is ready for Interim Acceptance in accordance with the provisions of Condition 5) also inform the Council of the amount due upon Interim Acceptance of the Vessel by the Council and deliver to the Council the said Interim Certificate, duly signed by the Contractor. In respect of each instalment the Interim Certificate shall be signed on behalf of the Council to signify that it agrees the payment is due whereupon the Council shall pay by electronic transfer the total amount due direct to REDACTED – FOI Act Section 43 for the account of the Contractor on the due date for payment.

3.6 At reasonable intervals, when so requested by the Council, the Contractor will forward to the Council a forecast of when instalment earnings will fall due.

OFFICIAL – SENSITIVE (COMMERCIAL)

- 3.7 No increase in the Contract Price will be claimed except as provided for in the Contract.

4. Financial Guarantee

The Contractor shall obtain the Guarantees for the amounts and in the form set out in the Schedule C6 hereof or such other form as may be agreed by the Parties. These guarantees shall be valid from the date of Contract signature until the end of the Guarantee Period.

5. Delivery

- 5.1 The Vessel shall be delivered alongside the Contractor's nominated quay at CAMMELL LAIRD SHIPREPAIRERS AND SHIPBUILDERS LTD of Campbelltown Road, Birkenhead, Merseyside, CH41 9BP not later than 27 June 2018.

- 5.2 When the Acceptance Trials referred to at Condition 50 to the General Terms and Conditions of Contract have been completed without the Council notifying the Contractor of any material failure to comply with the terms of this Contract or after the Contractor has remedied any such failure to the reasonable satisfaction of the Council the Council shall forthwith sign and deliver to the Contractor the Interim Acceptance Form confirming that the Vessel complies with this Contract except as therein expressly stated.

- 5.3 Upon final delivery of the vessel and after the Guarantee Period final dry dock completion, a Final Acceptance Form will be issued always provided that the Council has not notified the Contractor of any material failure to comply with the terms of this Contract at which time the Vessel shall be deemed to have been delivered to and accepted by the Council and all residual risks therein shall thereupon pass from the Contractor to the Council.

6. Performance Characteristics and Delay

- 6.1 The Performance Characteristics are to be assessed on, and liquidated and ascertained damages (if any) are to be evaluated by reference to, the Acceptance Trials or, if mutually agreed, by calculation. In the event that the Performance Characteristics are not achieved during the Contract Period then the Contractor shall have a reasonable opportunity to rectify the defect but if still not met the Contractor shall pay to the Council the liquidated damages set out in Schedule C4 in respect of those performance criteria that have not been met. After Interim Acceptance and the rectification of defects the Contractor and the Council shall sign and exchange a statement of performance characteristics achieved in the form set out in List C of Acceptance Form in Schedule C3.

- 6.2 In the event that the Vessel is not delivered by 27 June 2018 then the Contractor shall pay the Council liquidated damages as specified in Schedule C4.

OFFICIAL – SENSITIVE (COMMERCIAL)

7. Supervision and Inspection

- 7.1 **Programme Manager** - The Council has appointed a Programme Manager to act on its behalf in all matters pertaining to the proper progress of the Contract.

The functions of the Programme Manager are to approve any variations in the work, to approve and process all claims for stage payments and to accept on behalf of the Council, after satisfactory certification by the Technical Adviser, the completed Vessel, having undergone all specified tests and trials.

- 7.2 **Technical Advisers** - The Council has appointed Technical Advisers.

The Technical Advisers shall supervise the work while it is being performed to ensure that all materials and workmanship are of the required standard and that all arrangements of work and fittings are satisfactory. The Contractor shall at all times afford to the Technical Advisers or their authorised representative free and unrestricted access to the work in progress both at the shipyard and at the Contractor's subcontractor's facilities.

The Technical Advisers shall certify to the Programme Manager that the appropriate stage of the construction has been reached to entitle the Contractor to a stage payment. The Technical Advisers will have no authority to relieve the Contractor of any of its duties or obligations under the Contract nor to order any work involving delay or extra payment by the Council nor to make any variation of or in the construction of the Vessel.

The Technical Advisers will report to the Programme Manager at 7.1 above.

- 7.3 The Technical Advisers will act as technical advisers to the Council for the duration of the Contract and thereafter as may be required by the Council in respect of any matter arising from the Contract. In this capacity, the Technical Advisers will be responsible to the Council for the review of plans submitted by the Contractor in accordance with the SoR and for advice on all technical matters arising from the Contract. They will also act as representatives of the Council during the conduct of all trials as required by the Design Specification. The Contractor will be required to nominate one representative to liaise with a named officer of the Technical Advisers on all matters which require direct contact.

8. Operational Capabilities

The Vessel shall be constructed with the design objective of meeting the requirements expressed in the SoR.

Any failure by the Contractor to meet the design objective will be dealt with under the provisions of the General Terms and Conditions of Contract and Schedule C4.

9. Governing Laws

This Contract shall be governed by and construed in accordance with the laws of England, and the parties shall submit to the exclusive jurisdiction of the English courts.

OFFICIAL – SENSITIVE (COMMERCIAL)

10. Previous Agreements, Documents and Correspondence

This Contract constitutes the entire agreement between the Council and the Contractor in relation to the design, construction and purchase of the Vessel and no representation, warranty or statement made by or on behalf of the Contractor or Council prior to the date hereof shall affect the terms of this Contract or the rights or duties of the Contractor or Council hereunder.

No modification of the terms of this Contract shall be of any effect unless made in writing and signed on behalf of the Council and Contractor.

11. Notice

11.1 Unless otherwise provided herein any notice, consent, approval or other communication pursuant to the Contract shall be in writing and shall be deemed to have been duly given or served by or on behalf of the Council or by or on behalf of the Contractor if delivered personally, or sent by pre-paid first-class post, recorded delivery, commercial courier or email to the party at its business address, as stipulated below or any other address indicated in writing from time to time hereunder and;

11.2 A notice or other communication shall be deemed to have been received: if delivered personally, when left at the address referred to in this condition; if sent by pre-paid first-class post or recorded delivery, at 9.00 am on the second Working Day after posting; if delivered by commercial courier, on the date and at the time that the courier's delivery receipt is signed; or, if sent by email between the hours of 9.00am and 5.00pm on a Working Day, upon successful transmission (provided that the sender holds written confirmation automatically produced by the sender's email machine of error free and complete transmission of that email to the other party's email number), or if sent by email outside the hours of 9.00am and 5.00pm on a Working Day, at 9.00am on the next Working Day following successful transmission (provided that the sender holds written confirmation automatically produced by the sender's email machine of error free and complete transmission of that email to the other party's email number).

12. Waiver and cumulative remedies

12.1 The rights and remedies provided by this Contract may be waived only in writing by the relevant party's representative in a manner that expressly states that a waiver is intended, and such waiver shall only be operative with regard to the specific circumstances referred to.

12.2 Unless a right or remedy of the Council is expressed to be an exclusive right or remedy, the exercise of it by the Council is without prejudice to the Council's other rights and remedies. Any failure to exercise or any delay in exercising a right or remedy by either party shall not constitute a waiver of that right or remedy or of any other rights or remedies.

12.3 The rights and remedies provided by this Contract are cumulative and, unless otherwise provided in this Contract are not exclusive of any right or remedies provided at law or in equity or otherwise under this Contract.

OFFICIAL – SENSITIVE (COMMERCIAL)

13. Third party rights

13.1 Save as specifically provided under this Contract a person who is not a party to this Contract has no right under the Contracts (Rights of Third Parties) Act 1999 to enforce any term of this Contract but this does not affect any right or remedy of any person which exists or is available otherwise than pursuant to that Act.

13.2 Any rights created under Condition 13.1 may be altered or extinguished by the parties without the consent of the third party beneficiaries.

14. Addresses and contacts

Unless otherwise notified in writing, for the purpose of this Condition, the addresses and number of the parties are:

The Council: Natural Environment Research Council
 Polaris House
 North Star Avenue
 Swindon
 SN2 1EU
 United Kingdom

All communications to be marked for the attention of REDACTED – FOI Act Section 40

The Contractor: CAMELL LAIRD SHIPREPAIRERS AND SHIPBUILDERS
 LTD
 Campbeltown Road
 Birkenhead
 Merseyside
 CH41 9BP

All communications to be marked for the attention of REDACTED – FOI Act Section 40

IN WITNESS WHEREOF, the parties hereto have caused this Contract to be signed in their respective names.

FOR AND ON BEHALF OF CAMELL LAIRD SHIPREPAIRERS AND SHIPBUILDERS LTD

NAME: REDACTED – FOI Act Section 43

POSITION: Chief Executive Officer

Date:

OFFICIAL – SENSITIVE (COMMERCIAL)

FOR AND ON BEHALF OF **THE NATURAL ENVIRONMENT RESEARCH COUNCIL**

NAME: REDACTED – FOI Act Section 40

POSITION: Chief Operating Officer

Date:

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



Volume 1 of 2 Sections 1 to 6.2

STATEMENT OF REQUIREMENTS FOR THE PROCUREMENT OF THE NEW POLAR RESEARCH VESSEL

Company Confidential
NERC 2015



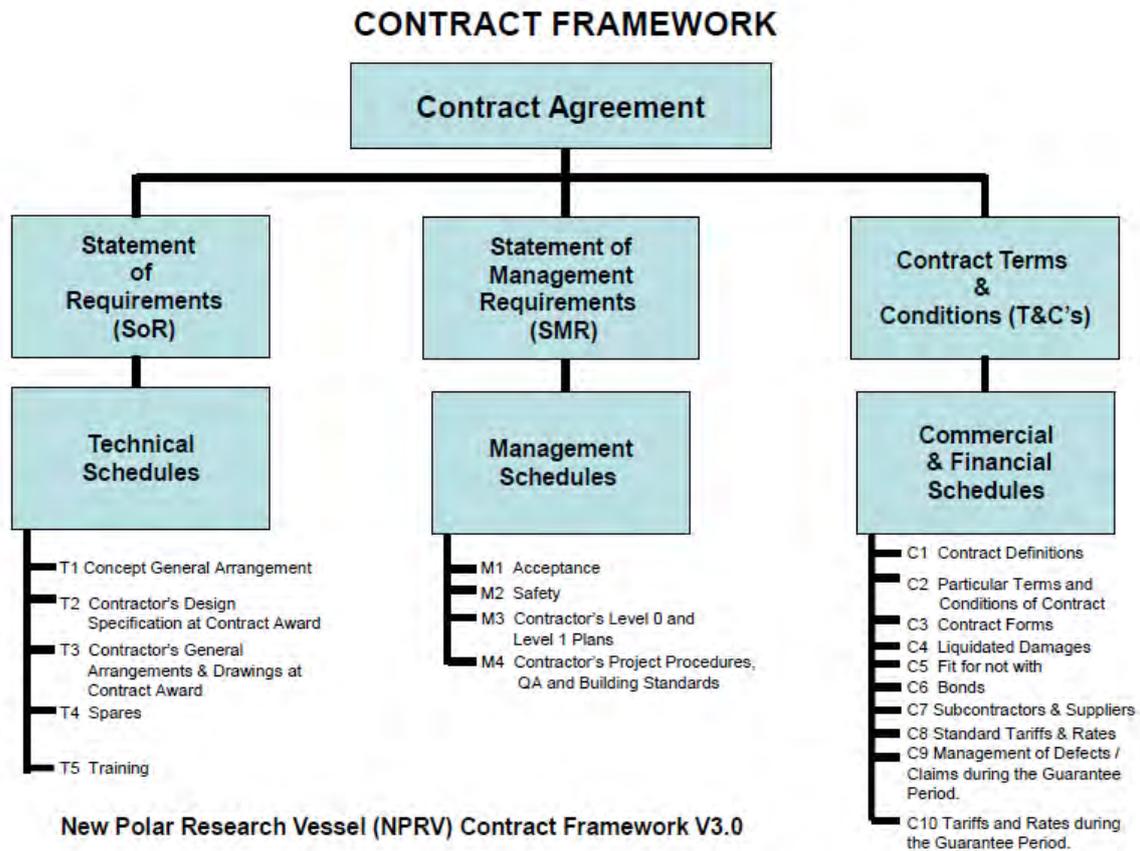
**New Polar Research Vessel (NPRV)
Statement of Requirements Foreword**

FOREWORD

This Statement of Requirements (SoR) contains the following information:

- a description of the detailed requirements and acceptance criteria for a New Polar Research Vessel (NPRV).
- design drawing arrangements for one possible concept and background information and further details relating to the requirements

The SoR is a key part of the contract with the Contractor, with parts of it providing indicative information. The SoR is supplemented by separate additional documents to provide the overall contract documentation as shown in the contract framework below:



DEFINITIONS, ACRONYMS AND TERMS USED IN THE STATEMENT OF REQUIREMENTS

ADCP	Acoustic Doppler Current Profiler
AUV	Autonomous Underwater Vehicle
AVCAT	Military Aviation Kerosene (Flash Point 60°C)
AVTUR	Commercial Aviation Kerosene (Flash Point 38°C)
BAS	British Antarctic Survey
CONTRACTOR	The organisation that NERC contracts with to deliver a new ship
CS	Classification Society
DASI	Deep-towed Active Source Instrument
DGPS	Differential Global Positioning System
DNV	Det Norske Veritas
DP	Dynamic Positioning
GPS	Global Positioning System
HRPT	High Resolution Picture Transmission
IACS	International Association of Classification Societies
ICES	International Council for the Exploration of the Sea
IMO	International Maritime Organisation
ITT	Invitation to Tender
LBL	Long Base Line navigation
LR	Lloyds Register
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime & Coastguard Agency, United Kingdom
MDO	Marine Diesel Oil
MGO	Marine Gas Oil
NERC	Natural Environment Research Council
NMF	National Marine Facilities
NPRV	New Polar Research Vessel
OTSB	Semi-Balloon Otter Trawl
PC	Polar Code or Class (as relevant)
ROV	Remotely Operated Vehicle
R.R.S.	Royal Research Ship
SCADA	Supervisory Control and Data Acquisition
SECA	Sulphur Emission Control Area
SHRIMP	Seabed High Resolution Imaging Platform
SOLAS	Safety of Life at Sea
SoR	Statement of Requirements
SPS	Special Purpose Ship
TOBI	Towed Ocean Bottom Instrument
UAV	Unmanned Aerial Vehicle
URN	Underwater Radiated Noise
USBL	Ultra Short Baseline navigation
VERTREP	Vertical Replenishment
WASP	Wide-Angle Seabed Photography
XBT	Expendable Bathythermograph
amp	Ampere
Hz	Hertz
kW	Kilowatts
m	Metre
mm	Millimetres
T	Metric tonne
v	Volts

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

TABLE OF CONTENTS

Section	Sub-Section	Paragraph	Requirement Number	Title	Page No.
				FOREWORD	Pgs 19
				Foreword	1 of 19
				Definitions, Acronyms & Terms used in Statement of Requirements	2 of 19
				Table of Contents of Statement of Requirements	3 of 19
1				INTRODUCTION	Pgs 1
				Introduction	1 of 1
2				THE OBJECTIVES & CONTEXT OF THE STATEMENT OF REQUIREMENTS	Pgs 2
	2.1			Objectives	1 of 2
	2.2			Context of the SoR	1 of 2
				<i>Affordability</i>	1 of 2
				<i>Creative Solutions</i>	2 of 2
				<i>Best Endeavours</i>	2 of 2
	2.3			Non-Compliance	2 of 2
3				THE STRUCTURE OF THE STATEMENT OF REQUIREMENTS	Pgs 4
	3.1			Contractor's Understanding and Interpretation	1 of 4
	3.2			Conventions Used in the SoR	1 of 4
				<i>Mandatory Requirements</i>	1 of 4
				<i>Notes</i>	1 of 4
			R3.1	<i>Acceptance Criteria</i>	1 of 4
				<i>Non Compliance</i>	3 of 4
				<i>Guidance & Information</i>	3 of 4
	3.3		R3.2	Overall Requirement	3 of 4
	3.4			SoR Structure	3 of 4
	3.5			The Concept General Arrangement	3 of 4
	3.6			Procurement and Responsibilities for Compliance	4 of 4
				<i>Contractor's Responsibilities</i>	4 of 4
				<i>Exemplars</i>	4 of 4
4				THE PURPOSE OF THE SHIP	Pgs 29
	4.1			Background	1 of 29
	4.2			New Ship Type, Role and Scientific User Disciplines	1 of 29
		4.2.1		Type	1 of 29
		4.2.2		Vessel Configuration	3 of 29
		4.2.3		Role	4 of 29
		4.2.4		Dynamic Positioning (DP) Description	4 of 29
		4.2.5		Operational Parameters	5 of 29
		4.2.6		Propulsion and Manoeuvring	5 of 29
		4.2.7		Cargo Capacities	6 of 29
		4.2.8		Complement	7 of 29
		4.2.9		Redundancy in Propulsion and Essential Services	7 of 29

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

		4.2.10	Ice Breaking Capability	8 of 29
		4.2.11	Winterisation / De-icing	8 of 29
	4.3		Scientific Systems and Equipment	9 of 29
	4.4		Operational Locations and Logistics	10 of 29
		4.4.1	Logistics & Cargo Requirements	10 of 29
	4.5		Operational Profile	10 of 29
	4.6		Operating Environment	13 of 29
	4.7		Whole-Life Costs and Affordability	14 of 29
		4.7.1	Total Cost of Ownership	14 of 29
	4.8		Operations – Basic Concepts and Overview	14 of 29
		4.8.1	ROV Operations	15 of 29
		4.8.2	AUV Operations	15 of 29
		4.8.3	Seismic Operations	15 of 29
	4.9		Scientific Operations	15 of 29
		4.9.1	Scientific Moonpool, Closing Device and Overflow Arrangements	15 of 29
		4.9.2	Working Decks - General Principles	16 of 29
		4.9.3	Working Decks - Layout	16 of 29
		4.9.4	Work Spaces	16 of 29
		4.9.5	Laboratories on Main Deck	17 of 29
		4.9.6	Other Laboratories & Scientific Rooms	17 of 29
		4.9.7	Container Laboratories	18 of 29
		4.9.8	Scientific Ready Use Storage	18 of 29
		4.9.9	Safety & Productivity	18 of 29
	4.10		Ship Operations	19 of 29
		4.10.1	Computer / Data Network	19 of 29
		4.10.2	Service Runs & Capacity	19 of 29
		4.10.3	Ship's Effect on the Environment	19 of 29
		4.10.4	Primary Power Generation	19 of 29
		4.10.5	Main Propulsion System, Track Lining & Dynamic Positioning	20 of 29
		4.10.6	Hydraulic Power Requirements	21 of 29
		4.10.7	Topsides Sensor Platform	21 of 29
		4.10.8	Underwater Sensor Arrangements	21 of 29
		4.10.9	Over-side Lifting Systems	21 of 29
		4.10.10	Scientific Winch System	22 of 29
		4.10.11	Helicopter Operations	22 of 29
		4.10.12	Helicopter Hangar	23 of 29
		4.10.13	Helicopter Refuelling	23 of 29
	4.11		Cargo / Capacities / Operation	23 of 29
		4.11.1	Deck Outfit	23 of 29
	4.12		Cargo Holds Heating, Cooling & Ventilation	24 of 29
		4.12.1	Cargo Holds	24 of 29
		4.12.2	Insulation & Lining of Cargo Holds	24 of 29
		4.12.3	Ventilation of Cargo Holds	24 of 29

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

		4.12.4		Heating of Cargo Holds	24 of 29
	4.13			Scientific Hold	25 of 29
		4.13.1		Scientific Hold	25 of 29
	4.14			Cargo and Access Hatches	25 of 29
		4.14.1		Cargo & Access Hatches	25 of 29
	4.15			Deck Cargo	26 of 29
		4.15.1		Cargo VERTREP Area	26 of 29
		4.15.2		Cargo Transfer Systems	26 of 29
		4.15.3		Cargo Handling Monorail / Gantry	26 of 29
	4.16			Auxiliary Craft	26 of 29
		4.16.1		Auxiliary Small Craft - General Requirements	26 of 29
	4.17			Cranes	27 of 29
		4.17.1		Cranes & Gantries	27 of 29
		4.17.2		Cargo Cranes	27 of 29
		4.17.3		Deck Cranes	28 of 29
		4.17.4		Working Deck Service Cranes	28 of 29
	4.18			Bulk Aviation Fuel	28 of 29
		4.18.1		Bulk Aviation Fuel System	28 of 29
	4.19			Style	29 of 29
	4.20			Security	29 of 29
5				THE OVERALL & INTEGRATED REQUIREMENTS OF THE TOTAL SYSTEM	Pgs 101
	5.1			Registration, Classification, Regulation and Certification	1 of 101
		5.1.1	R5.1	Registration	1 of 101
		5.1.2	R5.2	Classification	1 of 101
		5.1.3	R5.3	National and International Regulations	1 of 101
		5.1.4	R5.4	Certificate Book	8 of 101
		5.1.5	R5.5	Hull Form & Hydrodynamics	8 of 101
		5.1.6	R5.6	Model Test Programme	10 of 101
		5.1.7	R5.7	Hull Design & Construction	12 of 101
			R5.8	Hull Structure - General Requirements	14 of 101
			R5.9	Scientific Moonpool	15 of 101
			R5.10	Dimensional Survey	15 of 101
			R5.11	Sea Chests	16 of 101
			R5.12	Stern Ice Knife	16 of 101
		5.1.8	R5.13	Rudder	16 of 101
		5.1.9	R5.14	Steering Gear	17 of 101
		5.1.10	R5.15	Superstructure & Deckhouses	17 of 101
		5.1.11	R5.16	Hull Preservation	17 of 101
			R5.17	Paint Preparation	18 of 101
			R5.18	Paint Specifications	18 of 101
			R5.19	Paint Application	40 of 101
		5.1.12	R5.20	Cathodic Protection	41 of 101
		5.1.13	R5.21	Internal & External Markings	41 of 101

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

	5.1.14	R5.22	Winterisation	42 of 101
	5.1.15		Principal Dimensions	49 of 101
		R5.24	Draft	49 of 101
		R5.25	Length & Breadth	50 of 101
		R5.26	Trim	50 of 101
		R5.27	Depth	50 of 101
	5.1.16		Speed	51 of 101
		R5.28	Overall Requirements	51 of 101
		R5.29	Speed Control	51 of 101
		R5.30	Range	51 of 101
	5.1.17		Endurance	52 of 101
		R5.31	Overall	52 of 101
		R5.32	Fuel	52 of 101
		R5.33	Fresh Water	52 of 101
		R5.34	Provisions	52 of 101
		R5.35	Not Used	52 of 101
	5.1.18	R5.36	Seakeeping	52 of 101
		R5.37	Ship Stabilisation	53 of 101
		R5.38	Deck Wetness	53 of 101
		R5.39	Ship Motions & Habitability	54 of 101
		R5.40	Transit	54 of 101
	5.1.19	R5.41	Dynamic Positioning	54 of 101
	5.1.20	R5.42	DP System Description	57 of 101
		R5.43	DP Position Reference System and Sensors	58 of 101
		R5.44	Joystick Control	59 of 101
	5.1.21	R5.45	Ice Strengthening & Protection	59 of 101
	5.1.22		Manoeuvring & Directional Stability	60 of 101
		R5.46	Manoeuvring	60 of 101
		R5.47	Directional Stability	60 of 101
	5.1.23		Lightship Weight & Deadweight	60 of 101
		R5.48	Lightship Weight	60 of 101
		R5.49	Deadweight	61 of 101
			<i>Ship Deadweight</i>	61 of 101
			<i>Cargo and Science Deadweight</i>	61 of 101
			<i>Growth Margin</i>	62 of 101
	5.1.24	R5.50	Weight Control	62 of 101
	5.1.25	R5.51	Stability	62 of 101
	5.1.26	R5.52	Heel Angle Control	65 of 101
		R5.53	Heeling and Trimming in Ice	66 of 101
	5.1.27	R5.54	Freeboard	66 of 101
	5.1.28	R5.55	Design Life	67 of 101
	5.1.29		Noise & Vibration	67 of 101
		R5.56	Noise & Vibration	67 of 101
		R5.57	Onboard Noise	68 of 101
		R5.58	In-water Noise	74 of 101

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

		5.1.30	R5.59	Electro-Magnetic Compatability (EMC)	74 of 101
		5.1.31	R5.60	Lifesaving Equipment & Boats	74 of 101
		5.1.32	R5.61	Fast Rescue Boat(s)	74 of 101
		5.1.33	R5.62	Firefighting & Detection	75 of 101
			R5.63	Fixed Fire Extinguishing Systems	76 of 101
			R5.64	Fixed Fire Extinguishing System in Engine Rooms, Boiler / Incinerator Room	76 of 101
			R5.65	Fixed Fire Extinguishing System in Accommodation and Science Spaces	77 of 101
			R5.66	Foam Tank	78 of 101
			R5.67	Firefighting Systems on Aft Deck and Cargo Hold	78 of 101
			R5.68	Heli-deck Fire Extinguishing	81 of 101
			R5.69	Fire Detection Extinguishing System in Hangar	82 of 101
			R5.70	AVTUR Fuel Pump Room	82 of 101
			R5.71	AVTUR Tanks	82 of 101
			R5.72	Fire Fighters Outfits / Miscellaneous Equipment	82 of 101
			R5.73	Hydrants, Hoses and Extinguishers	83 of 101
		5.1.34	R5.74	Fire Detection System	83 of 101
		5.1.35	R5.75	Quick Closing Valves	84 of 101
		5.1.36		Spare Parts & Tools	84 of 101
			R5.76	Spare Parts List	84 of 101
			R5.77	Supply of Spare Parts	84 of 101
			R5.78	Supply of Tools	85 of 101
			R5.79	Stowage of Spare Parts	85 of 101
			R5.80	Availability of Spare Parts	85 of 101
		5.1.37	R5.81	Planned Maintenance System, Stock Control System & Lifting Equipment Register	86 of 101
	5.2			NERC Standards	86 of 101
	5.3			Tests and Trials Programme Requirement	87 of 101
	5.4			Training and Handover Requirements	100 of 101
	5.5			Requirements for Drawings, Manuals and Documentation	100 of 101
		5.5.1	R5.82	ISM System Information	100 of 101
	5.6			Contractor's Tender, Specification and Standards	100 of 101
	5.7			Standard Tariff Rates	101 of 101
6				THE REQUIREMENTS OF THE SHIP AND SHIP SYSTEMS	
	6.1			Hull, Structure & Living Space	Pgs 75
		6.1.1	R6.1	Masts	1 of 75
		6.1.2	R6.2	Aerial Platform	1 of 75
		6.1.3	R6.3	Meteorological Platform	2 of 75
		6.1.4	R6.4	Crow's Nest	2 of 75
		6.1.5	R6.5	U.K. Meteorological Office Weather Station	2 of 75
		6.1.6	R6.6	Wheelhouse	5 of 75
		6.1.7	R6.7	Integrated Navigation System	6 of 75
		6.1.8	R6.8	Dynamic Positioning Equipment	7 of 75

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

	6.1.9	R6.9	Gyro Compass / Magnetic Compass & Auto Pilot	8 of 75
	6.1.10	R6.10	Echo Sounder(Navigation System)	8 of 75
	6.1.11	R6.11	Anemometer	8 of 75
	6.1.12	R6.12	Speed Log	8 of 75
	6.1.13	R6.13	Radar Equipment	8 of 75
	6.1.14	R6.14	ECDIS - Electronic Chart System	9 of 75
	6.1.15	R6.15	DGPS	9 of 75
	6.1.16	R6.16	Facsimile Receiver	10 of 75
	6.1.17	R6.17	GMDSS Station	10 of 75
	6.1.18	R6.18	Not Used	11 of 75
	6.1.19	R6.19	Navigation System UPS	11 of 75
	6.1.20	R6.20	Additional Wheelhouse Requirements	11 of 75
	6.1.21	R6.21	Standard Clock System	13 of 75
	6.1.22	R6.22	Electronic Equipment Room	13 of 75
	6.1.23	R6.23	Electronic Workshop	14 of 75
	6.1.24	R6.24	Ship's Office	14 of 75
	6.1.25	R6.25	Purser's Office	14 of 75
	6.1.26	R6.26	Public Toilets	15 of 75
	6.1.27	R6.27	General Storage & Lockers	16 of 75
	6.1.28	R6.28	Laundries & Drying Rooms	16 of 75
	6.1.29	R6.29	Hospital, Dispensary & Medical Locker	17 of 75
	6.1.30	R6.30	Working Deck Change Room, Drying Room & Toilet	18 of 75
	6.1.31	R6.31	Safety Control Room	19 of 75
	6.1.32	R6.32	Helicopter Reception Area	19 of 75
	6.1.33	R6.33	Helicopter Operations	19 of 75
	6.1.34	R6.34	Helicopter Hangar, Workshop and Refuelling	23 of 75
	6.1.35	R6.35	Small Boat Access	26 of 75
	6.1.36	R6.36	Duty Mess / Coffee Shop	27 of 75
	6.1.37	R6.37	Galley, Servery, Scullery & Daily Stores	28 of 75
	6.1.38	R6.38	Mess Room	31 of 75
	6.1.39	R6.39	Recreation / Coffee Area	31 of 75
	6.1.40	R6.40	Conference Room / Muster Station	33 of 75
	6.1.41	R6.41	Fitness Centre	34 of 75
	6.1.42	R6.42	Accommodation Arrangement, General	35 of 75
	6.1.43	R6.43	Officer's & Crew Accommodation	36 of 75
	6.1.44	R6.44	Scientist's Accommodation	36 of 75
	6.1.45	R6.45	Alleyways	37 of 75
	6.1.46	R6.46	Stairways	37 of 75
	6.1.47	R6.47	Engineer's Change Room & Toilet	38 of 75
	6.1.48	R6.48	Engine Control Room	38 of 75
	6.1.49	R6.49	Engineering Workshop	40 of 75
	6.1.50	R6.50	Electrical Workshop	41 of 75
	6.1.51	R6.51	Cargo Holds	42 of 75
	6.1.52	R6.52	Scientific Hold	43 of 75

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

	6.1.53	R6.53	Bosun's Store(s)	44 of 75
	6.1.54	R6.54	Mooring Deck Forward	44 of 75
	6.1.55	R6.55	Mooring Deck Aft	45 of 75
	6.1.56	R6.56	Bollards and Fairleads	46 of 75
	6.1.57	R6.57	Mooring Rope Stores	46 of 75
	6.1.58	R6.58	Anchor Pocket Hawse Pipe and Chain Locker	46 of 75
	6.1.59	R6.59	Emergency Towing	48 of 75
	6.1.60	R6.60	Ship's Stores	48 of 75
	6.1.61	R6.61	Catering Stores	48 of 75
	6.1.62	R6.62	Beer Store	48 of 75
	6.1.63	R6.63	Bond Store	48 of 75
	6.1.64	R6.64	Dry Provisions Store	49 of 75
	6.1.65	R6.65	Refrigerated Stores	49 of 75
	6.1.66	R6.66	Engine Room Stores	49 of 75
	6.1.67	R6.67	Ship's Chemical Store	50 of 75
	6.1.68	R6.68	Ship's Oils Store	50 of 75
	6.1.69	R6.69	Waste Management	51 of 75
	6.1.70	R6.70	Garbage Store	60 of 75
	6.1.71	R6.71	Boat Store / Workshop (Garage)	61 of 75
	6.1.72	R6.72	SOPEP Store	61 of 75
	6.1.73	R6.73	Hatchways	61 of 75
	6.1.74	R6.74	Scientific Hold Hatch	63 of 75
	6.1.75	R6.75	Engine Room Hatches	63 of 75
	6.1.76	R6.76	Provisions Hatch	64 of 75
	6.1.77	R6.77	Starboard Side Lower Boarding Access Hatch	64 of 75
	6.1.78	R6.78	Safety in Way of Flush Hatches	64 of 75
	6.1.79	R6.79	Paint Locker	64 of 75
	6.1.80	R6.80	Safety Equipment Locker	64 of 75
	6.1.81	R6.81	Service Trunks	65 of 75
	6.1.82	R6.82	Master Key System	65 of 75
	6.1.83	R6.83	Internal Doors	65 of 75
	6.1.84	R6.84	Windows	66 of 75
	6.1.85	R6.85	Watertight Bulkhead Doors	67 of 75
	6.1.86	R6.86	Weather-tight Doors	68 of 75
	6.1.87	R6.87	Lifeboat, Rescue Boat & Work Boat Bay Curtain Coverings	68 of 75
	6.1.88	R6.88	Load Sensors on Hull	68 of 75
	6.1.89	R6.89	Escape and Evacuation Routes	69 of 75
	6.1.90	R6.90	Yokohama Fenders and Storage	69 of 75
	6.1.91	R6.91	Accommodation Ladders, Gangways and Pilot Ladders	69 of 75
	6.1.92	R6.92	Miscellaneous Outfitting Items	70 of 75
6.2			Scientific Spaces & Outfitting	Pgs 91
	6.2.1	R6.93	Science Hangar	1 of 91
	6.2.2	R6.94	Scientific Moonpool	3 of 91

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

		6.2.3	R6.95	Wet Laboratory	5 of 91
		6.2.4	R6.96	Deck Laboratory	6 of 91
		6.2.5	R6.97	Controlled Environment Laboratory	7 of 91
		6.2.6	R6.98	Core & Sample Chill Store	8 of 91
		6.2.7	R6.99	Main Laboratory	9 of 91
		6.2.8	R6.100	Clean Laboratory	9 of 91
		6.2.9	R6.101	Aerosol Laboratory	11 of 91
		6.2.10	R6.102	Atmospheric Science Laboratory and Stores	12 of 91
		6.2.11	R6.101	Dark / Photo Room	13 of 91
		6.2.12	R6.104	Salinometer Room	14 of 91
		6.2.13	R6.105	Uncontaminated Seawater Laboratory	14 of 91
		6.2.14	R6.106	Underway Instrumentation Control (UIC) Room for Scientific Control	15 of 91
		6.2.15	R6.107	Data Suite	16 of 91
		6.2.16	R6.108	Gravity Meter Room	17 of 91
		6.2.17	R6.109	Science Electronics Workshop and IT Workshop	17 of 91
		6.2.18	R6.110	Gas Bottle Store	18 of 91
		6.2.19	R6.111	Scientific Laboratory Structural and Outfitting Standards	19 of 91
		6.2.20	R6.112	Displays & Control Consoles	30 of 91
		6.2.21	R6.113	General Lighting and Bulkhead Penetrations	30 of 91
		6.2.22	R6.114	Server Room	30 of 91
		6.2.23	R6.115	Uncontaminated Seawater System	31 of 91
		6.2.24	R6.116	Scientific Low Pressure Compressed Air System	31 of 91
		6.2.25	R6.117	Scientific Cooling Water Systems	32 of 91
		6.2.26	R6.118	Scientific Hydraulic Systems	33 of 91
		6.2.27	R6.119	Science Hold & Stores	33 of 91
		6.2.28	R6.120	Scientific (walk in) Freezer.	34 of 91
		6.2.29	R6.121	Lifting Eyes	34 of 91
		6.2.30	R6.122	Sensor Junction Box Room	34 of 91
		6.2.31	R6.123	Science Laboratory / Stores	34 of 91
		6.2.32	R6.124	Science Office and Research Room	35 of 91
		6.2.33	R6.125	Other Store Rooms	35 of 91
		6.2.34	R6.126	Deck Workshop,	36 of 91
		6.2.35	R6.127	Rough Workshop,	38 of 91
				Scientific Spaces & Outfitting NERC Guidance	39 of 91
	6.3			Open Decks	Pgs 12
		6.3.1	R6.128	Aft Working Deck	1 of 12
		6.3.2	R6.129	"A" Frame & Science Crane Pedestals on the Aft Deck	3 of 12
		6.3.3	R6.130	Starboard Side Working Deck	3 of 12
		6.3.4	R6.131	Starboard Side CTD Handling	3 of 12
		6.3.5	R6.132	Coring Capability, Temporary Installation	3 of 12
		6.3.6	R6.133	Starboard Side Access & General Working Deck Bulwark Arrangements	4 of 12
		6.3.7	R6.134	Other Accommodation Open Decks	4 of 12

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

		6.3.8	R6.135	Access to Lifeboats, Liferrafts & Rescue Boats	5 of 12
		6.3.9	R6.136	Deck Coverings and Coating	5 of 12
		6.3.10	R6.137	Bolting Down Matrix	5 of 12
		6.3.11	R6.138	Wheelhouse / Observation Lounge Top (Open Deck)	6 of 12
		6.3.12	R6.139	Science Hangar Top	6 of 12
		6.3.13	R6.140	Container Slots	6 of 12
		6.3.14	R6.141	Container & Deck Services	7 of 12
		6.3.15	R6.142	Container Handling & Securing Twist Locks	8 of 12
		6.3.16	R6.143	Hydraulic Power Distribution System & Machinery Space	8 of 12
		6.3.17	R6.144	Not Used	10 of 12
		6.3.18	R6.145	High Pressure Air Piping Systems	10 of 12
	6.4			Power Generation, Machinery & Equipment	Pgs 50
		6.4.1	R6.146	Power Generation - General Requirements	1 of 50
		6.4.2	R6.147	Main Engine Rooms & Propulsion Motor Rooms	1 of 50
		6.4.3	R6.148	Main Power Generation	2 of 50
		6.4.4	R6.149	Machinery Arrangements	2 of 50
		6.4.5	R6.150	Diesel Engines	3 of 50
		6.4.6	R6.151	Automation & Control	4 of 50
		6.4.7	R6.152	Not Used	7 of 50
		6.4.8	R6.153	Torsional & Axial Vibration Calculations	7 of 50
		6.4.9	R6.154	Main Propulsion & Steering Systems	7 of 50
		6.4.10	R6.155	Power Management System	9 of 50
		6.4.11	R6.156	Dynamic Positioning Thrusters & Controls	10 of 50
		6.4.12	R6.157	Manoeuvring Thrusters	11 of 50
		6.4.13	R6.158	Emergency Power Generation	11 of 50
		6.4.14	R6.159	Harbour Power Generation	11 of 50
		6.4.15	R6.160	Winterisation Requirements	12 of 50
		6.4.16	R6.161	Auxiliary Boilers	12 of 50
		6.4.17	R6.162	Cooling & Waste Heat Recovery System	13 of 50
		6.4.18	R6.163	Central Fresh Water Cooling System	13 of 50
		6.4.19	R6.164	Sea Water Cooling System	15 of 50
		6.4.20	R6.165	Auxiliary Fresh Water Cooling Systems	16 of 50
		6.4.21	R6.166	Fresh Water Generators	16 of 50
		6.4.22	R6.167	Electro-Chlorination Unit	17 of 50
		6.4.23	R6.168	Sea Water Cooling Pumps	18 of 50
		6.4.24	R6.169	Bilge, Ballast, Fire and General Service Pumps	18 of 50
		6.4.25	R6.170	Chilled Water Compressor Cooling	19 of 50
		6.4.26	R6.171	Provision Room Machinery Cooling	19 of 50
		6.4.27	R6.172	Fuel Systems	19 of 50
		6.4.28	R6.173	Bunker Tanks	20 of 50
		6.4.29	R6.174	Diesel Oil (DO) Bunker and Transfer System	20 of 50
		6.4.30	R6.175	Bunker Stations Port & Starboard	21 of 50
		6.4.31	R6.176	Fuel Purifying and Filtering System	22 of 50

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

	6.4.32	R6.177	Separator Room	22 of 50
	6.4.33	R6.178	Fuel Oil Service System	22 of 50
	6.4.34	R6.179	Fuel Oil Overflow System	23 of 50
	6.4.35	R6.180	Lubricating & Hydraulic Oil Systems	23 of 50
	6.4.36	R6.181	Lubricating Oil Separators	24 of 50
	6.4.37	R6.182	Not Used	25 of 50
	6.4.38	R6.183	Domestic Fresh Water Systems	25 of 50
	6.4.39	R6.184	Fresh Water Tanks	26 of 50
	6.4.40	R6.185	Fresh Water Distribution System	26 of 50
	6.4.41	R6.186	Technical Fresh Water System	27 of 50
	6.4.42	R6.187	Domestic Hot Water System	27 of 50
	6.4.43	R6.188	Bilge System	28 of 50
	6.4.44	R6.189	Oily Bilge System	28 of 50
	6.4.45	R6.190	Sludge Pump	29 of 50
	6.4.46	R6.191	Sludge Tank	29 of 50
	6.4.47	R6.192	Ballast System	29 of 50
	6.4.48	R6.193	Ballast Water Treatment Plant	30 of 50
	6.4.49	R6.194	Ballast, Bilge and Gutter System	31 of 50
	6.4.50	R6.195	Air Pipe Systems for Tanks	31 of 50
	6.4.51	R6.196	Sounding Pipe Systems for Tanks	31 of 50
	6.4.52	R6.197	Fire & Wash Deck System	31 of 50
	6.4.53	R6.198	Sewage Systems (Black Water)	33 of 50
	6.4.54	R6.199	Waste Water Tanks	34 of 50
	6.4.55	R6.200	Sanitary Systems, Discharges and Drain System	35 of 50
	6.4.56	R6.201	Waste Water System (Grey Water)	35 of 50
	6.4.57	R6.202	Starting Air Systems	35 of 50
	6.4.58	R6.203	General Service Air Systems	36 of 50
	6.4.59	R6.204	Control Air Systems	37 of 50
	6.4.60	R6.205	Diesel Engine Exhaust Systems and Tier III for NOx and SOx	37 of 50
	6.4.61	R6.206	Incinerator	39 of 50
	6.4.62	R6.207	Lifting and Overhauling Gear	40 of 50
	6.4.63	R6.208	Name Plates	41 of 50
	6.4.64	R6.209	Sea Inlets	41 of 50
	6.4.65	R6.210	Engine or Engine Rooms Air Intakes	42 of 50
	6.4.66	R6.211	Tank Heating Coils	43 of 50
	6.4.67		Piping System – General Requirements	43 of 50
		R6.212	Pipes and Joints, General Requirement	43 of 50
		R6.213	Fittings, General Requirements	43 of 50
		R6.214	Materials for Piping	44 of 50
		R6.215	Piping System, General Requirements	48 of 50
6.5			Electrical Systems	Pgs 36
	6.5.1	R6.216	General	1 of 36
	6.5.2	R6.217	Electric Load Balance	3 of 36
	6.5.3	R6.218	Short Circuit Evaluation	3 of 36

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

	6.5.4	R6.219	Protective Device Co-ordination Study	4 of 36
	6.5.5	R6.220	Total Harmonic Distortion	4 of 36
	6.5.6	R6.221	Voltage Drop Analysis	5 of 36
	6.5.7	R6.222	Battery Sizing Calculation	5 of 36
	6.5.8	R6.223	Illumination Intensity Study	5 of 36
	6.5.9	R6.224	Power Supplies	5 of 36
	6.5.10	R6.225	Hybrid Electrical System	7 of 36
	6.5.11	R6.226	Alternators	9 of 36
	6.5.12	R6.227	Switchboards	9 of 36
	6.5.13	R6.228	Distribution Circuits	11 of 36
	6.5.14	R6.229	Controllers and Motor Control Centres	12 of 36
	6.5.15	R6.230	Transformers	13 of 36
	6.5.16	R6.231	Transformer for Main Power Distribution System	14 of 36
	6.5.17	R6.232	Transformer for 440V ROV system, 690V/440V	14 of 36
	6.5.18	R6.233	Transformer for 230V Main System	14 of 36
	6.5.19	R6.234	Emergency Lighting Transformers,	14 of 36
	6.5.20	R6.235	Galley Transformer	15 of 36
	6.5.21	R6.236	UPS Transformers	15 of 36
	6.5.22	R6.237	Welding Transformer	15 of 36
	6.5.23	R6.238	Propulsion Converters (Vfd Drivers) for Electrical Propulsion Motors	15 of 36
	6.5.24	R6.239	Power Converter Transformer for Propulsion	16 of 36
	6.5.25	R6.240	General Lighting	16 of 36
	6.5.26	R6.241	Lighting Wheelhouse.	17 of 36
	6.5.27	R6.242	Lighting Laboratories	18 of 36
	6.5.28	R6.243	Lighting Scientific Spaces	18 of 36
	6.5.29	R6.244	Lighting Cabins	18 of 36
	6.5.30	R6.245	Lighting Public And Amenity Rooms	18 of 36
	6.5.31	R6.246	Emergency Lighting	18 of 36
	6.5.32	R6.247	Floodlighting	19 of 36
	6.5.33	R6.248	Heli-deck Lighting	19 of 36
	6.5.34	R6.249	Lighting Control Panel	19 of 36
	6.5.35	R6.250	Shore Power Connection	19 of 36
	6.5.36	R6.251	Cabling	20 of 36
	6.5.37	R6.252	Machinery Control, Alarm and Monitoring System	20 of 36
	6.5.38	R6.253	Remote Diagnosis System	21 of 36
	6.5.39	R6.254	ECOMeter	21 of 36
	6.5.40	R6.255	Power Management System (PMS)	22 of 36
	6.5.41	R6.256	Mounting On Control Console	22 of 36
	6.5.42	R6.257	Audio Visual Alarms	22 of 36
	6.5.43	R6.258	Alarm Annunciator (VMS Output)	22 of 36
	6.5.44	R6.259	Pressure Sensors and Indicators	22 of 36
	6.5.45	R6.260	Engine Performance Monitoring	23 of 36
	6.5.46	R6.261	Vibration Monitoring System	23 of 36
	6.5.47	R6.262	Earth Fault Detection System	24 of 36

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

	6.5.48	R6.263	Batteries	24 of 36
	6.5.49	R6.264	UPS units	24 of 36
	6.5.50	R6.265	Battery Chargers	25 of 36
	6.5.51	R6.266	UPS Systems	25 of 36
	6.5.52	R6.267	Uninterruptible Power Supply (UPS) for DP, Computers and Navigation	26 of 36
	6.5.53	R6.268	Electrical Power and Lighting Systems for Laboratories	26 of 36
	6.5.54	R6.269	Scientific Laboratory Power Sockets	26 of 36
	6.5.55	R6.270	Electromagnetic Environmental Effects (E3)	27 of 36
	6.5.56	R6.271	Switchboard and Control Room	28 of 36
	6.5.57	R6.272	Engine Rooms	30 of 36
	6.5.58	R6.273	Methods of EMI Reduction	30 of 36
	6.5.59	R6.274	Laboratories	31 of 36
	6.5.60	R6.275	Container Laboratories	32 of 36
	6.5.61	R6.276	Bridge Equipment	32 of 36
	6.5.62	R6.277	Radio Communication Equipment	32 of 36
	6.5.63	R6.278	Equipment Earthing and Bonding (See IEC 61892-6, Clause 4)	33 of 36
	6.5.64	R6.279	Earthing of Exposed Conductive Parts (See IEC 61892-6, 4.2)	34 of 36
	6.5.65	R6.280	Science Power Cable and Ancillary Installations	34 of 36
	6.5.66	R6.281	Cabin Power Sockets	35 of 36
	6.5.67	R6.282	Equipment Name Plates and Markings	35 of 36
	6.5.68	R6.283	Measurement of Electromagnetic Interference	35 of 36
	6.5.69	R6.284	Measuring Equipment and Test Results	35 of 36
	6.5.70	R6.285	Conducted Interference	35 of 36
	6.5.71	R6.286	Radiated Emissions	35 of 36
	6.5.72	R6.287	Measurement Procedure	35 of 36
	6.5.73	R6.288	Schedule of Electric Sockets	36 of 36
6.6			Air Conditioning and Ventilation	Pgs 18
	6.6.1	R6.289	Air Conditioning Requirements	1 of 18
	6.6.2	R6.290	Noise	2 of 18
	6.6.3	R6.291	Thermal Insulation	3 of 18
	6.6.4	R6.292	Air Changes	3 of 18
	6.6.5	R6.293	Means of Cooling and Heating	4 of 18
	6.6.6	R6.294	Air Conditioning General Arrangements	4 of 18
	6.6.7	R6.295	Air Handling Unit (AHU) Serving Cabins And Wheelhouse	5 of 18
	6.6.8	R6.296	Air Handling Unit (AHU) Serving Mess, Recreation, Workshops and Technical Rooms	6 of 18
	6.6.9	R6.297	Air Handling Unit(AHU) Serving the Galley	7 of 18
	6.6.10	R6.298	Air Handling Unit(AHU) Serving the Laboratories	8 of 18
	6.6.11	R6.299	HVAC System Serving Helicopter Hangar, Cargo Holds and Scientific Hold	9 of 18
	6.6.12	R6.300	Chilled Water System	9 of 18
	6.6.13	R6.301	Chilled Water Pumps	10 of 18
	6.6.14	R6.302	Chilled Water Piping & Insulation	10 of 18

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

	6.6.15	R6.303	Ducting System	10 of 18
	6.6.16	R6.304	Fans	11 of 18
	6.6.17	R6.305	Fire Dampers	11 of 18
	6.6.18	R6.306	Not Used	11 of 18
	6.6.19	R6.307	Heating of Other Spaces	11 of 18
	6.6.20	R6.308	Ventilation and Heating of Specific Machinery Spaces General	12 of 18
	6.6.21	R6.309	Main Engine Room	12 of 18
	6.6.22	R6.310	Propulsion Motor Rooms	13 of 18
	6.6.23	R6.311	Auxiliary Machinery Rooms	13 of 18
	6.6.24	R6.312	Bow and Stern Thruster Rooms	14 of 18
	6.6.25	R6.313	Emergency Generator Room	14 of 18
	6.6.26	R6.314	Engine Room Stores	15 of 18
	6.6.27	R6.315	Incinerator / Boiler Room	15 of 18
	6.6.28	R6.316	Paint and Chemical Store	15 of 18
	6.6.29	R6.317	Engineering Workshop	15 of 18
	6.6.30	R6.318	Deck and Rough Workshop	15 of 18
	6.6.31	R6.319	UIC Room	15 of 18
	6.6.32	R6.320	Scientific Stores	15 of 18
	6.6.33	R6.321	Air Intakes / Discharges	15 of 18
	6.6.34	R6.322	Natural Ventilation	16 of 18
	6.6.35	R6.323	Cold Room Details	16 of 18
	6.6.36	R6.324	Refrigeration Machinery for Provision Rooms	17 of 18
	6.6.37	R6.325	Not Used	17 of 18
	6.6.38	R6.326	Refrigeration Machinery for Scientific Chill Room	17 of 18
	6.6.39	R6.327	Control and Automation	17 of 18
	6.6.40	R6.328	Remote Maintenance	17 of 18
	6.6.41	R6.329	ECO Notation Requirements	17 of 18
6.7			Ship's CCTV System	Pgs 5
	6.7.1	R6.330	Ship's CCTV System	1 of 5
	6.7.2	R6.331	Networked Maritime Surveillance System	4 of 5
6.8			Communications	Pgs 3
	6.8.1	R6.332	Internal Communications	1 of 3
	6.8.2	R6.333	Internal LAN	1 of 3
	6.8.3	R6.334	Business Computer Outfit	1 of 3
	6.8.4	R6.335	External Communications	2 of 3
6.9			Scientific Winch System	Pgs 21
	6.9.1	R6.337	Scientific Winch Systems	1 of 21
	6.9.2	R6.338	Special Features for Wires / Ropes	9 of 21
	6.9.3	R6.339	Winch Room	16 of 21
	6.9.4	R6.340	Winch Drive Room	16 of 21
	6.9.5	R6.341	General	17 of 21
	6.9.6	R6.342	Emergency Stops (E-stop)	17 of 21
	6.9.7	R6.343	Factory Acceptance Testing (FAT)	17 of 21
	6.9.8	R6.344	Test Rig Set-Up	18 of 21

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

		6.9.9	R6.345	Static Testing	18 of 21
		6.9.10	R6.346	Dynamic Testing	19 of 21
		6.9.11	R6.347	Harbour Acceptance Testing (HAT)	20 of 21
		6.9.12	R6.348	Sea Acceptance Testing (SAT) & Deep Sea Acceptance Testing (D-SAT)	21 of 21
	6.10			Overside Handling Equipment	Pgs 9
		6.10.1	R6.349	Over the Side Operating Requirements	1 of 9
		6.10.2	R6.350	Science Handling System – General Requirements	1 of 9
		6.10.3	R6.351	Hydraulic System Requirements	2 of 9
		6.10.4	R6.352	Hydraulic Power Pack	3 of 9
		6.10.5	R6.353	Hard Piping	3 of 9
		6.10.6	R6.354	Flushing	3 of 9
		6.10.7	R6.355	Greasing	4 of 9
		6.10.8	R6.356	Fixed Control Positions	4 of 9
		6.10.9	R6.357	General Requirements	4 of 9
		6.10.10	R6.358	Testing	4 of 9
		6.10.11	R6.359	Over-side Handling Requirements	5 of 9
		6.10.12	R6.360	Stern "A" Frame	5 of 9
		6.10.13	R6.361	CTD & Multipurpose Handling System	6 of 9
		6.10.14	R6.362	Scientific Moonpool Cursor	8 of 9
		6.10.15	R6.363	Starboard Side "A" Frame	8 of 9
		6.10.16	R6.364	Towing Booms	9 of 9
	6.11			Cranes	Pgs 18
		6.11.1	R6.365	General Lifting Requirements	1 of 18
		6.11.2	R6.366	Craneage Requirements	2 of 18
		6.11.3	R6.367	Pedestal Cranes (externally mounted) – Common Features	7 of 18
		6.11.4	R6.368	Gantry / Monorail / Hoists (mounted within an enclosed space)	9 of 18
		6.11.5	R6.369	Crane - Safety Case Analysis	11 of 18
		6.11.6	R6.370	Cargo Crane	11 of 18
		6.11.7	R6.371	Cargo Crane Performance	12 of 18
		6.11.8	R6.372	Science Crane	14 of 18
		6.11.9	R6.373	Science Crane Performance	14 of 18
		6.11.10	R6.374	Deck Service Cranes	15 of 18
		6.11.11	R6.375	Provision Stores Crane	15 of 18
		6.11.12	R6.376	Science Hangar	16 of 18
		6.11.13	R6.377	Helicopter Hangar Gantry Crane	15 of 18
		6.11.14	R6.378	Starboard Open Working Deck	
		6.11.15	R6.379	Lifts	15 of 18
	6.12			Cargo Tender, Workboat and Small Boats	Pgs 5
		6.12.1	R6.380	Cargo Tender	1 of 5
		6.12.2	R6.381	Workboat	3 of 5
		6.12.3	R6.382	5m General Purpose Inflatable Workboat	4 of 5
7				THE REQUIREMENTS of SCIENTIFIC SYSTEMS and EQUIPMENT	Pgs 27

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

	7.1		R7.1	Acoustic Doppler Current Profiler (ADCP)	1 of 27
	7.2		R7.2	Inertial Navigation Unit	1 of 27
	7.3		R7.3	Position, Heading and Attitude System	2 of 27
	7.4		R7.4	Switching Arrangement	2 of 27
	7.5		R7.5	Swath Bathymetry Systems Deep and Shallow	2 of 27
	7.6		R7.6	Sub-Bottom Profiler (1.5 - 7 kHz)	3 of 27
	7.7		R7.7	Scientific Echo Sounder	4 of 27
	7.8		R7.8	Biological Multi-Frequency Echo Sounder	4 of 27
	7.9		R7.9	Biological Multi-Beam Echo Sounder	5 of 27
	7.10		R7.10	Biological Multi-Beam Sonar	5 of 27
	7.11		R7.11	Omni-Directional Sonar	6 of 27
	7.12		R7.12	Ultra Short Baseline (USBL) Navigation System (Starboard)	7 of 27
	7.13		R7.13	Ultra Short Baseline (USBL) Navigation System (Port)	8 of 27
	7.14		R7.14	Synchronisation Unit	8 of 27
	7.15		R7.15	Net Monitor System	8 of 27
	7.16		R7.16	Air Sampling System	9 of 27
	7.17		R7.17	Clean Air Sampling Tubing and Cable Runs	9 of 27
	7.18		R7.18	Scientific Meteorological Instrumentation	10 of 27
	7.19		R7.19	HRPT Receiver	10 of 27
	7.20		R7.20	Hull Sea Surface Temperature Indicator	11 of 27
	7.21		R7.21	Scientific Display / Operation Consoles	11 of 27
	7.22		R7.22	Winch / CTD Operations Console	11 of 27
	7.23		R7.23	Scientific Winch Logging & Monitoring System	12 of 27
	7.24		R7.24	Scientific Wiring	12 of 27
	7.25		R7.25	Ship's Integrated Network System	13 of 27
	7.26		R7.26	Low Power Network	15 of 27
	7.27		R7.27	Gyro Inputs	15 of 27
	7.28		R7.28	Data Signals to the Server Room	16 of 27
	7.29		R7.29	Data Display System	16 of 27
	7.30		R7.30	Laboratory Gas Systems	16 of 27
	7.31		R7.31	Salinometers	17 of 27
	7.32		R7.32	Uncontaminated Sea Water Sampling Systems	17 of 27
	7.33		R7.33	Water Purification System	18 of 27
	7.34		R7.34	Transducer Cofferdams	18 of 27
	7.35		R7.35	Scientific Common Earth Systems	19 of 27
	7.36		R7.36	Spark Free Refrigerators	19 of 27
	7.37		R7.37	Freezer Units -20°C and -86°C	19 of 27
	7.38		R7.38	Liquid Nitrogen Generator	20 of 27
	7.39		R7.39	Laminar Flow Cabinet	21 of 27
	7.40		R7.40	Fume Cupboard	21 of 27
	7.41		R7.41	Fume Hood	21 of 27
	7.42		R7.42	Shipborne Wave Recorder (Radar)	22 of 27
	7.43		R7.43	Gravity Meter Unit	22 of 27

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

	7.44		R7.44	Co-ordinate Reference Point Survey	22 of 27
	7.45		R7.45	PAR Sensors on Science Mast	23 of 27
	7.46		R7.46	Air Temperature & Humidity	23 of 27
	7.47		R7.47	Small Survey ROV can be used for hull inspections	23 of 27
	7.48		R7.48	Fluorometer	23 of 27
	7.49		R7.49	Fast Repetition Fluorometry FRRF	24 of 27
	7.50		R7.50	Multi XBT Launcher	24 of 27
	7.51		R7.51	Expendable Bathythermograph (XBT) logging system	24 of 27
	7.52		R7.52	Fibre Optic Gyro	24 of 27
	7.53		R7.53	Seapath High Res GPS	24 of 27
	7.54		R7.54	Underway CTD	24 of 27
	7.55		R7.55	Ice Machine	24 of 27
	7.56		R7.56	Transducer & Hydrophones for Moorings	24 of 27
	7.57		R7.57	Transmissometer, CO ₂	24 of 27
	7.58		R7.58	Scintillation Counter X2	25 of 27
	7.59		R7.59	Not Used	25 of 27
	7.60		R7.60	Solar / IR Radiation	25 of 27
	7.61		R7.61	Radiometric SST Measurement	25 of 27
	7.62		R7.62	Visibility Sensor	26 of 27
	7.63		R7.63	Ozone	26 of 27
	7.64		R7.64	CO ₂ /CH ₄ /CO/H ₂ O	26 of 27
	7.65		R7.65	Black Carbon	26 of 27
	7.66		R7.66	Dedicated Sea Surface and Air Measurements of Trace Gases	26 of 27
	7.67		R7.67	Ceilometer:	26 of 27
	7.68		R7.68	Precipitation	26 of 27
	7.69		R7.69	pCO ₂ System	27 of 27
	7.70		R7.70	Shipborne Wave Recorder Hull	27 of 27
8				Provisions for Scientific Equipment	Pgs 37
	8.1		R8.1	ROV Integration	1 of 37
	8.2		R8.2	Autosub Integration	12 of 37
	8.3		R8.3	DASI Equipment Support Systems	18 of 37
	8.4		R8.4	Quadcopters and Fixed Wing UAV for Science and Ice Reconnaissance	18 of 37
	8.5		R8.5	Moving Vessel Profiler (MVP) .	19 of 37
	8.6		R8.6	Underway (VMP) Vertical Microstructure Profiler	19 of 37
	8.7		R8.7	Research Vessel Data Acquisition System / Scientific Computer System	20 of 37
	8.8		R8.8	Incubators	21 of 37
	8.9		R8.9	Onboard CTD	21 of 37
	8.10		R8.10	LADCP (onboard x4)	21 of 37
	8.11		R8.11	STCM (Onboard fixed magnetometer)	21 of 37
	8.12		R8.12	Aquarium Container	21 of 37
	8.13		R8.13	Aquarium Transport Container	21 of 37
	8.14		R8.14	Piston Corer 42m+ Capability	22 of 37

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

	8.15		R8.15	Dredging Equipment	24 of 37
	8.16		R8.16	Atmospheric Pressure	24 of 37
	8.17		R8.17	Winds	24 of 37
	8.18		R8.18	Freezing Rain and Detection of Icing Conditions	25 of 37
	8.19		R8.19	Dew Point	25 of 37
	8.20		R8.20	All Sky Camera	25 of 37
	8.21		R8.21	Turbulent Flux System	25 of 37
	8.22		R8.22	Lidars	26 of 37
	8.23		R8.23	Microwave Radiometers	26 of 37
	8.24		R8.24	Cloud Radar	26 of 37
	8.25		R8.25	Precipitation Radar	27 of 37
	8.26		R8.26	Whole Air Sampler (WAS)	27 of 37
	8.27		R8.27	Radisondes	27 of 37
	8.28		R8.28	Bulk Aerosol Filter Sampler	27 of 37
	8.29		R8.29	Sealed Microbial Culture Vessels	28 of 37
	8.30		R8.30	Rockdrill Integration	28 of 37

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 1 – INTRODUCTION

1. INTRODUCTION

This document contains:

- The objectives of the Statement of Requirements (Section 2)
- An explanation of the signposting and structure used in the SoR (Section 3)
- The purpose of the New Polar Research Vessel (NPRV), covering the basic operational concepts, the scientific working environment and the approach used for maintenance and support (Section 4)
- A description of the NPRV requirements to provide an efficient and effective platform to conduct scientific experiments, carry cargo and logistic support (Section 5).
- The requirements of the NPRV & ship systems, scientific systems, scientific equipment, logistics systems and equipment that need to be provided by the Contractor as part of the contract (Sections 6, 7 & 8).

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 2 – THE OBJECTIVES & CONTEXT OF THE STATEMENT OF REQUIREMENTS

2. THE OBJECTIVES & CONTEXT OF THE STATEMENT OF REQUIREMENTS

2.1 OBJECTIVES

The objectives of the Statement of Requirements (SoR) are:

- To provide the Contractor with contextual information relating to the procurement of the NPRV and how it will be operated and supported through its life. This information is to be used by the Contractor when understanding and interpreting the requirements.
- To set down the mandatory requirements for the NPRV.
- To define how NERC will accept the NPRV.
- To define the consequences of non-compliance.
- To provide sufficient guidance and information to help the Contractor prepare a suitable offer and to deliver the NPRV.

2.2 CONTEXT of the SoR

The SoR is an Output Specification

The SoR provides an 'Output Specification' for the contract. Section 4 of the SoR provides a description of the purpose of the NPRV and **the Contractor must deliver a solution that is fit for that purpose.**

NERC require the Contractor to provide a NPRV that is:

- Complete and ready for sea in every respect.
- Fit for purpose as described in the SoR.
- Capable of providing a cost-effective, safe, flexible, and reliable platform appropriate to the next 30 years of marine science.

The Contractor will carry all the risks of ship delivery.

The Contractor shall carry all the risks associated with the delivery of the ship, covering the areas of design, equipment and system procurement, build, test, commission, acceptance and handover. NERC requires the Contractor to apply the appropriate best practice techniques and approach to satisfy the requirements. However, where there is a conflict between different NERC requirements that cannot be resolved by the application of best practice techniques and methods, then **the Contractor must establish the nature and impact of the conflict and inform NERC before any consequential costs are incurred.** NERC will advise the Contractor of how it intends to resolve the conflict.

Affordability

NERC has budget limitations and the total project must be delivered within its allocated budget. Therefore NERC will need to analyse the information provided in the prospective Contractors' bids to determine the range of options proposed and establish, prior to letting the contract, a baseline scope of supply that is affordable.

To support NERC with this analysis, the prospective Contractors are requested to provide details of the price make-up within their Bid response, and to indicate clearly where options exist to vary the price, so that NERC can set a final scope of supply that matches its budget.

Affordability will be a continuous theme throughout the contract and will need to account for:

- The requirements to minimise whole-life costs

**New Polar Research Vessel (NPRV)
Statement of Requirements (SoR) Section 2**

- The need for a flexible, effective and efficient approach to install and hook-up to existing NPRV services the new scientific systems and equipment that will be needed for future science.

Availability, Reliability and Maintainability and with "Through Life Costs" the main focus

Availability is the probability that the system is operating satisfactorily at any time, and it depends on the reliability and the maintainability. Hence the study of probability theory is essential for understanding the availability, reliability and maintainability, of the system.

Reliability is the probability that an engineering system will perform its intended function satisfactorily (from the viewpoint of the customer) for its intended life under specified environmental and operating conditions.

Maintainability is the probability that maintenance of the system will retain the system in, or restore it to, a specified condition within a given time period.

Creative solutions

The SoR is intended to encourage the Contractor to use innovative thinking and produce ship solutions that support cutting edge scientific research and logistics capability. Cost-effectiveness, flexibility, safety and reliability of the NPRV must be at the heart of any solutions proposed for the ship design. The Contractor must be able to demonstrate that this is the case in the bid.

2.2 NON-COMPLIANCE

A series of escalating measures apply to non-compliance of the Contractor's solution with the NERC requirements. These cover liquidated and ascertained damages (LDs) set at a level by NERC to encourage compliance by the Contractor. If the non-compliance is beyond the limits of acceptance by NERC, then the ultimate penalty will be rejection of the NPRV. The contract agreement includes reference to the schedule of LDs that defines the size of LDs according to the level of non-compliance and also the conditions whereby NERC will reject the ship.

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 3 – THE STRUCTURE OF THE STATEMENT OF REQUIREMENTS

3. THE STRUCTURE OF THE STATEMENT OF REQUIREMENTS

3.1 CONTRACTOR'S UNDERSTANDING AND INTERPRETATION

If prospective contractors, in the preparation of their bids, have any doubts as to the interpretations of this document and its attachments, it is essential that they contact NERC for clarifications. The ultimate aim is for all the Bids received to reflect as far as possible the needs of NERC. Free and frank discussions and exchanges of ideas will be encouraged.

If the Contractor adopts any of the solutions illustrated by the information provided with this Statement of Requirements, or any clarifications, advice or guidance given by NERC or its representatives during bidding, or subsequently during the Contract, and any such information given during contract, then it will be deemed to have accepted full responsibility for the viability of those solutions under the Terms of the Contract.

The provision of guidance, drawings, information, clarifications and advice does not remove from the Contractor its responsibility to ensure that its Bid is complete in every way to the requirements of NERC and the Classification and Surveying Authorities.

Furthermore the provision of guidance, drawings, information, clarifications and advice does not remove from the Contractor the responsibility to design, build and deliver a ship complete in every way to the requirements of NERC and the Classification and Surveying Authorities.

3.2 CONVENTIONS USED in the SoR

The following conventions are used within the SoR:

- **Mandatory Requirements**

These are depicted in **bold** text and each has a unique reference number – **Rn.1**, **Rn.2**, etc, where **n** refers to the section in the SoR in which the requirement is defined. Each requirement is described in a 'requirement / acceptance' table within Schedule M1 - Testing and Acceptance.

For an example, see 'Acceptance Criteria' below

- **Notes**

The notes section provides the Contractor with an aid to interpretation of the NERC requirements.

- **R3.1 Acceptance Criteria**

The acceptance criteria that will be used by NERC to test whether its mandatory requirements have been satisfied are indicated in tabular form and shown in the Statement of Management Requirements.

The abbreviations used in the column headings have the following meanings:

- SCA Statutory and /or Classification Approval
- DI NERC will conduct a Design Inspection to gain confidence that the appropriate mandatory requirement can be satisfied. This will include but not be limited to: reviews that reference and check conformance with the baseline design specification agreed as part of the contract; subsequent agreed changes; drawing reviews; plan inspections; purchase specifications; purchase technical specifications.

**New Polar Research Vessel (NPRV)
Statement of Requirements (SoR) Section 3**

- Mo NERC will require the Contractor to arrange for suitable model testing (physical and computational models) and/or simulation trials to be undertaken as part of the contract. The scope and detail of such testing is to be agreed between the Contractor and the NERC at least 2 weeks prior to commencement of such testing
- FAT NERC will require the Contractor to arrange for suitable factory acceptance tests to be undertaken as part of the contract, including statutory inspections and statutory approvals where appropriate. The scope and detail of such testing is to be agreed between the Contractor and the NERC at least 2 weeks prior to commencement of such testing.
- II NERC will conduct an Installation Inspection and appropriate in situ testing to gain confidence that the appropriate mandatory requirement can be satisfied, and that statutory inspections and statutory approvals have been satisfied where appropriate.
- HAT NERC will require the Contractor to arrange for suitable harbour acceptance tests to be undertaken as part of the contract, including statutory inspections and statutory approvals where appropriate. The scope and detail of such testing is to be agreed between the Contractor and the NERC at least 2 weeks prior to commencement of such testing.
- SAT NERC will require the Contractor to arrange for suitable sea acceptance tests to be undertaken as part of the contract, including statutory inspections and statutory approvals where appropriate. The scope and detail of such testing is to be agreed between the Contractor and the NERC at least 2 weeks prior to commencement of such testing.
- D- SAT NERC will require the Contractor to arrange for suitable deep water sea acceptance tests to be undertaken as part of the contract, including statutory inspections and statutory approvals where appropriate. The scope and detail of such testing is to be agreed between the Contractor and the NERC at least 2 weeks prior to commencement of such testing.
- IST NERC will require the Contractor to arrange for suitable ice acceptance tests to be undertaken as part of the contract, including statutory inspections and statutory approvals where appropriate. The scope and detail of such testing is to be agreed between the Contractor and the NERC at least 2 weeks prior to commencement of such testing.
- NR NERC will require the Contractor to arrange for suitable noise ranging tests to be undertaken as part of the contract, including statutory inspections and statutory approvals where appropriate. The scope and detail of such testing is to be agreed between the Contractor and the NERC at least 2 weeks prior to commencement of such testing.
- A NERC will conduct an audit to ensure that all previous acceptance criteria for a mandatory requirement have been satisfied and any appropriate Statutory and / or Classification Approval documentation is in place before a later one has been accepted by NERC. In the case of a system or sub-system, the audit will also check that all acceptance criteria have been satisfied for the component parts.

The presence of a '√' alongside a mandatory requirement indicates that the specific acceptance criterion applies. Acceptance will be progressive and will be done as early as possible in the ship delivery project. The detailed acceptance test requirements will be established prior to contract signing.

**New Polar Research Vessel (NPRV)
Statement of Requirements (SoR) Section 3**

- **Non Compliance**
Where there is non-conformance with the acceptance criteria, then the ship may be rejected by NERC if the non-conformance is serious, otherwise liquidated and ascertained damages (LDs) may apply. These are listed in the 'schedule of liquidated and ascertained damages' given in the Contract documentation. The schedule will be referenced as part of the Contract Agreement.
- **Guidance and Information**
Guidance and information to help the Contractor compile a bid is shown in Section 4. This reflects the particular needs of BAS operation/logistics, UK scientific community and the experience and requirements of the ship operators BAS. The information is provided to help the Contractor understand the context of the requirements and to provide advice on accepted best practice.

3.3 R3.2 OVERALL REQUIREMENT

The Contractor will supply a ship:

- **Complete in every respect and ready for sea**
- **That is in compliance with all applicable Rules and Regulations in force or published at Contract signature or in force at "delivery and interim acceptance".**
- **Before the 27th June 2018.**
- **By the agreed date in the Contract.**

Anything not mentioned in this SoR but which is necessary for the proper working of the ship is nevertheless to be supplied by the Contractor without extra charge.

3.4 SoR STRUCTURE

The NERC requirements (Sections 5, 6, 7 and 8) are expressed in a structure that mirrors closely the Product Breakdown Structure (PBS) for the ship. The requirements are listed against the main functional systems and further divided into the constituent subsystems.

3.5 THE CONCEPT GENERAL ARRANGEMENT

The Concept General Arrangement provided with this Statement of Requirements is for guidance only and cannot be relied upon in the event of the Contractor's final design not being compliant with the Contract.

The Concept General Arrangement was developed to test the general requirements primarily against size and volume envelopes essentially in a geometric manner. The length, breadth and depth shown indicate that the desired arrangement should be able to be accommodated within those proportions.

The dimensions also reflect a need to balance the requirements of stability and desired deck areas against the needs of cargo capacity, fuel economy, seakeeping and of prime importance the suppression of turbulence and bubble sweepdown which could have a substantial effect on the performance of hull mounted transducers and associated acoustic equipment.

The Concept is not a promotion of a particular approach. It serves only to illustrate the principles of the desired arrangement.

3.6 PROCUREMENT AND RESPONSIBILITIES FOR COMPLIANCE

Contractor's responsibility

The Contractor is required to take full responsibility for the ship, ship systems and equipment meeting NERC's requirements. The same applies to the scientific equipment procured, installed and tested as part of the contract.

EXEMPLARS

To assist the Contractor in the choice of some specific systems and equipment, NERC has indicated in a number of cases, the supplier (and/or model number) of a system or equipment that NERC believes would provide a suitable solution to its requirements. These are prefixed by the term '**EXEMPLAR**'. Note that in proposing an **EXEMPLAR** as a likely option, NERC has taken account of its requirements for:

- Meeting the scientific requirements – any alternative would need to have a specification and track record of satisfactory performance at least as good as that of the **EXEMPLAR**
- Minimum whole-life costs:
 - ❖ High levels of reliability of the systems and equipment
 - ❖ Proven in service
 - ❖ Features to minimise maintenance and support costs
 - ❖ Commonality of systems and equipment across the NERC fleet of ships
 - ❖ Availability of spare parts at global locations
- Maximum flexibility and low susceptibility to obsolescence.

The Contractor is free to use the **EXEMPLAR** option or an alternative in order to meet the NERC requirement. However, **where the Contractor chooses to use an alternative, then the Contractor shall satisfy NERC that each of the points listed above, in totality, are at least as good as the EXEMPLAR.**

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 4 – THE PURPOSE OF THE SHIP

4. THE PURPOSE OF THE SHIP

This Section describes the use of the ship, its operation and the way in which it is supported and maintained. **The Contractor will deliver a ship to Natural Environmental Research Council (NERC) that is fit for the purpose as described in this section. The Contractor must interpret this Statement of Requirements (SoR) strictly in commercial terms based upon modern first-class Western European shipbuilding standards.**

4.1 BACKGROUND

The existing **R.R.S. James Clark Ross** was delivered to British Antarctic Survey (BAS) of NERC in 1991 to carry out primarily scientific research with a logistics capability and **R.R.S. Ernest Shackleton** has been bare boat chartered by BAS to carry out logistics support to UK Antarctic Research Stations and limited science research capability.

Owing to the age of these vessels, it is necessary to replace the capabilities of both ships by June 2018. The new ship will be owned by NERC and operated by BAS.

4.2 NEW SHIP TYPE, ROLE AND SCIENTIFIC USER DISCIPLINES

4.2.1 Type

The ship will be dual purpose:

- Providing a platform to support scientific experiments.

For which the primary scientific users of the ship will be BAS along with UK universities and research institutions. Some specialist commercial charters may also be carried out. The ship will become part of the pool of international ships that barter ship time. European nations and the USA will be regular users and participants in joint tasks.

- Providing logistical support to the UK's Antarctic research stations.

As such the vessel is to be capable of operating safely in Antarctic waters, to transport cargo and personnel from the United Kingdom and South Atlantic ports to the BAS stations in Antarctica and to discharge cargos without port assistance of craneage.

The ship will support the needs of UK science community and will carry out a variety of scientific tasks for the following disciplines:

- Marine Geology.
- Marine Geophysics.
- Marine Chemistry.
- Marine Physics.
- Marine Biology.
- Atmospheric Science.

The vessel will be a dynamically positioned, Polar Research Vessel, designed for unrestricted worldwide operation: in the Polar Regions, transit to and from the UK and operate in tropical conditions.

The vessel will be designed to incorporate the following key features:

- Scientific winch system with a proven robust design.

**New Polar Research Vessel (NPRV)
Statement of Requirements (SoR) Section 4**

- Efficient hull form optimised to minimise the Underwater Radiated Noise (URN), occurrence bubble sweepdown, reduce propulsive power at service speed, whilst also providing good seakeeping performance. Ice breaking capability - up to 1m thick at 3 knots.
- Minimum surface area for ice accretion.
- Environmental protection of equipment.
- De-icing facilities where necessary.
- Ease of mobilisation and demobilisation.
- Self Sufficient craneage.
- Flexible cargo holds with tween decks configured for efficient stowage of containers and cargo.
- AVTUR Bulk Cargo Tanks (flash point 38 deg C).
- Dynamic positioning.
- Flexible working spaces.
- Scientific Moonpool, with closing doors top and bottom.
- Helicopter capable, including the provision of hangar and refuelling.
- Maximum protection of working areas.
- Reliability and redundancy in propulsion and essential safety systems.
- Minimum maintenance.
- Efficient use of energy.
- Speed and economy in transit.
- Minimum environmental impact. Including provision for compliance with NOx requirements and Environmental requirements of the POLAR code and the Antarctic Treaty.

**New Polar Research Vessel (NPRV)
Statement of Requirements (SoR) Section 4**

4.2.2 Vessel Configuration

The ship design configuration will be influenced by the following considerations:

Feature	Considerations
Low URN	DNV Silent R.
Ice Capability	PC4, Ice breaking capability - up to 1m thick at 3 knots.
Accommodation block	Position is not critical - comfort is the primary consideration.
	Crew and scientists cabins to be separate from public areas.
	Cabins for both crew and scientists to have natural light.
	Efficient arrangement of catering spaces, provisions stores and waste management.
Heli-deck	Position to be adjacent to the helicopter hangar.
	Obstruction free.
	Infrequent use.
	The helideck will accommodate a SAR helicopter (e.g. Sikorsky S-92).
Helicopter hangar	To accommodate two small helicopters, Eurocopter AS365 N3 or similar. Secondary use for containerised laboratories / light cargo / stores.
Heli-deck and hangar deck	CAA compliant.
Cargo hold space	In reach of the main ship's crane. Easy access for movement of cargo to the heli-deck for VERTREP operations. Stowage of aviation fuel in drums including fire detection & extinguishing arrangements.
	Flexible internal handling systems for cargo in the hold spaces.
Working deck	Direct access for working over the stern, over the side or through the moonpool, using common transfer systems.
	May be partially enclosed.
	Open in way of key equipment, such as corer.
	Safe working deck for operation at sea.
Deck cargo	In reach of the ship's cargo crane.
Dynamic Positioning	DP2 (DP(AA)) capable.
Cargo Tender	The cargo tender will be located in a suitable position that will allow safe deployment and recovery. The Cargo Tender will carry a 20ft ISO container and have space to open the doors for discharge to the shore.
Starboard side "A" Frame	To allow deployment and recovery of scientific packages from the hangar and over the side.
Starboard side CTD gantry	To allow deployment and recovery of scientific packages from the hangar and over the side.
Survey towing winch/A frame	Arranged for over the stern deployment.
Lifeboats	Size for the full ship's complement in each boat port and starboard.
Rescue boats	Fast rescue boat required port and starboard.
Laboratories	Direct access to the scientific hangar.
Subsea survey	Transducers / transceivers mounted behind titanium plate "ice windows" flush with the shell plating in optimum position to minimise bubble sweep-down effects and prevent ice damage to the sensors.
Scientific Moonpool	Close to midships to minimise motion to allow enhanced operability.

**New Polar Research Vessel (NPRV)
Statement of Requirements (SoR) Section 4**

HVAC	Air conditioning systems will be required to handle the extremes of both the Antarctic and tropical conditions in transit. Redundancy will be incorporated into the system.
Aviation fuel bulk tanks	Restrictions on surrounding spaces.
	Ventilation requirements.
	Fire fighting requirements.
	Consider deep tanks for minimum impact on decks above.
	Pump Room above.

4.2.3 Role

The role of the ship is to support the activities of the BAS in the Polar Regions. The primary roles for the ship are considered as follows:

- Polar research.
- Logistic support to the UK's Antarctic research stations

Secondary roles are as follows:

- Search & rescue with helicopter capability.
- Emergency Response.
- Collaborative support to other agencies operating in Polar Regions.
- Alternative deployment in the Austral winter (up to 120 days).

4.2.4 Dynamic Positioning (DP) Description

DP capability will be determined by installation of a balance of forward and aft thruster capacity.

Bollard pull is to be determined by calculation of the available thrust resulting from the above powering requirement.

The vessel is to be dynamically positioned to IMO Class 2. All systems are designed and installed to ensure that adequate redundancy is maintained and that no single failure will result in a loss of propulsion/position keeping.

The DP system is to maintain a position in deep water and track follow subsea devices, such as ROVs. Position reference systems should reflect this purpose.

The DP system should include programmes customised to suit the purpose and optimised for maximum fuel efficiency when simply maintaining a position should be undertaken. This effectively downgrades the distance the ship is permitted to drive off and increase the time to regain its set position, avoiding rapid changes and surges in power demand. The system can also be switched to more accurate position keeping mode.

The ship will have combined control positions in the navigating bridge.

The DP control station is located on the bridge. The bridge will be a combined navigation control centre and engine control centre containing remote control stations for all engine rooms, thruster rooms, cargo and ballast pumping.

**New Polar Research Vessel (NPRV)
Statement of Requirements (SoR) Section 4**

4.2.5 Operational Parameters

- Range - 19,000 nm. at 13knots (plus 10% margin of fuel remaining).
- Accommodation for crew plus 60 scientists / supernumeraries, up to 90 persons onboard.
- Provisions - capacity for 180 days endurance with full complement.

4.2.6 Propulsion and Manoeuvring

The various modes of operation are identified as follows, together with the expected operating time in each mode. This is based on a typical single round voyage per annum from the UK to the Antarctic Region for logistic support and research.

Operating mode	Days of operation (rounded)	Proportion of time in each mode of operation	Power	Design Driver
Free running in clear water	82	23%	Power for Transit at 13knots,	Fuel efficiency
Transit with risk of ice	30	8%	1/3 of time using full propulsion power for transit at 3knots through 1m ice. Remaining 2/3rds of time using propulsive power to transit through 0.5m ice at 4knots.	Bollard Pull
Alongside in port	49	13%		Internal noise / external airborne noise & pollution
Cargo transfer (at Research stations) at anchor or DP	23	6%		Internal noise
Research, comprising <ul style="list-style-type: none"> • 80% at ~ 11knots acoustic survey / relocation • 10% at 6 - 8 knots towing devices • 10% stopped/DP mode for deployment/recovery of over the side devices 	154	42%	Propulsive power for survey speed	External Underwater Radiated Noise & internal noise for crew comfort
Shore power (in repair yard)	21	6%		
Other	6	2%		

The power generation, propulsion and manoeuvring systems will be designed for best overall efficiency.

New Polar Research Vessel (NPRV) Statement of Requirements (SoR) Section 4

The nature of the service and remote operating areas should be considered to require a fully redundant power generation system, involving at least two engine rooms. Alternative back-up propulsion systems may also be considered.

The propulsion and manoeuvring systems are to be arranged and installed to provide maximum fuel economy consistent with the operating profile, indicated in the above table.

The ship will be installed with a diesel electric power plant comprising main diesel generator sets with two main switchboards located in totally independent machinery spaces and switchboard rooms.

As far as practical the power generation system shall be arranged for operation with a single engine running, reliable battery back-up to meet the power demand pending a standby generator being starting and brought on line, meeting the electrical load demand. For operation in quiet modes sufficient back-up shall be provided to meet the same noise criteria in case of failure of a main engine and thus allow scientific work to continue.

Sufficient thruster capacity is to be fitted for position keeping and manoeuvring and provide the required redundancy.

The thrusters/propellers are configured for independent and integrated operation with the dynamic positioning control system. The aft main propulsion is also configured to be operated in free running mode for course keeping via the steering control system.

Powering for propulsion and manoeuvring will be determined by the following:

- Free running speed
- Ice breaking.
- Berthing in cross wind of up to 30 knots, gusting 40 knots on the beam

Redundancy is to be provided throughout the essential propulsion and generating systems, but with acceptance of loss of performance in case of single failure. In the case of the worst single failure the ship will still have manoeuvrability to navigate in ice.

4.2.7 Cargo Capacities

The ship is to be self-sustaining with respect to cargo handling using the ship's main cargo crane with SWL of 50t.

Cargo stowage is required for general supplies and food, including 20 standard ISO 20ft cargo containers and vehicles. Containerised cargo will be stowed partly in the cargo hold and partly on deck. General cargo/containers will also be stowed in the holds.

Cargo Volumes

- Net Cargo Hold volume 2,180m³
- Capable of stowage of up to 2000 nos. 208 litre drums of aviation fuel (AVTUR with flash point 38⁰C)
- Bulk Aviation Fuel tanks volume (Cargo) 660m³ (AVTUR with flash point 38⁰C).

**New Polar Research Vessel (NPRV)
Statement of Requirements (SoR) Section 4**

Cargo Deadweight

- 1000t of Cargo distributed in the hold and on deck
(Note the weight of Aviation Fuel Drums is included in this figure)
- Bulk Aviation Fuel 545t

Cargo and Science deadweight required to be carried at the 7m design draught.

Services outlets will be required on deck to support portable laboratories, science equipment and refrigerated cargo containers, in cargo holds and in the helicopter hangar.

4.2.8 Complement

Accommodation is required for:

• Marine crew	28
• Scientists / Personnel in transit	60
• <u>Additional Personnel</u>	<u>2</u>
Total	90

Accommodation standard should be considered as contemporary Western European standard.

Communal mess arrangements, allowing some flexibility of catering service is required.

4.2.9 Redundancy in Propulsion and Essential Services

Considering operation in the Antarctic waters remote from potential assistance, the vessel is to be designed with redundancy inherent in the design sufficient to allow the vessel to navigate to a safe port in the event of a fire or flooding damage.

The main propulsion and steering systems will be configured such that, in the event of a single failure in equipment, the ship will retain not less than 50 per cent of the installed prime mover capacity and not less than 50 per cent of the installed propulsion systems and retain steering capability. With the exception of a failure, such as fire or flood in one propulsion motor room the reduced power shall remain available to both port and starboard shaft lines. This will allow the vessel to retain full operational capability except for ice breaking mode.

This will be achieved by installing the propulsion and steering arrangements in separate compartments such that, in the event of the loss of one compartment, due to fire or flooding damage the ship will retain availability of propulsion power and manoeuvring capability.

Redundancy will be provided in the following auxiliary systems:

- Communication
- Power generation
- Heating and ventilation
- Boilers
- Water production
- Food preparation, for example using Pantry.
- Grey and black water

**New Polar Research Vessel (NPRV)
Statement of Requirements (SoR) Section 4**

However as the vessel is not a passenger ship. The safe return to port notation is not required. Early stage design support, an overall assessment of all essential systems and a detailed assessment of critical systems should be sought from the Classification Society.

4.2.10 Ice Breaking Capability

The ice breaking capability will be in accordance with PC4 to permit the following operations:

- Mainly first year ice.
- Limited multi-year ice.
- Some ice ridges.
- Accidental ramming only.
- 3kn through 1m thick ice.

4.2.11 Winterisation / De-icing

IMO Guidelines aim at mitigating the additional risk imposed on shipping due to the harsh environmental and climatic conditions existing in polar waters.

Cold temperatures may reduce the effectiveness of numerous components of the ship, ranging from deck machinery and emergency equipment to sea suction. When ice is present, it can impose additional loads on the hull, propulsion system and appendages.

The Antarctic sea ice retreats significantly during the summer season or is dispersed by permanent gyres in the two major seas of the Antarctic: the Weddell and the Ross. Thus, there is relatively little multi-year ice in the Antarctic. Conversely, Arctic sea ice survives many summer seasons, and there is a significant amount of multi-year ice. Whilst the marine environments of both polar seas are similarly vulnerable, response to such challenge should duly take into account specific features of the legal and political regimes applicable to their respective marine spaces.

The Guidelines for ships operating in polar waters are intended to address those additional provisions deemed necessary for consideration beyond existing requirements of the SOLAS and MARPOL Conventions, in order to take into account the climatic conditions of polar waters and to meet appropriate standards of maritime safety and pollution prevention.

The Guidelines recognize that this is best achieved by an integrated approach, based on requirements in existing Conventions which cover the design, outfitting, crewing and operation of ships for the conditions which they will encounter.

The Guidelines take into account that Arctic and Antarctic conditions may include sea and glacial ice that can represent a serious structural hazard to all ships.

The Guidelines address the fact that the polar environment imposes additional demands on ship systems, including navigation, communications, life-saving appliances, main and auxiliary machinery, environmental protection and damage control, etc. They emphasize the need to ensure that all ship systems are capable of functioning effectively under anticipated operating conditions and provide adequate levels of safety in accident and emergency situations. Refer to the Enhanced contingency planning guidance for passenger ships operating in areas remote from SAR facilities (MSC.1/Circ.1184).

New Polar Research Vessel (NPRV) Statement of Requirements (SoR) Section 4

The basic requirements for structure, stability and subdivision, machinery, life-saving appliances, fire protection, ship routing, navigation systems and equipment, radio communication, pollution prevention equipment, liability and safety management systems, as applicable to the different types and sizes of ships which may undertake voyages in polar waters, are obtained from the relevant Conventions.

Winterisation features are to mitigate the additional risk imposed on shipping due to the harsh environmental and climatic conditions existing in polar waters.

The Guidelines, recognizing the sensitive nature of polar waters, have the intention of providing high standards of environmental protection to address both accidents and normal operations.

4.3 SCIENTIFIC SYSTEMS AND EQUIPMENT

Scientists use a mixture of systems and equipment that is:

- Already on board the ship as an integral part of the ship's systems
- Purpose-built, pre-assembled and ready for operation. It is shipped to the port of embarkation and joins the ship with the scientific team
- Owned by one of the teams of scientists undertaking the cruise who may wish to deploy its own scientific equipment and systems
- Part of the existing equipment in the National Marine Equipment Pool that is deployed specifically for the period of a particular cruise.

In all cases where equipment is brought on to the ship as part of a cruise, it is essential that efficient and effective mechanisms exist to enable the equipment to be placed on board, installed, hooked-up to the ship's services, integrated into the scientific and ship's systems and made ready for experiments as quickly as possible using the following, but not limited to, types of equipment:

- CTD Handling.
- Subsea coring.
- Over the side handling of scientific equipment.
- Subsea Acoustic survey.
- Seismic survey.
- Meteorological mast.
- Space for portable laboratories.
- Data Acquisition / Storage

For example, packages of scientific equipment will need to be lowered precisely to the seabed up to 9000m. Towing operations will be carried out with 12,000m of wire deployed.

The ship will be required to support other developing pieces of scientific equipment such as unmanned seabed laboratories (Landers) and data gathering buoy systems. The work will involve scientific operations that require either direct retrieval of deployed equipment or interventions using Remotely Operated Vehicles (ROVs). The requirement to perform a maintenance and retrieval role for scientific equipment already deployed in the field is expected to increase.

**New Polar Research Vessel (NPRV)
Statement of Requirements (SoR) Section 4**

The ship will also be required to act as a mother ship for Autonomous Underwater Vehicles (AUVs), Unmanned Aerial Vehicles (UAVs) as well as large ROV packages.

4.4 OPERATIONAL LOCATIONS & LOGISTICS

The vessel will be capable of operating safely and effectively on an unrestricted worldwide basis from Polar Regions to equatorial regions including the highest air / water temperature regions (e.g. The Red Sea). Transits of Suez Canal and Panama Canal will be required.

4.4.1 Logistics and Cargo Requirements

The vessel will be required to have dry cargo hold space, deck space and bulk tanks for aviation fuel. The logistics support is primarily to take personnel, equipment and supplies to and from the UK and the UK's Antarctic Research Stations which also entails carriage of all waste from the research stations.

Cargo shipped will be comprised of material required to support the science activities carried out on board or from shore stations, ranging through:

- Provisions and consumables (dry, cool and frozen),
- Fuels and oils:- 205 litre-drummed aviation fuel (AVTUR), lubricating oil, petrol and paraffin; bulk marine gas oil
- Scientific equipment in a variety of sizes of package, vehicles, hazardous materials (paints, chemicals, pyrotechnics, compressed gases) and explosives (stored in containers on deck)

Cargo is either palletised carried in pre-stowed containers (standard TEU ISO and some high cube units). Cargo containers, can be stowed either on deck or in the Cargo Holds.

In some locations the vessel cannot berth alongside and cargo is transferred ashore using a cargo tender, with capacity of a single 20ft ISO cargo container of 10t (with doors open).

The nature of the locations served is such that the ship must be self- sufficient in terms of cargo handling.

4.5 OPERATIONAL PROFILE

A typical voyage will involve several teams of scientists who will conduct experiments that may be integrated or separate along with the logistics support to the Antarctic UK Research Stations. A Typical Voyage profile is provided as follows: