RRS *Sir David Attenborough* Cruise Planning and Operations Workshop Report

Compiled from a workshop held on the 22 and 23 May 2017 at the Thornton Hall Hotel, Neston Road, Thornton Hough, Wirral, CH63 1JF.

Edited by Ray Leakey (Workshop Chair)

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British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

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Acknowledgements

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Acronyms

AWI	Alfred Wegener Institut	NOC	National Oceanography Centre
BAS	British Antarctic Survey	PML	Plymouth Marine Laboratory
BODC	British Oceanographic Data Centre	PSO	Principal Scientific Officer
JCR	RRS *James Clark Ross*	SAMS	Scottish Association for Marine Science
NERC	Natural Environment Research Council	SDA	RRS *Sir David Attenborough*
NMF	National Marine Facilities	SME	Ship-time and Marine Equipment Profile

Contributors

The following participants contributed to this report via workshop discussions and post-workshop correspondence:
Povl Abrahamsen (BAS), Andy Barker (BAS), Joana Beja De Almeida(BODC), Nigel Bird (NERC), Steve Bremner (BAS), Ian Brooks (Leeds), Neil Brough (BAS), Linda Capper (BAS), Natalie Clark (NERC), Louise Darroch (BODC), Colin Day (NOC/NMF), Mike Dinn (BAS), Michelle Dyer (NERC), Sophie Fielding (BAS), Yvonne Firing (NOC), Elaine Fitzcharles (BAS), Jon Fuhrmann (BAS), Dominic Hodgson (BAS), Andy Jeffries (BAS), Brian King (NOC), Rob Larter (BAS), Ray Leakey (SAMS/NERC), Heinrich Miller (AWI), Helen Peat (BAS), Christine Peirce (Durham), Mike Pinnock (BAS), Alex Poulton (Heriot Watt), Mark Preston (BAS), Andrew Rees (PML), Jeremy Robst (BAS), Randy Sliester (BAS), Ralph Stevens (BAS) , Paul Tyler (NOC), Rob White (BAS), Malcolm Woodward (PML), Simon Wright (BAS)

Contents

Executive Summary (Recommendations and Actions)

This report summarises the presentations, discussions, conclusions and recommendations of a workshop on research cruise planning and operations for the UK's new polar research vessel, the RRS *Sir David Attenborough (SDA)*. The aim of the workshop was to explore and understand the scientific, technical, operational and communications implications of the new ship, and help develop new ways of working that optimise its use given new opportunities provided.

The workshop identified the following recommendations with respect to bringing the ship into service via sea-trials and rehearsal cruises, and optimising delivery subsequent research cruises.

- *NERC Marine Planning, BAS Operations and NMF to work together to ensure support staff and equipment resources are available to support concurrent research on both the SDA and JCR during 2019/20. [paragraph 4.3]*
- *Multi-disciplinary cruises on the SDA recommended to be minimum of at least 5 weeks' duration with 24/7 working (and associated technical support). [paragraph 5.1]*
- *BAS to consider adopting a "main plus ancillary" multi-disciplinary research cruise model led by one PSO, with appropriate long-term planning/funding horizon facilitating science co-operation. [paragraph 5.2]*
- *Science community to embrace, on an ongoing basis, all opportunities offered by the SDA to optimise and enhance delivery of science, training and outreach. [paragraph 6.4]*
- *NERC to assess and protect delivery of the average of 154 science days at sea available on the SDA (as written into the NPRV business plan) via annual assessments of research cruise performance conducted by the NERC Cruise Programme Review Group. [paragraph 6.5]*
- *SDA Project Board to maintain current plans (full sea-trials followed by joint JCR/SDA rehearsal year) to mitigate risks to science delivery presented by the move to a one-ship operation. [paragraph 6.6]*
- *NERC Marine Planning, BAS Operations and NMF to work together, and with science community, to ensure staff and equipment resources are aligned with the requirement to optimise science delivery on the SDA. [paragraph 6.7]*
- *BAS Operations to ensure the SDA provides an environment conducive to the maintenance of staff morale and productivity via provision of optimal recreational and office working spaces and ship-to-shore communications. [paragraph 6.7]*
- *BAS Operations, NERC Marine Planning and NMF to review and where necessary adapt research cruise management practices, including the selection and role of the PSO, to ensure clear decision-making, prioritisation and management of expectations. [paragraph 6.8]*
- *BAS Operations to review data management resources and waste chemical handling capacity when planning large, longer duration research cruises. [paragraph 6.9]*
- *NERC to review current research cruise planning and funding structures to align with the longer-term planning horizons required to maximise productivity of science, education and outreach activities on the SDA. [paragraph 6.10]*
- *NERC to raise visibility of marine science planning portal to enable prospective Principal Investigators to identify potential partners (match-making service). [paragraph 6.10]*
- *Science community to utilise the 60 day duration of the SDA to access remote locations and sample rare or unpredictable environmental conditions. [paragraph 7.2]*
- *Science community to utilise, with NERC support, the excess capacity of the SDA to enhance single- or multi-discipline science activities, training and outreach via use addition berths for scientists and students. [paragraph 7.9]*

- *Science community to utilise, with NERC support, the excess capacity of the SDA to support true inter-disciplinary science. [paragraph 7.10]*
- *Science community to explore options for enhancing on-ship sample and data processing. [paragraph 7.11]*

The workshop identified the following actions with respect to bringing the ship in to service via sea-trials and rehearsal cruises, and optimising delivery of ongoing science.

- *Nominated lead PSOs to submit SMEs for science sea trials on the SDA. [paragraph 3.3]*
- *NMF (Colin Day) to update its website with SDA SME form. [paragraph 3.4]*
- *BAS Ship Operations to provide deck plans for understanding where equipment and cargo will be on each SDA research cruise. [paragraph 3.5]*
- *Science community to consider the opportunity to undertake rehearsal cruises and to submit ideas to Ray Leakey in first instance. [paragraph 4.3]*
- *Nigel Bird and Ray Leakey and to consider further options for soliciting ideas/proposals for the rehearsal cruises (e.g. an "announcement of opportunity" with follow-up workshop to develop ideas). [paragraph 4.3]*
- *NERC Cruise Programme Review Group to assess SDA science delivery performance and report to NERC. [paragraph 6.5]*
- *Science community to consider ideas for adapting current research cruise planning and funding structures to align with the longer-term planning horizons, and to submit ideas to NERC Marine Planning in first instance. [paragraph 6.10]*
- *NERC Marine Planning to consider inputs from the science community that could, if implemented, provide the longer-term planning horizons required to maximise productivity of science, education and outreach activities on the SDA. [paragraph 6.10]*
- *BAS (Jeremy Robst) to prepare report on data management for NPRV Board following discussion with science community, BAS IT staff and UK data managers. [paragraph 7.12]*

1. Introduction and Workshop Aims

1.1 This report summarises the presentations, discussions, conclusions and recommendations of a workshop on research cruise planning and operations for the UK's new polar research vessel, the RRS *Sir David Attenborough*. The workshop was held at Thornton Hall Hotel on 22 and 23 May 2017 and funded by the NERC New Polar Research Vessel programme.

1.2 The entry into service of *SDA* has implications for the delivery of marine science programmes supported by the ship, the choice (and maintenance) of equipment and facilities, and the execution of operational activities. Research cruises are likely to change from current practice in response to the new ship's capabilities and capacity, including more berths, longer endurance and the resulting ability to support larger, longer-duration, multi-disciplinary cruises in more remote regions. The NPRV board were keen that science end-users and operational and logistical teams fully explore and understand the scientific, technical, operational and communications implications of the new ship, and help develop new ways of working that optimise its use given new opportunities provided. The Workshop was initiated in response to this background.

1.3 The workshop's aims were as follows:

- to initiate discussions about a future operating model for research cruises on the *SDA* by bringing together science end-users, operational, engineering and technical teams,
- to identify and discuss the opportunities and challenges around planning and delivering science cruises given: the possibility of longer cruises involving a greater number of scientists; operational changes relating to the resupply of research stations; the need to realise other benefits including improved fuel efficiency,
- to initiate discussions and identify appropriate individuals/teams to take forward science equipment sea trials in 2018/19,
- to initiate discussions and identify appropriate groups/disciplines to participate in a rehearsal cruise during 2019/20 season.

1.4 The workshop was attended by 36 invited scientists and managers from NERC research centres, UK universities and NERC Head Office to bring together and represent the diverse range of expertise involved in the planning and operation of UK polar research cruises (see Annex 1). Professor Heinrich Miller of the Alfred Wegener Institut, Germany, was also invited to contribute his extensive international expertise in research cruise leadership.

2. Workshop Structure and Presentations

2.1 The workshop was structured to both inform and engage participants with a mix of presentations, plenary and breakout group discussions. Participants also visited the Cammell Laird shipyard for a tour of the ship-build. The full agenda is shown in Annex 2.

2.2 The presentations (summarised in Annex 3, pages 14 to 21) included:

- an introduction to the aims of the workshop and requirement to optimise the planning and operation of research cruises on the *SDA*,
- summaries of the design, capabilities and capacity of the *SDA* (including laboratory and deck layout and facilities, science equipment, IT, data and communications),
- an outline of the operational timetables for bringing the ship into service,
- a summary of the science planning and operation of research cruises on the RV *Polarstern* which is a ship of comparable size, capability and capacity to the *SDA*.

2.3 Breakout discussion groups (summarised in Annex 3 and Annex 4) explored the advantages and disadvantages of operating large long-duration multi-disciplinary cruises on the *SDA*, and planned scenarios for operating single- and multi-discipline cruises on the *SDA*. Sea-trails and rehearsal cruises were discussed in plenary.

3. Sea-Trials Planning

3.1 Sea-trials for the *SDA* are likely to start in September or October 2018 and are anticipated to include the following science related activities (see Annex 3, pages 29 to 30):

- acoustic trails in the North Atlantic during February 2019 (~16 days),
- sea ice trials in the Arctic during April and May 2019 (~35 days),
- science equipment trials in the North Atlantic from May to August 2019 (~70 days).

3.2 The NPRV board and BAS operations will require the following information for sea trials:

- specific science trials disciplines,
- duration & location of each trials package,
- science lead for each trials package,
- technical lead for each trials package,
- trials programme itinerary (including post ship-in-service trials),
- deliverables and dates due,
- SME submissions.

3.3 Three science equipment trial cruises were proposed during workshop discussions with associated PSOs identified to plan and submit SMEs for each cruise:

Discipline	Duration	PSO	Activities
Multiple	30 days	Y. Firing (lead), I. Brooks, S. Fielding, A. Poulton, M. Woodward.	Biogeochemistry, biology, physics & atmospheric science equipment.
Geophysics & Geology	30 days	C. Peirce (lead)	Seismic & coring/dredging systems (except giant piston corer).
Geology	10 days	Colm O'Cofaigh (lead), R. Larter	Giant piston corer.

Action: *Nominated lead PSOs to submit SMEs for science sea trials on the SDA.*

3.4 It was noted that the NMF website requires updating with an SME template for the *SDA*.

Action: *NMF (Colin Day) to update its website with SDA SME form.*

3.5 It was noted that deck plans will be essential for understanding where equipment will be on each *SDA* research cruise. These have been available for science on the *JCR* but there now needs to be a plan for logistics/cargo and science together on the SDA.

Action: *BAS Ship Operations to provide deck plans for understanding where equipment and cargo will be on each SDA research cruise*

4. Rehearsal Cruise Planning

4.1 The first year of operation of the *SDA* is likely to start in September or October 2018 with the SDA undertaking a rehearsal year in both the Antarctic and Antarctic. During this year the *JCR* will remain in operation supporting peer-reviewed polar marine science. The rehearsal year is anticipated to include:

- a full logistics programme in Southern Atlantic, with extra time for operation learning,
- ~50 days available for Antarctic rehearsal research cruises in Jan/Feb 2020,
- ~50 days available for Arctic rehearsal research cruises in Summer 2020.

4.2 It is anticipated that competitive, peer-reviewed science will not be undertaken on the *SDA* rehearsal research cruises, but in all other respects the cruises will simulate single- or multi-discipline peer-reviewed research cruises in order to test and refine delivery of real science on the *SDA*. The NPRV programme would pay all rehearsal cruise costs except scientist salaries.

4.3 Workshop discussions acknowledged the benefit of rehearsal cruises for testing and refining the *SDA* as a science platform, and also the opportunity to undertake extra science. However, concerns were raised with respect to scientist availability given that many may already be funded to undertaken research on the *JCR* that season or already committed to other projects. The extra demands placed on support personnel and the availability of UK marine science pool equipment was also a concern given the need to support science on both the *JCR* and *SDA*. No ideas for rehearsal cruises were forthcoming during the discussions.

Recommendation: *NERC Marine Planning, BAS Operations and NMF to work together to ensure support staff and equipment resources are available to support concurrent research on both the SDA and JCR during 2019/20.*

Action: *Science community to consider the opportunity to undertake rehearsal cruises and to submit ideas to Ray Leakey in first instance.*

Action: *Nigel Bird and Ray Leakey and to consider further options for soliciting ideas/proposals for the rehearsal cruises (e.g. an "announcement of opportunity" with follow-up workshop to develop ideas).*

5. Research Cruise Opimisation: Lessons from the operation of the RV *Polarstern*

5.1 Important lessons can be learnt from the science planning and operation of multi-disciplinary research cruises on the RV *Polarstern*, which is comparable to the *SDA* in terms of size, science capability, capacity (berths and duration) and joint logistics/science role (although with some significant differences). These lessons are summarised Annex 3 (page 25). They include:

- the opportunity to undertake multi- and inter-disciplinary science,
- the opportunity to maximise use of the ship in variable environments (esp. sea-ice),
- the opportunity to enhance education, training and a shared-learning environment,
- the requirement for a long-term (minimum 3-year) planning horizon,
- the requirement to run 24/7 operations on long (minimum 5 week) multi-discipline cruises,
- the benefits of a "*main plus ancillary*" research cruise model led by one PSO.

Recommendation: *Multi-disciplinary cruises on the SDA recommended to be minimum of at least 5 weeks' duration with 24/7 working (and associated technical support).*

5.2 The RV *Polarstern* "*main plus ancillary*" research cruise model builds the research cruise around one main science project and discipline with a single PSO in charge of all science. Smaller ancillary science projects then bid for time/berths to join the cruise. It requires an experienced and fair-minded PSO. This model is considered by the RV *Polarstern* operators to be more effective than models, adopted by some nations, involving a neutral cruise manager or two PSOs simultaneously running two main projects.

Recommendation: *BAS to consider adopting a "main plus ancillary" multi-disciplinary research cruise model led by one PSO, with appropriate long-term planning/funding horizon facilitating science co-operation.*

6. Research Cruise Opimisation: Advantages and disadvantages of operating large, long-duration multi-disciplinary cruises on the *SDA*

6.1 The breakout session exploring the advantage and disadvantages of operating large long-duration multi-disciplinary cruises on the *SDA* identified a wide range opportunities and challenges. These are presented in Annex 3 (pages 22 to 24). Several key issues emerged.

6.2 The *SDA* offers several opportunities to enhance science output and maximise productivity, both quantitatively and qualitatively via:

- new equipment capabilities (e.g. giant piston corer, moonpool, helicopters and AUVs, etc.) enabling new science and enhanced temporal and spatial sampling resolution,
- longer duration at sea enabling access to remote locations and temporal resolution of seasonal problems,
- efficiencies and cost savings (e.g. from reduced fuel use, shorter base resupply, combined science and logistics operations, reduced mobilisation/demobilisation) releasing time and resources for science,
- more berths enabling greater international collaboration and a wider pool of scientific and technical skills on ship,
- enhanced capacity and capability enabling more holistic science (nested surveys, atmosphere to seabed), truly inter-disciplinary science, and regional themed science.
- more berths to foster inter-group interactions and education between scientists (e.g. between experimentalists and theorists/modellers).

6.3 The S*DA* offers several opportunities to enhance science training via more berths and lab facilities for postgraduate research students. Undergraduate teaching activities may also be possible for a limited number of students.

6.4 The SDA offers greater opportunities for outreach activities via more berths.

Recommendation: *Science community to embrace, on an ongoing basis, all opportunities offered by the SDA to optimise and enhance delivery of science, training and outreach.*

6.5 The move from a two-ship to one-ship operation may lead to a ~15% reduction in science days at sea and, while the greater number of science berths can compensate to some extent (by increasing the number of scientist days at sea), science output does not necessarily increase in proportion to berths due to greater vulnerability to bad weather, geographic restriction of science activities, and restrictions on “wire-time” (i.e. the time available to utilise over-side handling equipment to deploy/retrieve equipment and collect samples).

Recommendation: *NERC to assess and protect delivery of the average of 154 science days at sea available on the SDA (as written into the NPRV business plan) via annual assessments of research cruise performance conducted by the NERC Cruise Programme Review Group.*

Action: *NERC Cruise Programme Review Group to assess SDA science delivery performance and report to NERC.*

6.6 The move from a two-ship to one-ship operation may enhance the possibility of single point failure and/or problems emerging from more complex logistics/science operations, including larger mobilisation and demobilisation operations (e.g. if the *SDA* can only visit certain bases on a good weather day then this limits the science time and location). The transition period to a one-ship operation will also be challenging.

Recommendation: *SDA Project Board to maintain current plans (full sea-trials followed by joint JCR/SDA rehearsal year) to mitigate risks to science delivery presented by the move to a one-ship operation.*

6.7 Longer and larger multi-disciplinary cruises will place greater demands on scientists, technicians and equipment when at sea for long periods of time. Key issues include:

- the availability and cost of supplying UK marine science pool equipment for long periods,
- the availability and cost (salaries) of technical support to maintain and operate a larger and more sophisticated range of equipment on-ship, and undertake 24/7 operations,
- the availability and cost (salaries) of scientists,
- inefficiencies from longer periods of personnel and equipment down-time,
- pressures on ship's staff (especially stewards, catering and deck staff),
- morale and work-life balance of personnel.

Recommendation: *NERC Marine Planning, BAS Operations and NMF to work together, and with science community, to ensure staff and equipment resources are aligned with the requirement to optimise science delivery on the SDA.*

Recommendation: *BAS Operations to ensure the SDA provides an environment conducive to the maintenance of staff morale and productivity via provision of optimal recreational and office working spaces and ship-to-shore communications*.

6.8 Longer and larger multi-disciplinary cruises may present conflicts of interest and place greater demands on cruise management including:

- prioritisation of logistics versus science,
- prioritisation of different science activities and projects,
- management of personnel expectations and science downtime.

Recommendation: *BAS Operations, NERC Marine Planning and NMF to review and where necessary adapt research cruise management practices, including the selection and role of the PSO, to ensure clear decision-making, prioritisation and management of expectations.*

6.9 Longer and larger multi-disciplinary cruises may require greater resources for data management and handling of waste chemicals.

Recommendation: *BAS Operations to review data management resources and waste chemical handling capacity when planning large, longer duration research cruises.*

6.10 Longer and larger multi-disciplinary cruises present significant challenges for the planning and funding of science cruises, including:

- the need for longer-term science planning horizons to support more complex multi-disciplinary research cruise models (e.g. to enable inter-disciplinary or themed cruises, or to support a "*main plus ancillary*" multi-disciplinary model - see para 5.2),
- the need to align current funding structures with the demand for longer-term planning horizons,
- the possible requirement for an overall increase in funding to support greater and more sophisticated polar marine science.
- the possible requirement for an overall increase in funding to maximise productivity of science, education and outreach outputs (e.g. via the opportunities offered in para 6.2, 6.3 and 6.4).

Recommendation: *NERC to review current research cruise planning and funding structures to align with the longer-term planning horizons required to maximise productivity of science, education and outreach activities on the SDA.*

Recommendation: *NERC to raise visibility of marine science planning portal to enable prospective Principal Investigators to identify potential partners (match-making service).*

Action: *Science community to consider ideas for adapting current research cruise planning and funding structures to align with the longer-term planning horizons, and to submit ideas to NERC Marine Planning in first instance.*

Action: *NERC Marine Planning to consider inputs from the science community that could, if implemented, provide the longer-term planning horizons required to maximise productivity of science, education and outreach activities on the SDA.*

7. Research Cruise Opimisation: Scenario planning for operating single- and multi-discipline cruises on the *SDA*.

7.1 Scenario plans translating single-discipline cruises from the *JCR* to the *SDA* reveal excess capacity on the *SDA* which, if appropriately resourced, could be used to support additional science. Five single-disciplines were considered: atmospheric science, physics, geology (including geophysics), biology, and biogeochemistry. These are presented in Annex 3 (pages 26 to 29).

7.2 Research cruise duration is typically 4 to 6 weeks and has generally not limited single-discipline science delivery on the *JCR*. The *JCR* has a maximum duration at sea of 55 days (~7 weeks) compared to 60 days (~8 weeks) on the *SDA*; duration is therefore unlikely to be limiting on the *SDA* for single-discipline cruises. However, the addition time available at sea on the *SDA* may offer opportunities for geologists to access remote locations, for atmospheric scientists to sample rare or unpredictable weather systems, or for biologists and biogeochemists study phytoplankton blooms over longer time periods.

Recommendation: *Science community to utilise the 60 day duration of the SDA to access remote locations and sample rare or unpredictable environmental conditions.*

7.3 This excess capacity varies according to discipline and in all cases represents a <50% increase in capacity over and above the *JCR*, commensurate with the adoption of a "*main plus ancillary*" multi-disciplinary research cruise model (see para 5.2).

7.4 Optimal science berth occupancy for single-discipline cruises on the *JCR* varies from ~25-26 (atmospheric science, physics, geology) to ~30-46 (biology and biogeochemistry). The *JCR* has 46 science berths compared to 60 on the *SDA*; berths are therefore unlikely to be limiting on the *SDA* for single-discipline cruises with typically 15-35 berths anticipated to be available for additional scientists or students. However, single cabin occupancy (i.e. 38 scientists) is desirable on long-duration cruises.

7.5 Laboratory capacity (ship-fitted and containerised) on the *SDA* is unlikely to be limited, even on large biology or biogeochemistry cruises.

7.6 Deck and science hangar capacity on the *SDA* is unlikely to be limiting except on geology and geophysics cruises where the aft-deck, science hangar, wet, dry and controlled temperature core-store are likely to be fully occupied.

7.8 Geology cruises deploying the giant piston corer would require full use of the aft-deck and science hangar, and dominate ships activities, thus likely preventing all other science activities. Some ROV operations might similarly prevent other science operations.

7.9 Atmospheric science activities are predominantly located at the forward end of the *SDA* (atmospheric lab, aerosol lab, heli-hangar, heli-deck) away from other science activities. They also utilise the ships stationary time without the need to continuously sample. Atmospheric science is therefore well-placed to be undertaken alongside other science disciplines.

Recommendation: *Science community to utilise, with NERC support, the excess capacity of the SDA to enhance single- or multi-discipline science activities, training and outreach via use addition berths for scientists and students.*

7.10 The excess capacity of the *SDA* can enable and enhance true inter-disciplinary science across all disciplines. Biology and biogeochemistry research cruises undertaken on the *JCR* are often already multi- or inter-disciplinary in nature.

Recommendation: *Science community to utilise, with NERC support, the excess capacity of the SDA to support true inter-disciplinary science.*

7.11 “Wire-time” is likely to limit science activities on large multi-disciplinary cruises. Optimal use of laboratory and computer facilities to enable on-ship processing of samples and data can mitigate scientist down-time and help maximise productivity.

Recommendation: *Science community to explore options for enhancing on-ship sample and data processing.*

7.12 Scenario planning for operating single- or multi-discipline cruises on the *SDA* identified several challenges related to data (availability and ease of use to scientists on board, but also ease and speed of getting data into shore-based data centres). Issues concerning data logging and management are a priority. These include:

- larger data returns - the *JCR* currently collects around 3TB of data per cruise but with the increased equipment on *SDA* it is anticipated the data returns will be in hundreds of TB,
- the requirement to specify data requirements, data format (in data centre) and a system to manage the data and train staff,
- the potential requirement for a dedicated data manager on ship to ensure data is captured and metadata tagged correctly.

Action: *BAS (Jeremy Robst) to prepare report on data management for NPRV Board following discussion with science community, BAS IT staff and UK data managers.*

Annex 1: List of Workshop Participants

Name	Organisation	Job Title/Role
Povl Abrahamsen	BAS	Physical Oceanographer
Andy Barker	BAS	Project Manager, SDA Science Equipment
Joana Beja De Almeida	BODC	Data Manager
Nigel Bird	NERC	Director of Finance
Steve Bremner	BAS	Lead, SDA Ship into Service
Ian Brooks	Leeds University	Atmospheric scientist - SDA Science Rep
Neil Brough	BAS	Atmospheric scientist
Linda Capper	BAS	Head of Communications
Natalie Clark	NERC	Marine Planning Officer
Louise Darroch	BODC	Data Manager
Colin Day	NOC / NMF	Programme Manager
Mike Dinn	BAS	Operations Manager
Michelle Dyer	NERC	Programme Management Officer
Sophie Fielding	BAS	Biological Oceanographer - SDA Science Rep
Yvonne Firing	NOC	Physical Oceanographer
Elaine Fitzcharles	BAS	Senior Lab Manager
Jon Fuhrmann	BAS	SDA Communications & Engagement Manager
Dominic Hodgson	BAS	Palaeoenvironments, Ice Sheets & Climate Change Lead
Andy Jeffries	BAS	Project Manager, SDA
Brian King	NOC	Physical Oceanographer – SDA Science Rep
Rob Larter	BAS	Maine Geophysicist - SDA Science Rep
Ray Leakey	SAMS / NERC	Marine Microbiologist - SDA Senior Science User
Heinrich Miller	AWI	Glaciologist - SDA External Reviewer
Helen Peat	BAS	Data Manager
Christine Peirce	Durham University	Marine Geophysicist
Mike Pinnock	BAS	Director's Project Support Manager
Alex Poulton	Heriot Watt University	Marine Biogeochemist
Mark Preston	BAS	Electronics Engineer
Andrew Rees	PML	Marine Biogeochemist
Jeremy Robst	BAS	Acting Head of ICT
Randy Sliester	BAS	Head of Ships Operations
Ralph Stevens	BAS	Master, SDA
Paul Tyler	NOC	Biological Oceanographer
Rob White	BAS	Senior Marine Engineer
Malcolm Woodward	PML	Marine Biogeochemist – SDA Science Rep
Simon Wright	BAS	Deck Engineer, SDA

Annex 2: Workshop Agenda and Timetable

Monday 22 May

09.30	Introduction, Housekeeping, Agenda	*Ray Leakey/Nigel Bird*
10:00	Ship capabilities: Laboratories	*Sophie Fielding*
10.30	Ship capabilities: Deck equipment & layout	*Simon Wright*
11.00	Tea/coffee & refreshments	
11.20	Ship capabilities: Science equipment	*Andy Barker*
11.40	Ship capabilities: IT, Data, Communications	*Jeremy Robst*
12.00	Scope of operational timetables	*Randy Sliester*
12.15	Questions & discussion	
12.30	LUNCH	
13.30	Coach from Thornton Hall to Cammell Laird	
14.00	Tour of Cammell Laird construction hall	
15.00	Return to Thornton Hall	
15.20	Tea/coffee & refreshments	
15.30	Breakout session 1: Pros and cons of larger, multi-disciplinary cruises	
17.00	Reports from breakout session & discussion	
17.30	End of day 1	

Tuesday 23 May

09.00	Lessons from multidisc. cruises on RV *Polarstern*	*Prof. Heinrich Miller*
10.00	Funding	*Natalie Clark*
10:10	Breakout session 2: Scenario planning	
10.30	Tea/coffee & refreshments	
11.30	Reports from breakout session & discussion	
12.45	LUNCH	
13.30	Sea trials and rehearsal cruise	*Randy Sliester*
14.00	Discussion & questions	
15.00	Workshop ends	

Annex 3: Rapporteur notes on presentations and discussions (Michelle Dyer)

A new polar research ship for Britain • **RRS *Sir David Attenborough***

A New Polar Research Vessel for Britain

Cruise Planning Workshop

22-23 May 2017

NERC SCIENCE OF THE ENVIRONMENT | British Antarctic Survey NATURAL ENVIRONMENT RESEARCH COUNCIL | CAMMELL LAIRD | Department for Business, Energy & Industrial Strategy | UKSBS

A new polar research ship for Britain • **RRS *Sir David Attenborough***

Introduction and Welcome

- Welcome and thanks from Ray Leakey

- Key Objectives and success criteria:
  - The RRS *Sir David Attenborough* (*SDA*) is single, dual purpose new polar research vessel to replace RRS *James Clark Ross* and RRS *Ernest Shackleton.*
  - The SDA must deliver:
    - Frontier polar science
    - UK presence in polar regions
    - Long term cost savings for government: "Spend to Save"

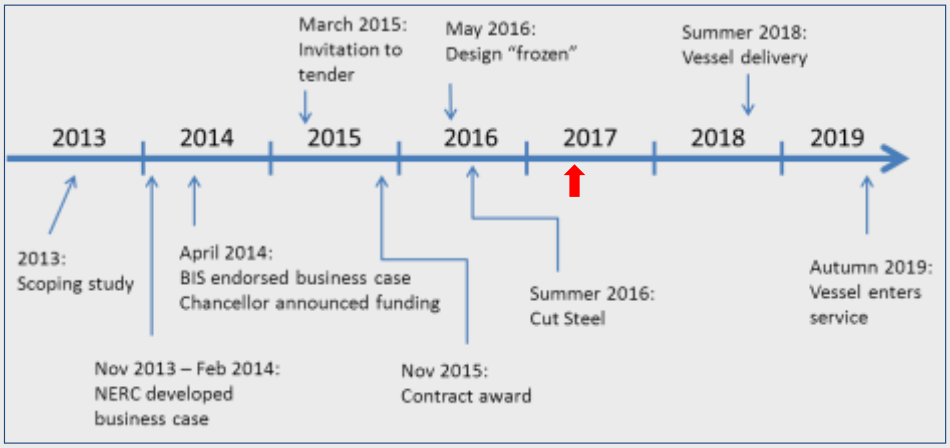
The entry into service of the SDA requires new ways of working to deliver required frontier science and cost savings while accommodating larger, longer science cruises as well as resupply operations.

This workshop is interactive but will not cover design or build: it is **about bringing the ship into service.**

NERC SCIENCE OF THE ENVIRONMENT | British Antarctic Survey NATURAL ENVIRONMENT RESEARCH COUNCIL | CAMMELL LAIRD | Department for Business, Energy & Industrial Strategy | UKSBS

A new polar research ship for Britain • **RRS *Sir David Attenborough***

RRS *Sir David Attenborough* Project Timeline



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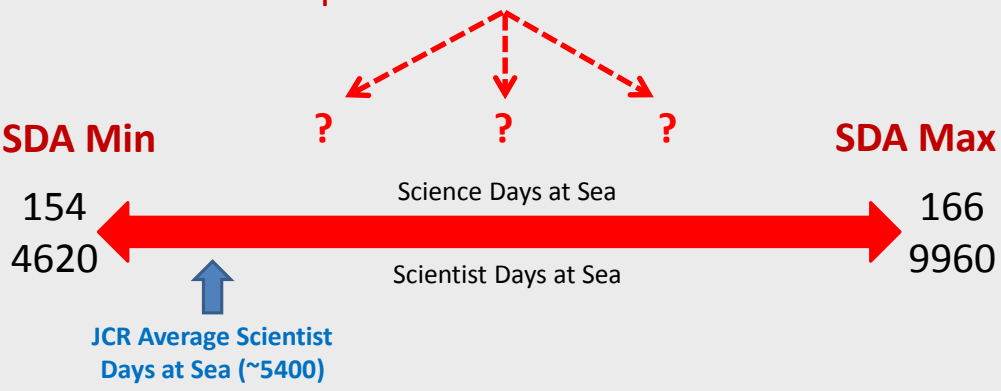
Key Question for this workshop

What is the optimum science cruise scenario?



- Science cruises v logistics - station locations dictate destinations to a degree. Station upgrades will accelerate resupply operations – exact impact TBA
- Increase in scientist days at sea doesn't directly translate into same % increase in science!

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Ship Capabilities: Lab Layouts (Sophie Fielding)

The new ship must:

- Provide a multi-disciplinary research platform able to support a wide range of science
- Carry a large number of scientists
- Stay at sea undertaking science for as many days as possible
- Be very quiet for environmental monitoring
- Have good dynamic positioning for instrument deployment
- Resupply all UK Antarctic stations

NOTE: 760m^2 total lab space – 50% increase from other NERC ships

Summary:

- 3 cruise planning hub areas: main lab, data suite, UIC (underway instrument control)
- Large flowing multidisciplinary laboratories
- Instrument control room with clear views over deck to facilitate winch/instrument control
- Strategically located specific laboratories (e.g. Clean, aerosol, atmospheric)
- Increase in facilities for laboratory containers (2 in-built and up to 8 deck based)
- Well specified labs (fume hoods, chemical handling, milli-q)

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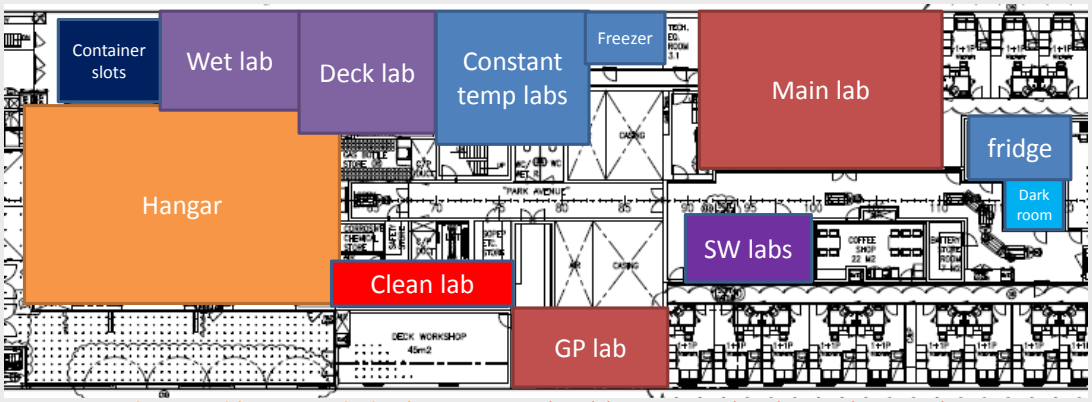
Ship Capabilities: Lab Layouts (Deck 3)



Hangar – sample retrieval (CTD, cores, biology)
Wet lab/Deck lab – wet sampling areas (benthos/zooplankton, corers)
Constant temperature – sample manipulation/storage, freezer space
Main lab and GP lab – chemically intense sample analysis
Clean lab – trace metal work, DNA clean sampling requirements
Seawater) labs – underway water sampling, salinometry
Dark room – bioluminescence science, etc
Container slots – lab container slots connected to wet lab (e.g. transport aquarium, multi sensor core logging etc.)

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Deck Equipment, Machinery & Arrangements (Simon Wright)

Ship's Facilities:

- Side A-frame (30t)
- Stern A-frame
- Bow fold-out towing platform
- Winches & cranes
- Moon pool
- Lab container positions
- Deck hydraulics
- Survey boat
- No drop keel – but RR-designed gondola to deploy EK80 echo sounder via moon pool

Deck Arrangements:

- ISIS ROV
- Seismics
- BGS RD1, Vibracorer/Rock Drill
- Crane coverage
- Giant Piston Corer
- BGS Rock Drill 2
- General AUV layout

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Deck Equipment, Machinery & Arrangements (Simon Wright)

Additionally, 6 cranes on board:

- Main crane: 50t @18m (port only), 20t @33m (both sides)
- Helideck provision crane: 8t @16m
- Starboard deck service crane: 8t @8m, 5t @16m, 2t @21m
- Port deck service crane: 5t @16m
- Port & starboard science cranes: 5t @16m each

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Deck Equipment, Machinery & Arrangements (Simon Wright)

Other points to note:

- Workboat also has a small winch, can be used for non-conducting CTD work; also side-on sonar capable
- 12,000 meter long cable (16mm), traction unit
- Winch factory testing – Issues that were identified are being addressed by the factory in Vietnam; CL will pick up any others items that need resolving
- Science Hangar – deploying equipment through the moon pool and other options – planning needed to have ways of working determined in advance
- Piston Corer – shortened from 42m to just over 40m
- RD2: challenge of deploying 3.4m^2 instrument through 4m^2 moon pool.
- SDA will not be the only ship; a "+" option is being looked into for another vessel for logistics/resupply support
- Science and logistics balance need to have greater focus on the planning and model
- Deck plans will be essential for understanding where equipment will be on each cruise. Used to doing this for the science, but there hasn't been a plan for logistics/cargo and science together – who will do this? Is it the responsibility of the science planner?

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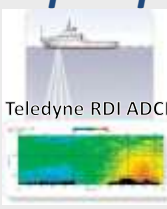
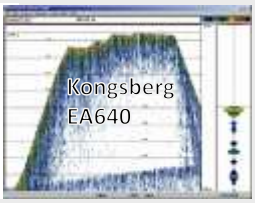
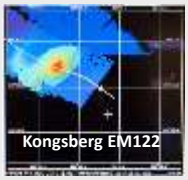
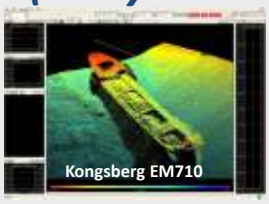
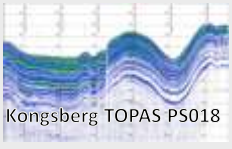
Ship Capabilities: Science equipment (Andy Barker)

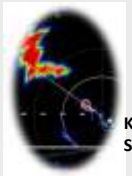




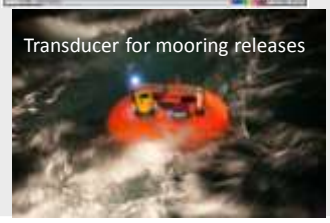








Kongsberg
SU94 & SC94



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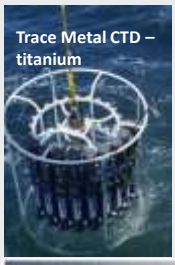
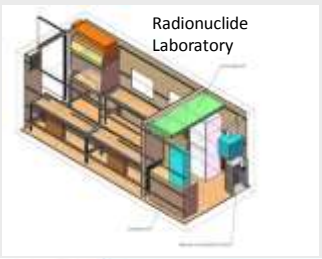
Ship Capabilities: Science equipment (Andy Barker)


Stainless Steel CTD – 24 bottle carrousel

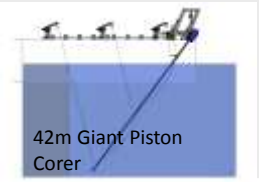

Trace Metal CTD – titanium


Radionuclide Laboratory

Containers

- 2 seismic compressor containers
- Radionuclide laboratory – samples may need to be taken onto the ship.
- Aquarium experimental transport container – dedicated container
- Multi-sensor core logging container – processing to take place on board
- Glacial ice core container – similar to what we have now
- Ultra clean chemistry container
- These will not all be on board when not in use, looking at logistics: Cambridge and/or southern hub (Stanley/Punta).
- Gas bottle store off hangar connected to labs by gas lines: indoors storage will hopefully reduce wear & tear.


Transportation of Explosives & Detonators


42m Giant Piston Corer

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Ship capabilities: IT, Data, Communications

IT: Network

- Several different networks around the SDA
- SeaQNet – ship's telephone and PA system
- SDANet
  - Business computing network
  - Scientific logging network
  - Instrument networks
  - Data display network
- Engine room networks
- Larger access points for labs and external spaces

IT: Communications

- VSAT communications
- Bandwidth likely to be double JCR initially
- Approx 1.5 – 3 Mb/s
- (cf UK home 70Mb/s)
- Part of the BAS Cambridge network
- VOIP telephones – BAS internal numbers

IT: Data Logging

- Data Logging System for stream based systems
  - Meteorological
  - Oceanographic
  - Navigation
- Central file server for instruments such as swath, fisheries echosounders, ADCP
- DLS supplier not yet confirmed
  - NOAA SCS
  - Ifremer Techsas
  - AWI – DSHIP ?
- Data formats
  - Plain text
  - NetCDF
  - Database ?
  - Web / JSON access
- Event logging
  - Currently using in house system
  - Improve, find external system ?
- Cruise planning / operations
  - In house system
  - Improve, find external system ?
- Integration with DLS and other ship's systems

SDANet

- 10Gb/s redundant backbone
- 10Gb/s server connections
- 1Gb/s to the desktop
- Cat 7 copper
- OM4 multimode fibre
- Single mode fibre
- ~900 network ports
- Network will be used for most instrument communication (e.g serial to Ethernet)

SDANet (2)

- Uncommitted scientific wiring available for future use.
- WiFi network covering all locations on deck 3 and above
- Some locations on deck 2 (e.g ECR)
- Full integration into SDANet
- Likely to have per cabin wireless access points

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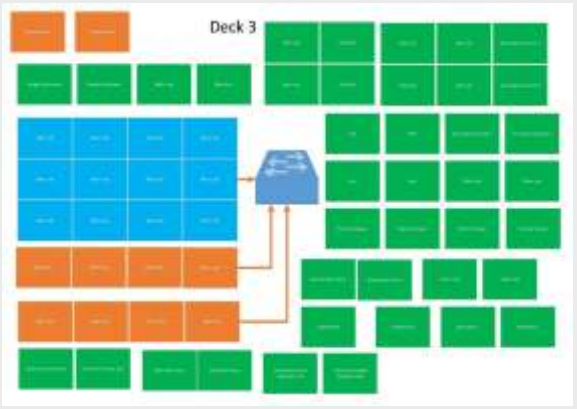
Ship capabilities:
IT, Data, Communications

IT: Data Display

- Video over IP distribution system
- Approx 32 sources (scientific computers, ship navigation systems)
- Approx 180 output displays
  - Video walls – 3x 12 (4x3) screens , 2x 4 (2x2) screens
  - Operator workstations – 6x 4 screen, 1x 2 screen
  - 2 – 4 displays per lab space
  - 2 displays in living areas (mess, coffee shop, gym)
  - Links to integrated bridge display
- Access from computers, laptops
- Lab displays using copper network currently FHD (1920x1200) max
- Video walls / operator workstations using fibre for future 4K use
- Probably that 4K will work over copper in future and/or 4K scaled down for Lab displays
- 24" monitors as standard
- Conference room will have projector/large display linked in

IT: Data Display – Operator Workstation - Layout options

- 4 monitors in slight U shape
- One keyboard/mouse can control up to 4 computers
- Doesn't block view over deck
- Easy to secure for ship's motion
- Easy to replace individual monitors
- Comfortable for 1 – 2 people



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Scope of operational timetable (Randy Sliester)

- **Dates** - Two year testing, trials and rehearsal period planned to begin on 1 October 2018
- **Why do trials?** Before (funded) science comes on-board there is a need to understand the health and safety and how to use equipment to eliminate risk.
- **Ice trials** – a month allocated from March till April 2019.
- **Science trials -** scheduled for spring 2019 (70 days allocated)
- **System testing -** all been factored into the plan
- 2-year guarantee period with the shipyard

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Scope of operational timetable (Randy Sliester)

Port	Arrive	Depart	Days
Liverpool	28/06/2018	26/09/2018	91
Liverpool	27/09/2018	26/10/2018	30
Local Trials	27/10/2018	30/10/2018	4
Liverpool	31/10/2018	06/11/2018	7
Local Trials	07/11/2018	08/11/2018	2
Liverpool	09/11/2018	11/11/2018	3
Local Trials	12/11/2018	13/11/2018	2
Liverpool	13/11/2018	19/11/2018	7
Loch Goil	21/11/2018	25/11/2018	5
Liverpool	26/11/2018	02/12/2018	7
DP Trials	03/12/2018	07/12/2018	5
Liverpool	11/12/2018	16/12/2018	6
Local Trials	21/12/2018	29/12/2018	9
Winch engeering Trials shallow depth <1500m	30/12/2018	14/01/2019	16
winch engeering acceptance trials Full Ocean depth 1500-6000m	15/01/2019	29/01/2019	15
Transit to Liverpool	30/01/2019	03/02/2019	5
Transit to acoustics calibration	04/02/2019	07/02/2019	4
Acoustics Trials	08/02/2019	23/02/2019	16
Transit to Liverpool	24/02/2019	26/02/2019	3
Liverpool	27/02/2019	08/03/2019	10
Transit to arctic sea ice trials	09/03/2019	13/03/2019	5
Sea Ice Trials	14/03/2019	12/04/2019	30
Moon Pool Sea Ice Trials	13/04/2019	17/04/2019	5
Transit to Southampton	18/04/2019	23/04/2019	6
Southampton	24/04/2019	28/04/2019	5
PAP	29/04/2019	13/05/2019	15
Southampton	14/05/2019	18/05/2019	5
Transit to Liverpool	?	?	0
Liverpool	19/05/2019	28/05/2019	10
TBD Science Trials	31/05/2019	29/06/2019	30
TBD Science Trials	02/07/2019	31/07/2019	30
TBD Science Trials	01/08/2019	10/08/2019	10
Liverpool	12/08/2019	26/08/2019	15
Transit to MOB port	27/08/2019	29/08/2019	3
TBD Mob for Rehersal Season 1	29/08/2019	22/09/2019	25

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Shipyard Tour





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Breakout 1: pros & cons of multidisciplinary cruises

What advantages and disadvantages are there in undertaking large, long duration, multidisciplinary cruises on the *SDA*?

Scope and Format:

- Three breakout groups of mixed participants
- Brainstorm discussion to capture all implications – from initial science question, funding and pre-cruise planning to post-cruise data and publication, and everything in between.
- Chair to report back to plenary.

Consider anything and everything!

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Breakout 1: group 1 report

Pros	Cons
Longer range, improved efficiency (time management needed)	Down time when other groups doing their work and when ship doing logistics
Imperative for NERC to review funding models – e.g. funding for all add-on projects)	Support intensive systems e.g. autosubs, ROVs may be at sea for periods when not required.
Berths available for students	Single point of failure – greater jeopardy in refocusing if major problems occur
Better outreach potential?	Chain of command uncertainty – PSO/cruise manager?
Helicopter potential – increased capability in the future. (plus UAV)	Morale? Will it be an issue with longer cruises
More international and interdisciplinary collaboration	Geographic constraints (ship only in one place)
Fewer mobs and demobs	Longer mob and demob because more complexCost
Opportunities to work in ice (more power, moon pool)	in taking more people to sea (salaries, allowances, T & S)
More scientists days at sea - Can be more science if managed well - Better student training opportunities	Transition issues: Technical support during transition (also in longer term)
Better lab facilities: more & more sophisticated work done at sea	Smaller pool of Marine staff (so less back up)
Considerations	
Need genuine 24-hr operation capability – crew numbers, catering; More automation of equipment desirable	
Also an opportunity – funding model, morale, tech support (particular for transition)	

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Breakout 1: group 2 report

Pros	Cons
'Doing less, but doing it better'	Lowering funding rates per grant round.
Holistic approach to science – "From atmosphere to seabed"	Standard Grant is monospecific
Wider skillsets on-board	More technicians required with wider skillset – cost!
Gives a better use of time – more options	Equipment tied up for longer (NMEP)
Greater collaboration/integration → improved publication rate	Resource for data management
Opportunities to train people – Science and Technicians	Scientist, technician, funding-unknown time
Temporal resolution to seasonal problems	Work life balance
Autonomous data collection	More waste – chemicals
More money for science (e.g. fuel savings as fewer transits)	Cruise managers? How will this be dealt with?
Get to more remote places	
Geographic area – can we fund science funding for specific areas	
Multi skilled technicians	

Considerations
Logistics and Science planning
Cruise Management
Bandwidth Management
Opportunities – Data management
Grand overview of Governance

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Breakout 1: group 3 report

Pros	Cons
Less transit time	Problems of forcing groups together are the disciplines compatible
Reduced fuel consumption	Enough Techs for longer duration trip
Heli Deck for UAV and Helicopter activities	Costs associated with keeping staff on board longer
More capacity for combined logistics and Science	University staff have commitment
Shorter base resupply time	How and who prioritizes when there is conflicts

Considerations
Must manage expectations
May need to expand catering crew
Capacity of the ships compliment would require a large mobilization to be in Punta or Montevideo
Marine Manager / Marine projects coordinator to manage multiple groups
Regional hub (Rothera)
Is a single deck engineer enough for 24/7 operation? Labour law, but also looking after our staff!
Themed or regional funded science
Bolt on / add on science to existing grants

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Breakout 1: opportunities & challenges

Opportunities:

- "Nested" survey and sampling regime as different disciplines make use of ship at various times
- Geographically thematic funding calls
- Interdisciplinary science to foster ideas and publications
- Training for students/early-career researchers

Challenges:

- Funding model
- Downtime on long cruises
- Morale on long cruises
- Technical support and resources
- Equipment available for long cruises (NMEP)
- Transition issues (1st year south)
- Logistics versus science planning – who decides?
- Managing expectations (comms is key!)

Funding model – can this be worked through by BAS and NERC together?

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Funding

– What are the concerns from Scientists?

– There is scope to develop ideas – but these ideas need to come in from the community

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Lessons from multidisciplinary cruises on RV Polarstern

Presentation from Professor Heinrich Miller

'In order to have multidisciplinary cruises, you must have longer cruises.'

- German vessel is funded and utilised in different way to UK ships
  - 3 Fixed dates per year for submission, evaluated by 3 reviewers and then ranked. It is an interactive process to work with reviewers and teams to look at priorities.
  - 3 year lead time for multidisciplinary cruises
  - Cruise teams (ship staff & Pis) meet 18 months in advance of their cruise. Long forward planning critical for success.
  - Anyone, from anywhere in the world can apply to use the ship – key is to speak with AWI in advance.
- RV POLARSTERN
  - 3 main functions:
    - Icebreaker
    - Supply Vessel: science cannot happen without the support runs to Neumayer etc.
    - Research Vessel
  - To support the 24/7 operations the ship is made up of: 44 Crew, 48 scientists, 4 Heli crew .
  - There is room for 5 lab containers; one fixed in place and science groups are expected to bring their own technicians.
- Advantage - learn about other disciplines. Groups present their results to other scientists on board, great way of learning.
- Feedback from scientists is that they enjoy the cruise time, they have time to review and do work they don't get time to do at home. Mike Pinnock notes the special atmosphere aboard Polarstern which is conducive to working/writing.

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Lessons from multidisciplinary cruises on RV Polarstern

Lessons

- Multidisciplinary cruises are particularly effective in sea ice, where changing conditions favour different disciplines at different times.
- They should be at least 5 weeks in duration to be worthwhile
- Educational value – take advantage of other researchers in different fields
- 24/7 operational capability a necessity
- Chief scientist (Fahrtleiter) deals with conflicts/anxieties at the start – these quickly fade if dealt with correctly
- 3 year operational planning horizon; cruise team & PIs meet 18 months ahead of their cruise to discuss cooperation once aboard.

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Scenario Planning: Large Single-Discipline Cruise

Using knowledge of science discipline and operations, develop a "typical" optimal single-discipline science cruise scenario for the *SDA*.

- Three breakout groups based on disciplines - atmospheric science, physics, geology, biology, biogeochemistry and data mgmt.
- Chair or rapporteurs to report back to plenary.

What is the optimal number of scientists to deliver a single discipline cruise?

- Is the JCR average sufficient or has this limited past science?
- Would a larger number of scientists on ship enhance delivery of single-discipline science project objectives?
- Would extra scientists/students add value or detract from delivery?

What is the optimal duration of a single-discipline cruise?

- Is the JCR average duration sufficient or has this limited past science?
- Would longer cruises enhance delivery of single-discipline science project objectives?
- If so what are the key challenges in delivering a longer single-discipline cruise and how can they be overcome?

What does a typical single-discipline cruise look like on the SDA?

- Number of scientists on ship and in each lab?
- Location of major equipment and containers on deck?
- Technical support required?
- How much "wire-time" required?
- What excess capability and capacity is there for other science activities?

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Atmospheric Science

- Past science has not been limited by JCR's size.
- Advantages to longer cruises, especially for sampling rare/unpredictable weather systems
- Would use the containerised labs the most
- Sample lines may need to be longer, not ideal running long lines.
- ~ Half the berths would be used.
- True interdisciplinary cruses would be a huge advantage.
- Atmospheric science utilises stationary time best but doesn't need continuous sampling – can work around other operations.
- Utilises poor conditions – storms of major interest.

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Physics

- Optimal number of berths 25
- Limitation on JCR is the lab space
- Extra scientists and students could be of value.
- Key Challenges:
  - Time people are up for, potential 12h day for the duration on board.
  - Duration time on-board
  - Morale could be an issue
  - Staffing for the duration could be challenge. Change from 4/5wk cruise to 60/70 days will be a big jump.
- Wire-time, all the time apart from bad weather.
- Could like with Chemistry – tonnes of water thrown back overboard.
- Definite excess capacity

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Geology

- 28 people optimal number – equal numbers of scientist and technicians
- Deck space and containers would be most used
- More cabins a bonus but have not been limited before
- Duration increase means we may be able to reach more remote locations – additional time can be utilised well.
- Giant piston corer cruise an exception to this – GPC would dominate any cruise and nothing else could really be done at the same time.

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Biology

- Don't do single disciplinary science at present – cruises generally multidisciplinary already
- Always open to others joining a cruise
- Currently use all the lab space on JCR – increased space on SDA welcome
- Need to be smarter about the facilities aboard the new vessel. Currently freezer and chemical spaces provided but could make better use of "downtime" with processing facilities
- Eg. video – it takes 4x longer to review the tape than the duration of the video itself. This could be done onboard, especially with increased berth space for students/junior staff to be trained.

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Biogeochemistry

- Interdisciplinary and include other sciences like atmospheric, sampling, meteorological, geological, physical and oceanography.
- 35 scientists on the SDA (this doesn't include technical staff)
- Increase PhD students to utilise the extra berths.
- 6x containers
- ~4-6 weeks optimal duration
- Planning funding – 2/3y lead time
- Wire time – need all of it, ideally including simultaneous sampling from different winches.

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Data Logging System

JCR currently picks up around 3TB of data per cruise; with the increased equipment on SDA it is anticipated the data returns will be far larger, into hundreds of TB.

- Specification:
  - Science requirement on cruise
  - Format to place data in the data centre
  - System to manage and train
- What formats do other countries use?
- What is the output format required?
- Dedicated data manager
  - for the larger cruises?
  - Funding?
  - Ensure data is captured correctly
  - Ensure metadata tagging

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Science Trials (Randy Sliester)

The Programme board need the following info:

- Define specific science trials disciplines
- Decide on duration & location of each trials package
- Designate science lead for each trials package
- Designate tech lead for each trials package
- Design Trials programme itinerary. Post ship in service trials
- Set list of deliverables and dates due
- Input SME science trials expedition into the MFP.

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Science Trials (Randy Sliester)

Timelines

- June 2018 – Cammell Laird testing and commissioning
- Oct 2018 – BAS training and testing begins in the Northern Hemisphere (Mersey, Irish Sea, North Sea)
- Spring 2019 – Short duration testing for both fixed and portable science equipment
- Oct 2019 – "Rehearsal" year
  - Full logistics programme in Southern Atlantic, with extra time for initial operation learning
  - ~50 days available for rehearsal science in Jan/Feb 2020
  - ~50 days available for Arctic rehearsal science in Summer 2020
- October 2020 – Ship comes into service for funded science

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Science Trials

70 Days – Spring 2019

What can we do in these 70 days?

- Simulating real cruises for operational purposes
- Scientists can test the ship & new equipment and get science results.
- Multidisciplinary cruise ideas required to practice collaboration.

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Next steps…

Action	Who	When
Deck plans provided for understanding where equipment and cargo will be on each SDA research cruise	BAS Operations?	To be decided
Funding model – raise ideas with Natalie Clare	All workshop participants	Anytime
Engage with NERC regarding funding model – Natalie to take forward	Natalie Clark	To be decided
Multi-discipline sea-trials cruise plan and SME submitted	Yvonne Firing, Ian Brooks, Sophie Fielding, Malcolm Woodward.	Autumn 2017
Piston Corer sea-trials cruise plan and SME submitted	Colm O'Cofaigh, Rob Larter	Autumn 2017
Geophysics/Geology sea-trials cruise plan and SME submitted	Christine Piece	Autumn 2017
Data management report to NPRV Board	Jeremy Robst	7 July 2017
Add SME to NMF/NMF website	Colin Day	1 August 2017
Rehearsal cruise – raise ideas with Ray Leakey	All workshop participants	Anytime
Rehearsal cruise proposal announcement	Nigel Bird and Ray Leakey	To be decided

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Annex 4: Co-chair notes on presentations and discussions (Natalie Clark)

Ray Leakey – introduction talk

Needs of the ship:

- Delivering frontier polar science
- UK presence in the Antarctic
- Spend to save

Aims of the workshop, to discuss:

- Planning and delivery of routine cruises and optimal models (e.g. like JCR now or different?)
- Sea trials in North Atlantic and Arctic – equipment and scientist mapping
- First year in service South (Oct '19 – Sep '20), with JCR. To include potential rehearsal cruise – do we need, who, where, when?

NPRV opportunities:

- Multidisciplinary cruises
- Greater endurance, reach more remote regions
- More scientists
- More lab/container space
- More 'scientist' days at sea (although can't assume this will be reflected in outputs)
- Ask more/new science questions?

Possible issues:

- Additional tech support – availability and funding?
- ~15% less 'science' days at sea: 180 → 154.
  Important to protect those 154 days and optimise wherever possible e.g. longer, larger multidisciplinary cruises.
  If logistics work is covered by another ship, there's no reason why SDA can't go anywhere in the world for a whole year, although likely to be doing similar polar work to JCR with an average of 154 science days per year.

If we run SDA in the same way as JCR, there'll be a decrease in scientist days at sea – assuming 30 scientists on ship gives ~4500 days.
Other extreme is to have 60 scientists on ship gives ~9200 days.
Potential to also do fewer, larger cruises to save transit time.
Need to explore the optimum cruise scenarios.

Question/Comment from Audience
Extra time does not necessarily equate to extra sampling or compensate for less time – likely to be less sampling.
The geographic location of the bases will impact on the science – if SDA can only visit the bases on a 'good' day then this limits the potential for science – time and location.

Sophie Fielding – labs talk
SDA will have ~760m^2 of lab space, with main lab ~ 120m^2.
(cf. ~ 460m^2 on Cook/JCR and ~550m^2 on Discovery.)
May need to operate with different groups in different labs; 3 cruise planning hubs = Main lab, data suite, UIC.

Simon Wright – decks talk
Retained forward crane, as on JCR (e.g. used commonly on AMT)
Side A-frame
Stern A-frame
Moonpool
Workboat with small winch, echosounders. Good for shallow water work.

Issue with doing multiple coring at same time – will always have to do other coring before giant piston coring? Options:

- Use moonpool for other
- Configure giant corer to do other coring too
- Gravity coring off the stern

Might have more need for proper deck plans to plan exactly where equipment will go and how it will be moved around. Deck plans have been used before but haven't always included any cargo, which must be included at the same level. NMF use deck plans.
e.g. Vibrocorer plus ISIS ROV cannot be used at the same time – there will be certain permutations which are not possible.

Andy Barker – equipment talk
Who will look after (and resourcing for that time) the atmospheric equipment? Assumed that lab manager will do this to some extent.
Containers will not necessarily need to be on board the whole time, some will need to return to BAS and other might be able to be left at a Southern hub e.g. Punta/Falklands.
Gas cylinders will be a gas bottle store off the hangar.
Will be purchasing a basic seismic profiling system.
RapidCAST – a more environmentally friendly version of an XBT.

Jeremy Robst – IT, data, comms talk
10-fold improvement in IT cf. JCR.
Wifi reaches virtually everywhere, deck 3 upwards, with bandwidth ~1.5-3Mb/s (double that of JCR).
Increased data storage to allow multidisciplinary work over longer durations.
Possibility of incorporating a HPC on the ship to allow onboard processing, particularly on longer, larger cruises with downtime.

Data is the immediate priority – availability and ease of use to scientists on board, but also ease and speed of getting data into BODC or other DCs.
H/e, no agreement yet on the Data Logging System (DLS) and supplier, and will need to make a decision on this by end of this year.
Would be useful to start a discussion on this at this workshop, between IT experts, data managers from DCs and scientist end users – planned for day 2.

Randy Sliester – operational timetable talk
Sea trials – likely to start Sep/Oct 2018.
Sea-ice trials scheduled for mid-March → mid-April 2019.
Acoustic trials planned for February 2019 near PAP.
Call for the equipment to be turned on before this, to check working and also opportunistically use to assess different locations in different sea states; then have the scientists present for the calibration work.

70 days of science trials available, possibly:

- 30 days biology/physics
- 30 days geology/geophysics/coring
- 10 days specifically seismics

Polarstern – sea trials happen before the operator takes ownership of the vessel.

Breakout session 1

- Who pays for additional data collection costs associated with longer multidisc cruises?
- Imperative for NERC to review funding models (e.g. funding for add-on projects).
- Should NERC provide support for funding regional specific thematic programmes which would integrate funded science into big multidisciplinary science cruises?
- Should be thinking 'interdisciplinary' rather than multidisciplinary – working together rather than simultaneously.

Heinrich Miller – Polarstern talk

Operated by AWI, is an icebreaker, supply vessel and research vessel.
44 crew, 48 scientists, 4 heli crew. 24/7 operations.
During 1982-2016 – 31 Arctic cruises, ,34 Antarctic cruises, 310 science days/yr, 45 users/cruise.
9% of shiptime is logistics – more widely called science support.
~ 25% of shiptime is used by international institutions.

ROVs – Victor 6000 and QUEST 4000 (neither owned by AWI).
Fixed places for 5 containers.

Technicians are provided by the science groups and not supplied by AWI. As such, the science users are not having to pay cruise costs for technicians – bring their own. AWI only have a few techs – IT, winch systems, etc.

To be effective, multidiscipline cruises need to be longer than standard stand-alone cruises, at least 5 weeks.
Multidisc cruises always have a 'main' project and other ancillary projects.
Benefit of a multidisciplinary cruise is that, if one piece of equipment fails, you can switch to use another piece, have other options.
Can also be very effective in changing sea-ice conditions – the changes favour different disciplines at different times.
PIs can initially get anxious about getting time for their own research but that usually goes away!
Need a lot of planning to be effective – programmed at least three years in advance. E.g. now proposals are now requesting 20/21.
Immense educational value.
Need 24/7 operational capability.
Example cruise: Cape Town → Neumayer (people/kit exchange) → Punta, c. 10 weeks. Main science in Filchner Trough.

Polarstern is largely oversubscribed – three times over. With larger blocks of science and smaller blocks fitted in opportunistically at a later date.

OFOS – camera system which gets towed behind, take images of iceberg scours impact on seafloor, temporal study.

Question/Comment from Audience:
How do we move to a three year planning horizon?
Some of the Marine Planning process is there to enable this, and NERC are already looking further ahead than previously. However, we cannot necessarily change NERC funding timelines (e.g. need to spend in a certain year) and PIs may not always want to wait 3+ years for a cruise.
Polarstern has a different funding mechanism which may more easily allow longer term planning.

Question/Comment from Audience:
How can we get an idea of upcoming cruises to see if there's potential for bolt on activities, with enough advance warning to look for suitable funding? Including those cruise which are funded and programmed, funded and not in the published programme, and not yet funded. This would assist with long-term planning.
European partners have search portals which advertise the science underway and how many spare berths, days, etc on each cruise might be available.
The new Marine Facilities Planning website has the potential to do this, but there is always the danger that work is conducted to think about bolt on activities to projects which are not then funded.

Randy Sliester – sea trials talk
The sea-ice trials will take place in the Arctic mid-April to mid-May 2019, but no other ice work planned for 'heavier' ice. May be more able to test this during a rehearsal cruise in 19/20.

NERC take ownership of the SDA 01/10/18 (may be earlier).
1/10/18 → 1/10/19 is a 'test and train' year of sea science trials. During this time, three science trial packages were discussed:

1. Biogeochem, biophysics, atmospheric for 30 days (Sophie, Yvonne, Malcolm, Ian)
2. Seismic, multi-channel streamer, coring systems (except giant piston corer), dredging, vertical hydrophone for 30 days (Christine)
3. Giant piston corer for 10 days (Rob)

The associated PIs will complete SMEs for each cruise.

Randy/Ray/Nigel Bird – rehearsal cruise talk
During the first year south (Oct 19 to Spring 20), Nigel Bird invited the community to put together two cruises to run in that year, around 50 days each.
NERC would pay all costs except scientist salaries.
There will be no competition or peer review for the science as there may be problems and the cruise fails; these cruises are designed to find out if and where things are going to go wrong.
In all other ways will simulate a real cruise – SMEs, cruise planning, PCAs, etc.
1st cruise will go south in Dec '19/Jan '20 (e.g. a cruise into the Weddell Sea, science inbound to Halley for first call)
2nd cruise will go north in early Jul-Sep '20.
May be an issue with all of the likely PIs already on JCR (or waiting to hear about funding that might put them on JCR!).
Scientists to send ideas to Ray in first instance, with potential for a follow-up workshop to discuss/integrate/firm up ideas.