

## Day three – Doing things differently: science opportunities and challenges

- Realising our science ambitions – Prof Susan Waldron
- Challenges and opportunities – Dr Ray Leakey
- Marine planning – Dr Natalie Powney
- Science and operations – Simon Garrod

# RRS *Sir David Attenborough* – *science users' workshop*

## DAY 3 – Friday 27 November 2020

9.50am to 10am	Arrival	
10am to 10.15am	Welcome. Realising our science ambitions. Long-term horizon scanning	Professor Susan Waldron, <i>NERC</i>
10.15am to 10.20am	Ambitious science – a vision for the future.	Professor Dame Jane Francis, <i>BAS</i>
10.20am to 10.40am	Challenges and opportunities. Review of key issues from the first science user workshop held in 2017.	Dr Ray Leakey, <i>SAMS</i>
10.40am to 11.00am	Marine Planning. Current mechanisms for research cruise planning and funding	Dr Natalie Powney, <i>NERC</i>
11am to 11.20am	Science and Operations. The dual role of RRS <i>Sir David Attenborough</i>	Simon Garrod, <i>BAS</i>
11.20am to 11.30am	Questions	Professor Susan Waldron, <i>NERC</i>
11.30am to 11.35am	Break	

## Realising our science ambitions: Long term Horizon Scanning



Image from Dr. Bob Larter, BAS

# RRS *Sir David Attenborough* – *science users' workshop*



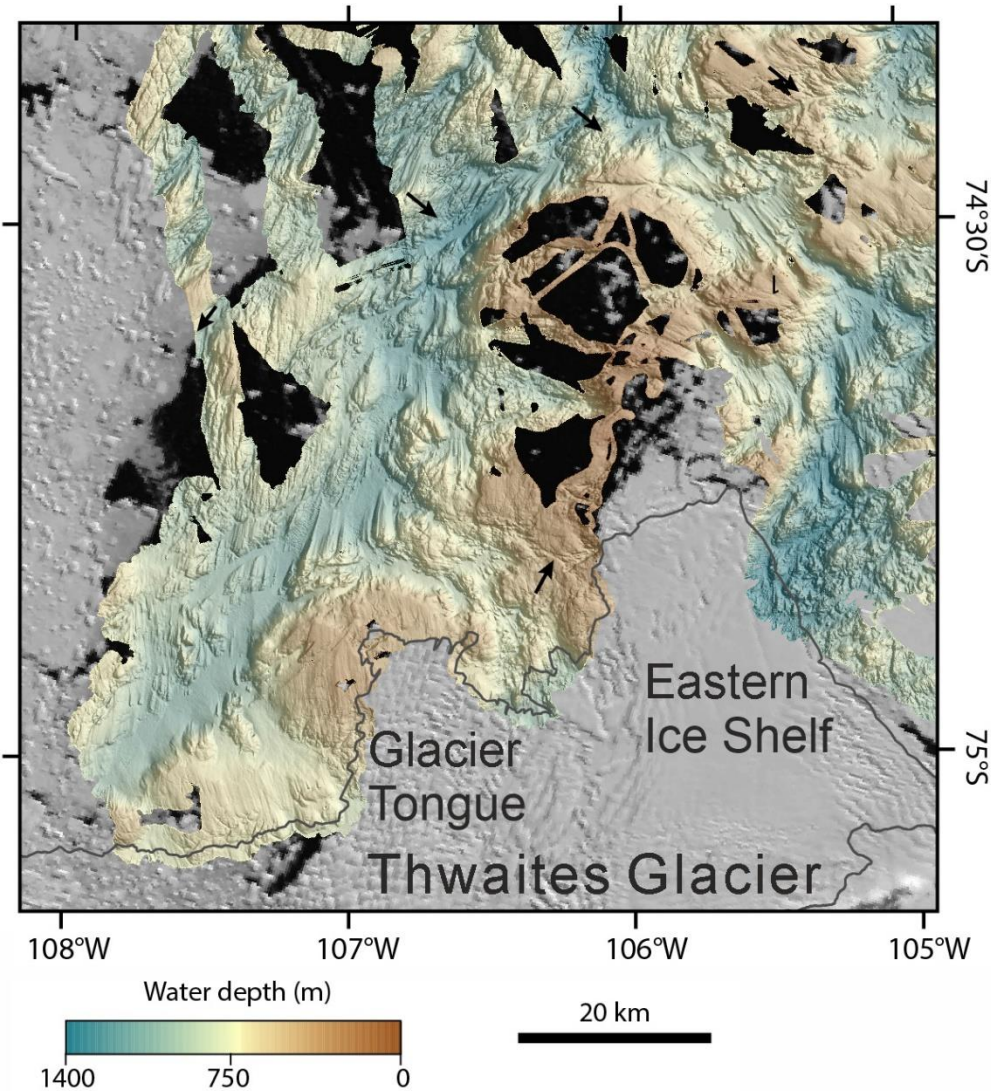
- NERC-supported Antarctic research provides the UK with vital understanding of how the polar regions are responding to natural and human-driven pressures, and their impact on global climate.
- Invest ~ £17M in 2019/20 in the operation of RRS (Royal Research Ships)
- The RRS Sir David Attenborough: 60 scientists; state-of-the-art laboratories and equipment (+AUV); the first UK polar research vessel with a helipad and moon pool



# RRS *Sir David Attenborough* – *science users' workshop*



# 2019: First International Thwaites Glacier Collaboration (ITGC) Cruise



- Initial work for three ITGC projects plus oceanographic moorings
- Physical oceanography research used autonomous underwater vehicle, seaglidors and satellite tags attached to seals
- Oceanographic moorings recovered contain 5-year long records
- Coastal island geology and geomorphology constrains long-term rates of glacial isostatic adjustment
- Marine geology and geophysics revealed troughs deeper than previously thought routing warm water under ice shelf, and recovered sediment cores to extend records to pre-satellite era



**Hogan et al: The Cryosphere, 14, 2883–2908, 2020** Calculations of trough capacity, and thus oceanic heat flux, may be significantly underestimated



# Present: UK-German Amundsen Sea Seabed Drilling Expedition



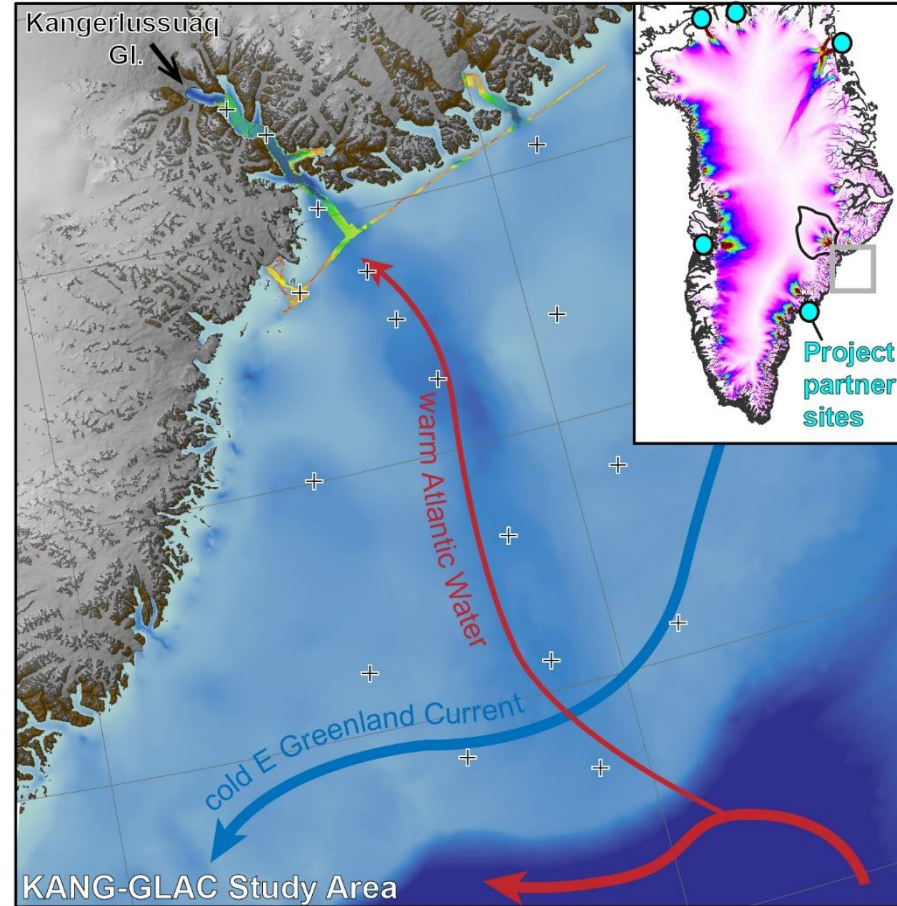
- First operation of MARUM-MeBo70 sea-floor drill rig on Antarctic shelf during RV *Polarstern* expedition PS104
- 4 UK & 6 German institutions : led by AWI and BAS
- Discovered remains of temperate rainforest at ~82°S with high plant diversity and mild mean annual temp. (~13°C)
- Combined palaeoenvironmental evidence used as target values for global climate model
- Reconstructed conditions can only be simulated with 1,120-1,680 ppmv CO<sub>2</sub> and vegetated Antarctic continent without larger continental ice masses.

In the future run GCM with various types of vegetation cover coupled with other drivers such as palaeogeography or changes in cloudiness



# Future (2023-2026): **KANG-GLAC** - Marine terminating Glaciers in the Earth System)

- NERC Highlight topic: Ice sheet behaviour where it meets the ocean highly uncertain. Greenland Ice sheet losing mass at fastest rate measured
- Key deliverable – To determine the role of the ocean in driving decadal-to- centennial marine-terminating glacier dynamics through the Holocene
- Ship – Large multidisciplinary cruise on SDA 2023\*
- Partners – BAS, Durham, Leeds, SAMS plus 6 international research institutions (USA, Sweden, Denmark, Italy, Canada, Belgium)



\*- date to be confirmed



Natural  
Environment  
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# RRS *Sir David Attenborough* – *science users' workshop*

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11.30am to 11.35am	Break	
11.35am to 12.20pm	Breakout 1: What is our vision for ambitious science on the SDA in the Antarctic?	Chair: Professor Karen Heywood, <i>UEA</i> Rapporteur: Dr Alex Burton Johnson, <i>BAS</i>
12.20pm to 1.30pm	Lunch	
1.30pm to 2.15pm	Breakout 2: What is our vision for ambitious science on the SDA in the Arctic?	Chair: Prof Finlo Cottier, <i>SAMS</i> Rapporteur: Dr Kelly Hogan, <i>BAS</i>
2.15pm to 2.30pm	Break	
2.30pm to 3.15pm	Breakout 3: Making it happen. How should we plan, fund and schedule science on the RRS <i>Sir David Attenborough</i> ?	Chair: Prof Susan Waldron, <i>NERC</i> Rapporteur: Dr Alex Brearley, <i>BAS</i>
3.15pm to 3.30pm	Break	
3.30pm to 4.15pm	Breakout 4: Building inter-disciplinary, diverse and inclusive polar science communities of the future	Chair: Dr Sian Henley, <i>U. of Edinburgh</i> Rapporteur: Dr Huw Griffiths, <i>BAS</i>
4.15pm to 4.30pm	Break	
4.30pm to 5.15pm	Plenary: break out session reports and close	Professor Susan Waldron, <i>NERC</i>
5.15pm	Close	



# Challenges and Opportunities: Review of key issues from the 2017 workshop

Dr Ray Leakey

*SDA science user lead, Scottish Association for Marine Science*



# Science Opportunities and Challenges



RRS *Sir David Attenborough* has implications for the delivery of marine science programmes.

Research cruises are likely to change from current practice in response to:

- transition from a two-ship to one-ship polar science and logistics operation,
- the new ship's capabilities and capacity.

New opportunities to enhance science output.

Challenges to optimise delivery of marine polar science programmes.

# Science User Workshop 2017

RRS Sir David Attenborough cruise planning and operations workshop:

- 36 scientists and managers from NERC and UK HEIs.
- Future operating model for research cruises.
- Opportunities and challenges around planning and delivering science cruises.





# Lessons from the RV *Polarstern*

Prof. Heinrich Miller (AWI)



Comparable to the *RRS Sir David Attenborough* in terms of size, science capability, berths, duration and joint logistics/science role.

## Large size enables:

- Multi- and inter-disciplinary science.
- Maximum use of the ship in variable environments (especially sea-ice).
- Enhanced education, training and a shared-learning environment.

## But requires:

- Long-term (minimum 3-year) planning horizon.
- 24/7 operations on long (minimum 5 week) multi-discipline cruises.
- “*Main plus ancillary*” research cruise model led by one chief scientist.

# Scenario Planning for Multidisciplinary Cruises



Scenario planning to translate single-discipline cruises from the RRS *James Clark Ross* to the RRS *Sir David Attenborough*.

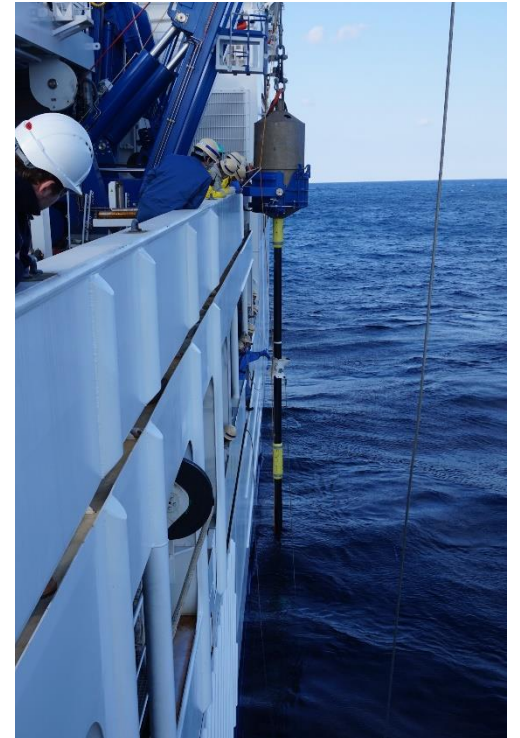
- Reveals excess capacity on the RRS *Sir David Attenborough* which, if appropriately resourced, could be used to support additional science.
- This excess capacity varies according to discipline and in all cases represents a <50% increase in capacity over and above the RRS *James Clark Ross*.
- Berths, duration, lab space and deck space available for additional science.
- However, wire time and data (availability and ease of use) may be limiting.



# Opportunities

to enhance scientific research, training and outreach

- New equipment capabilities enabling new science.
- Enhanced capacity and capability enabling more holistic (nested surveys, atmosphere to seabed), inter-disciplinary and regional themed science.
- Longer duration at sea enabling access to remote locations and temporal resolution of seasonal problems.
- More berths enabling greater international collaboration and a wider pool of scientific and technical skills on ship.
- More berths and lab facilities teaching and outreach activities.

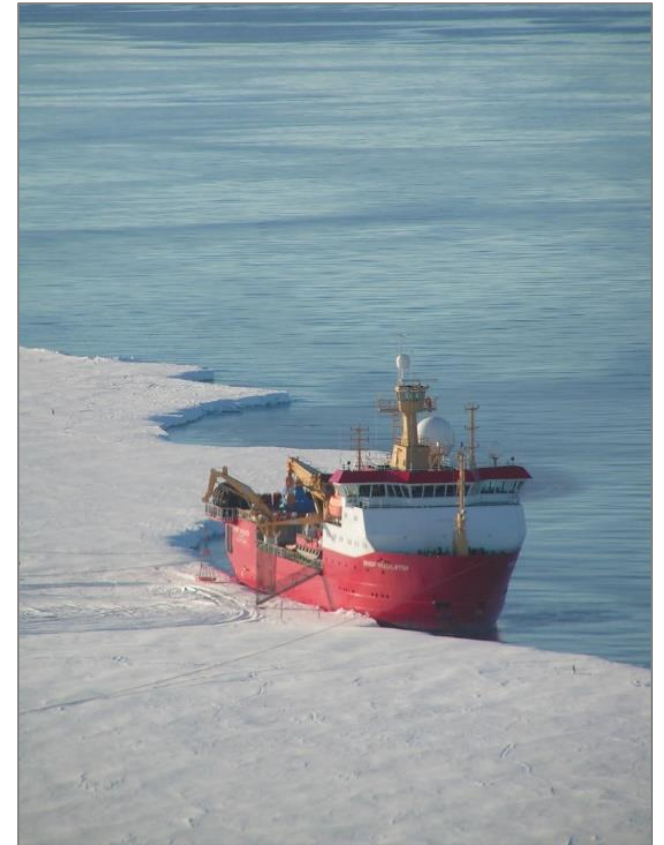


# Challenges

to optimise delivery of marine polar science programmes

The move from **two-ship to one-ship operation** may lead to:

- a reduction in science days at sea,
- the possibility of single point failure or problems emerging from more complex logistics/science operations,
- a challenging transition period to a one-ship operation.





# Challenges

## to optimise delivery of marine polar science programmes

Longer and/or larger multi-disciplinary cruises may present conflicts of interest and place greater demands on **cruise management**:

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



# Challenges

## to optimise delivery of marine polar science programmes

Longer and/or larger multi-disciplinary cruises may place **greater demands** on scientists, technicians and equipment when at sea for long periods of time:

- availability and cost of staff,
- availability and cost of equipment,
- prioritisation of different science activities and projects,
- equipment and personnel downtime,
- pressures on ship staff,
- morale and work-life balance.





# Challenges

## to optimise delivery of marine polar science programmes

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

- the need for longer-term science planning horizons for more complex research cruise models,
- the need to align current funding structures with the demand for longer-term planning horizons,
- the possible requirement for increase in funding.



# Workshop Recommendations

- 14 recommendations and 9 actions.
- Several addressed during the last 3 years.
- Others outstanding and relevant to this workshop





# Workshop Recommendations

## for NERC, BAS and NMF

- *To work together, and with science community, to ensure staff and equipment resources are aligned with the requirement to optimise science delivery.*
- *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.*



# Workshop Recommendations

## for the science user community

- *Embrace, on an ongoing basis, all opportunities to optimise and enhance delivery of science, training and outreach.*
- *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.*



# Addressing the Challenges

Time

Strategic Issues

Operational Issues

## Science Community

Discovery science?  
Strategic programmes?  
National Capability?

Alignment

## NERC, BAS, NMF Operations

How do we optimise  
ship operation?

## RRS *Sir David Attenborough*

What will ship be doing?  
When will ship be doing it?  
Where will ship be doing it?





# Doing Things Differently

Understand the RSS Sir David Attenborough's new science capabilities



Identify new science ideas and opportunities enabled by the new capabilities



Identify any barriers preventing the realisation of these ideas



Explore solutions to these barriers by doing things differently

# Marine Planning. Current mechanisms for research cruise planning and funding

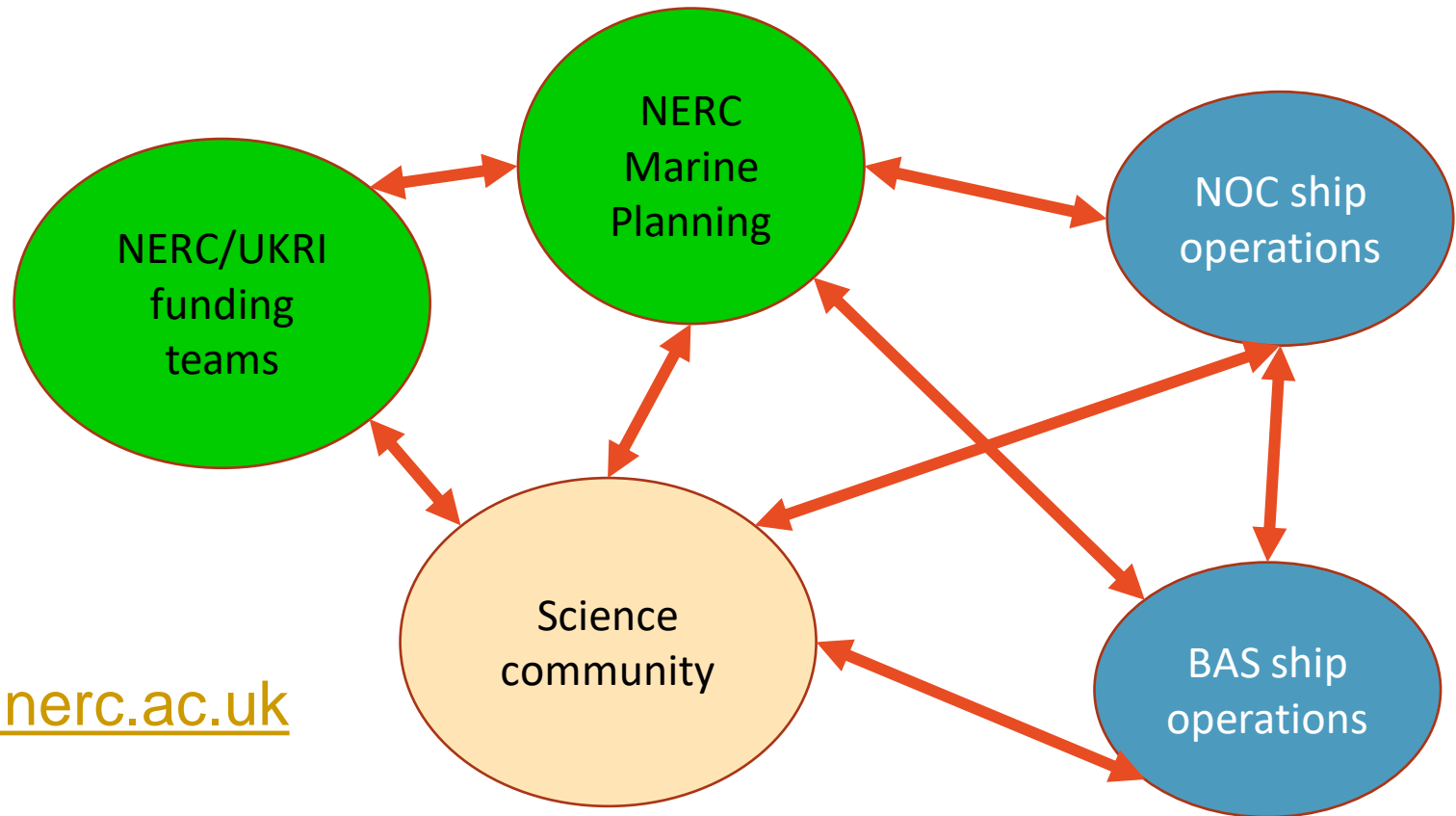
Dr Natalie Powney

*Head of Marine Planning, Natural Environment Research Council*

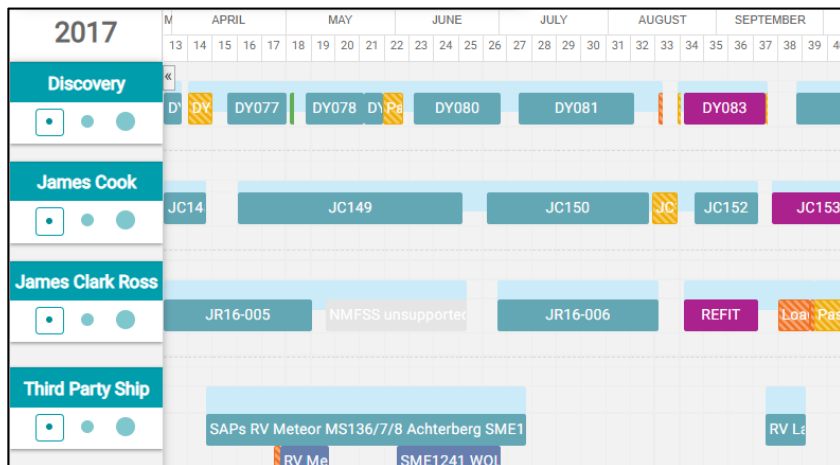
# Marine Planning

Shiptime and marine equipment requests:

- *Discovery, James Cook, SDA*
- NMEP and SDA equipment
- Barter vessels/equipment



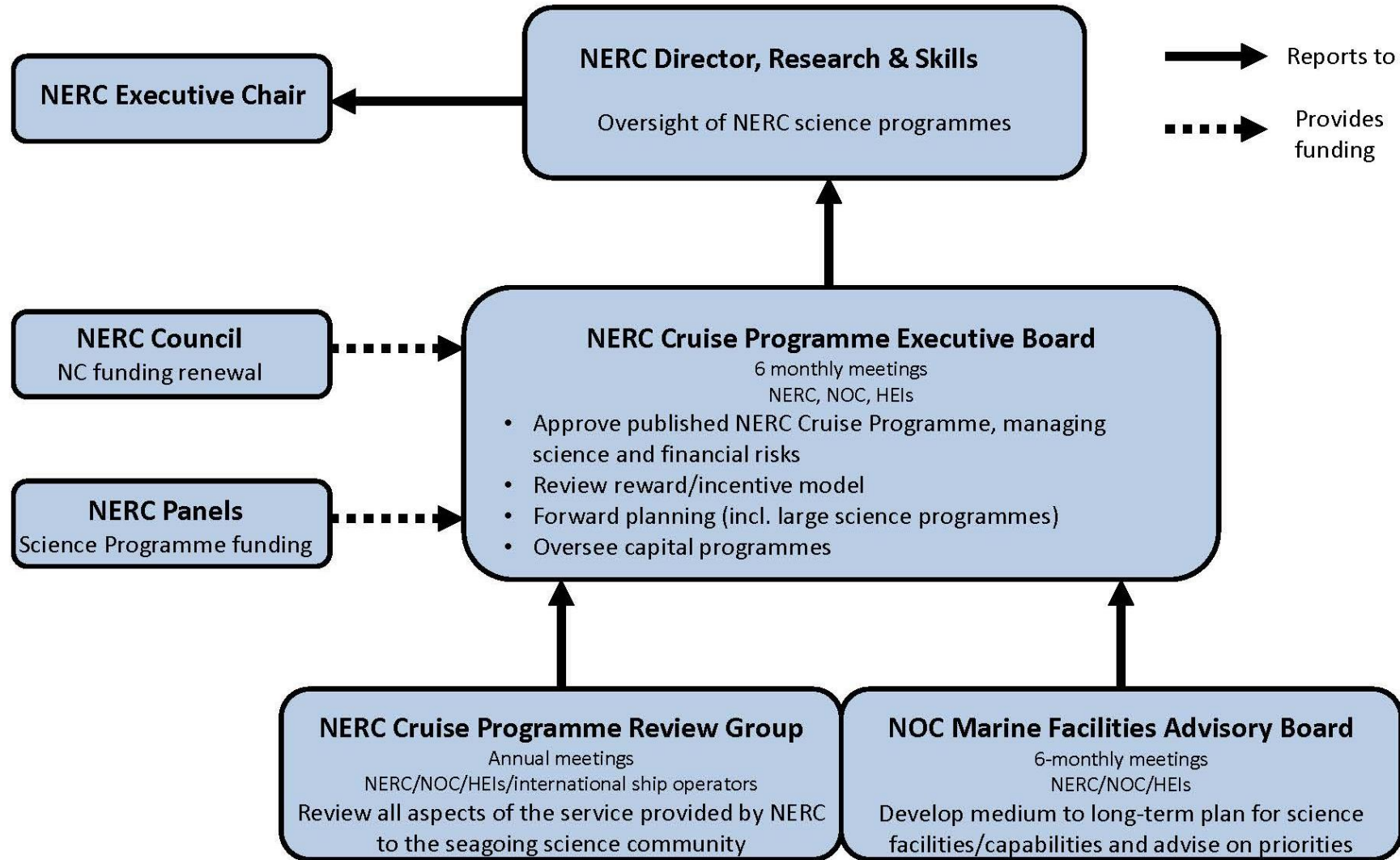
Marine Planning [marineplanning@nerc.ac.uk](mailto:marineplanning@nerc.ac.uk)



*We want to work with you (over many years!) to enable excellent science using state of the art capabilities*

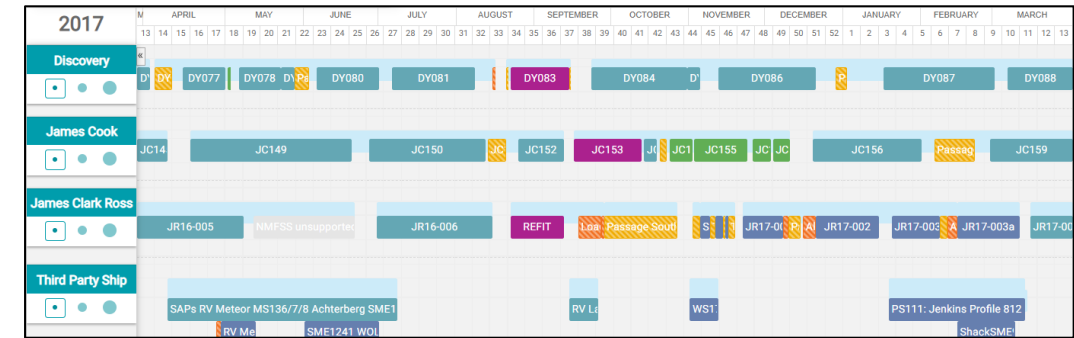
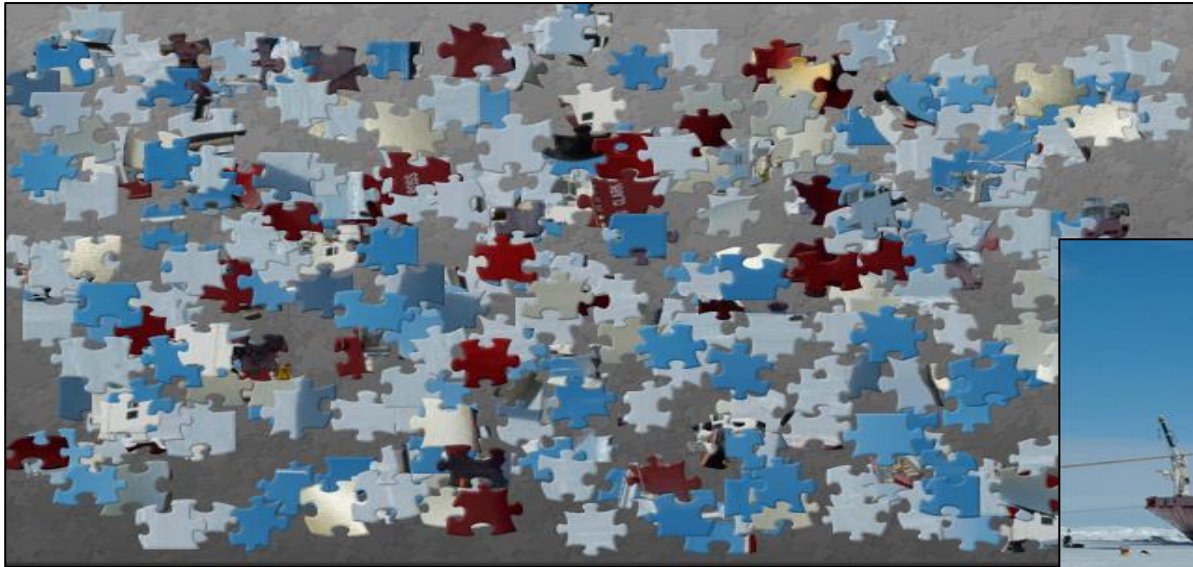


# Marine Planning governance

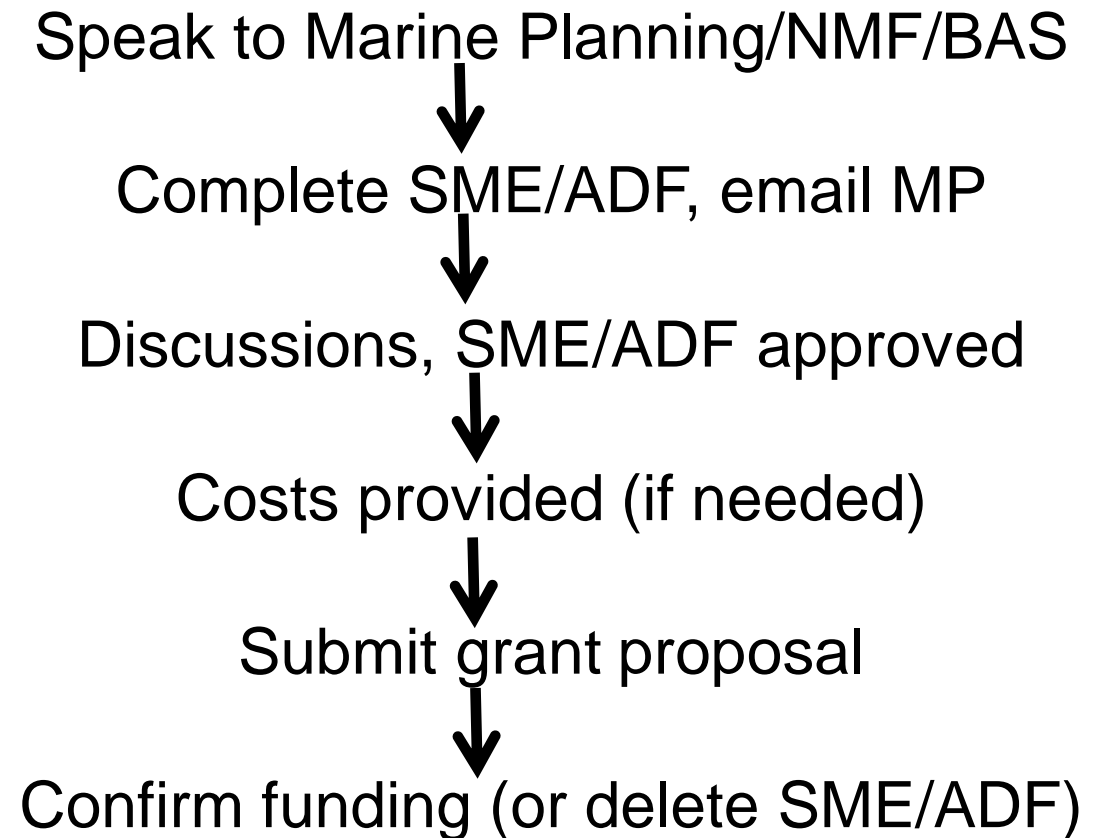
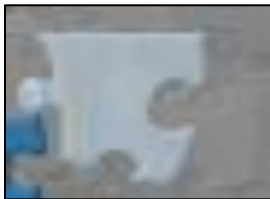
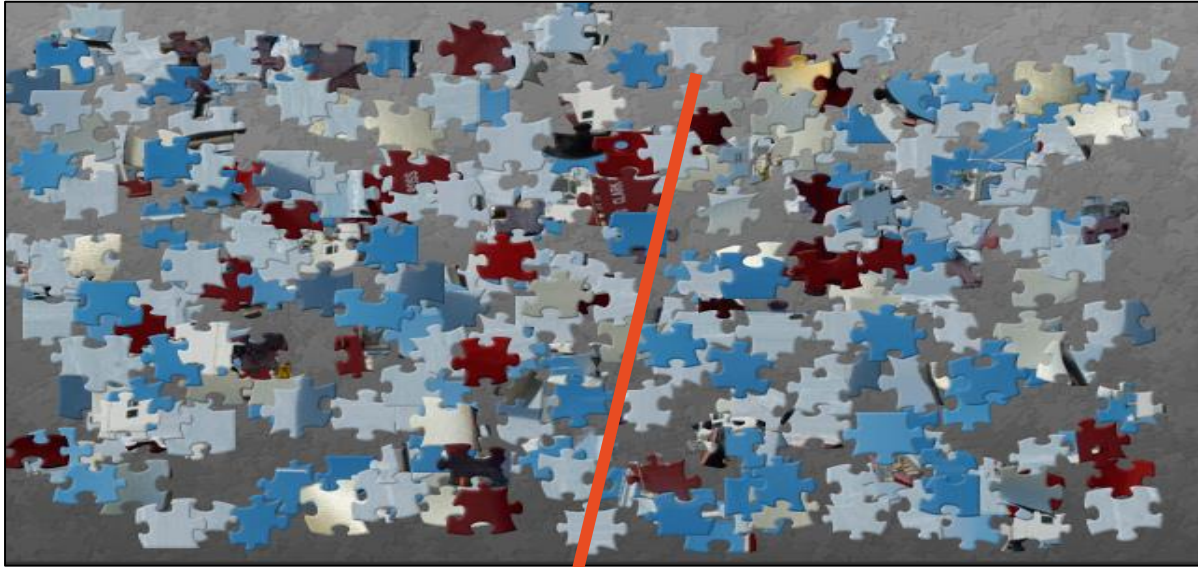


# Constructing the Marine Facilities Programme

Giant jigsaw puzzle!



# How do I request shiptime?





# How do I request shiptime?



The screenshot shows the homepage of the Marine Facilities Planning website. The header includes the title 'Marine Facilities Planning' and a 'Login' link. The main content area welcomes users and explains the purpose of the site: to allow scientists to apply for marine facilities. It mentions that the site is supported by the Natural Environment Research Council (NERC) and the Netherlands Institute for Ocean Research (NIOZ). A world map is displayed with callouts for NIOZ and NERC. At the bottom, there are navigation buttons for 'PROGRAMME', 'ABOUT', and 'REQUEST AN ACCOUNT', along with logos for GEOMAR, NIOZ, and NERC.

Marine Facilities Planning

Welcome to the Marine Facilities Planning Page

This website allows Scientists to apply to use marine facilities in support of marine science from both the Natural Environment Research Council (NERC) and the Nederlands Instituut voor Onderzoek der Zee (NIOZ).

It is possible to view parts of this webpage including the published research voyage programmes for the NERC and NIOZ Marine Facilities by selecting the 'Public Page' below.

In order to apply to use these marine facilities you must be a registered user of the Marine Facilities Planning Website. Please request an account or login above.

PROGRAMME ABOUT REQUEST AN ACCOUNT

the nioz royal netherlands institute for sea research is the national oceanographic institution for the netherlands. our mission is to gain and communicate scientific knowledge on seas and oceans for the understanding and sustainability of our planet.

the natural environment research council is the uk's largest funder of independent environmental science, training and innovation, delivered through universities and research centres.

GEOMAR NIOZ NERC



The screenshot shows the NERC Ship-time & Marine Equipment Application Form (SME). The header includes the title 'Application Form' and a date '16/093'. The main content area includes the NERC logo and the title 'Ship-time & Marine Equipment Application Form (SME)'. Below this, there is a section for 'TITLE OF PROJECT' with the text '2020 RRS Discovery refit trials and commissioning period'. A table shows the 'Last modified' and 'Submitted' dates as '29/11/2016 Mr Colin Day'. Another section for 'PRINCIPAL INVESTIGATOR' includes a table with fields for 'Name', 'Organisation', and 'Email', with values 'Mr Colin Day', 'National Oceanography Centre, Southampton', and 'cdy@noc.ac.uk' respectively.

Application Form

16/093 Project Management > 2020 RRS Discovery refit trials and commissioning period

NERC SCIENCE OF THE ENVIRONMENT

Ship-time & Marine Equipment Application Form (SME)

TITLE OF PROJECT

2020 RRS Discovery refit trials and commissioning period

Last modified	29/11/2016 Mr Colin Day
Submitted	29/11/2016 Mr Colin Day

PRINCIPAL INVESTIGATOR

Name	Mr Colin Day
Organisation	National Oceanography Centre, Southampton
Email	cdy@noc.ac.uk

Marine Facilities Programme website:  
<https://nerc.marinefacilitiesplanning.com>

Start early!  
Provide details!  
Be accurate!  
Talk to experts

# Funding for shiptime

**1<sup>st</sup> April**

**Cut-off for funding confirmation to be considered for the following cruise programme year (opportunistic afterwards)**

Standard Grant

Large Grant

Strategic Research Programmes

NERC/UKRI funding\*

National Capability Science

Other peer reviewed funding

Other non-peer reviewed funding

Fellowships

Other Research Council funding

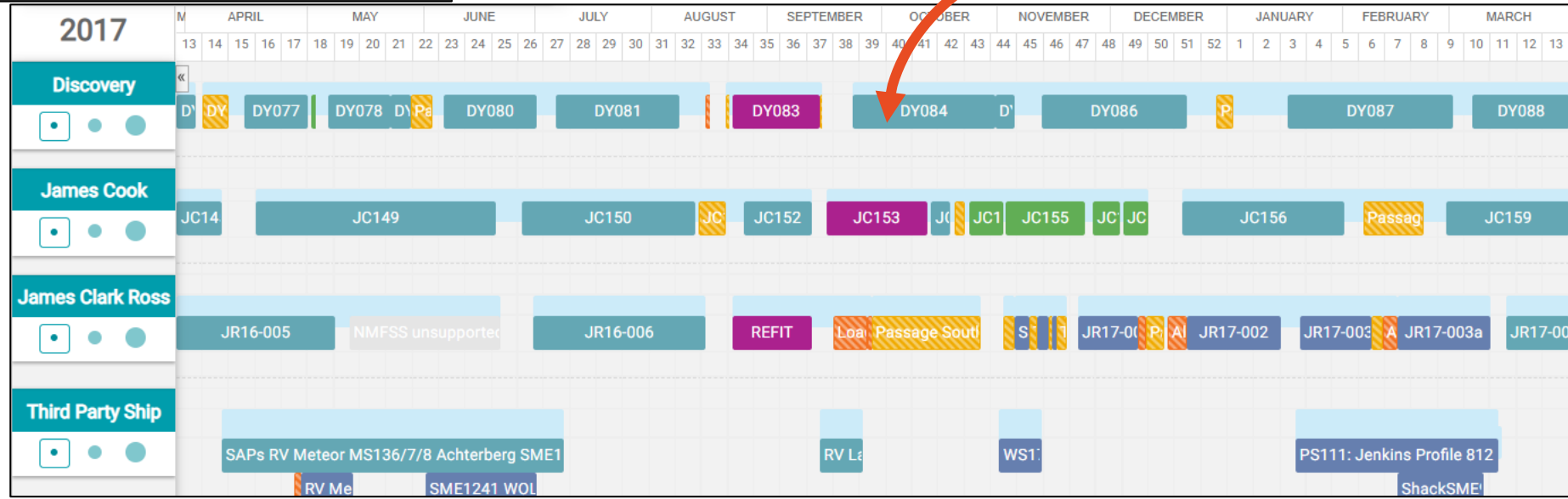
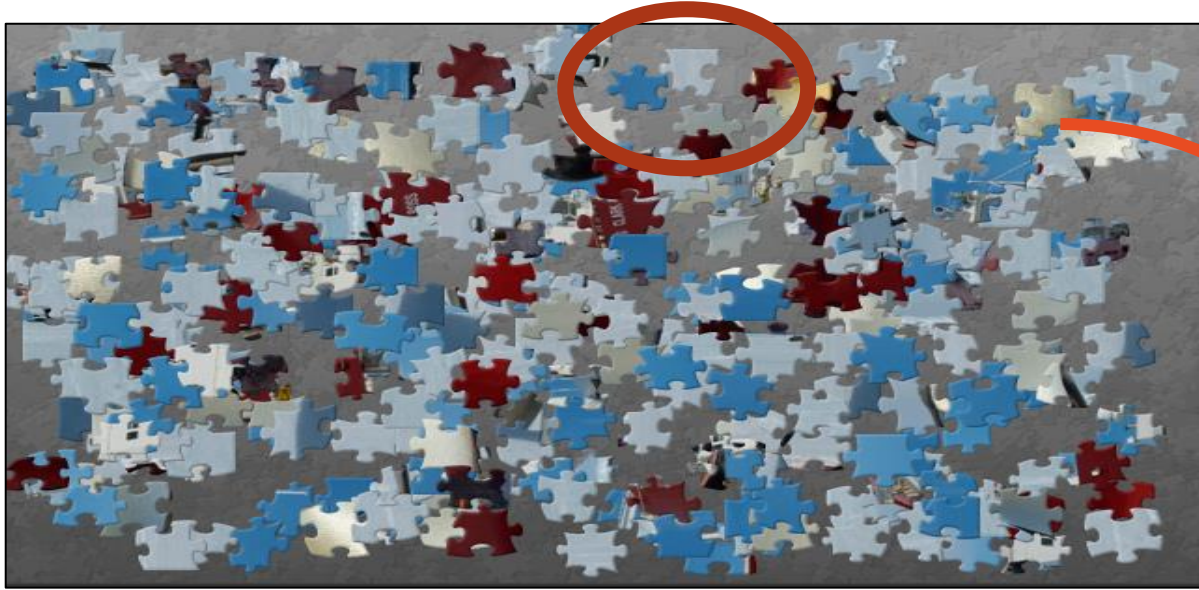
EU funding



Natural Environment Research Council

\* Cost models vary – speak to Marine Planning and check call announcements

# Constructing the Marine Facilities Programme





# Constructing the Marine Facilities Programme



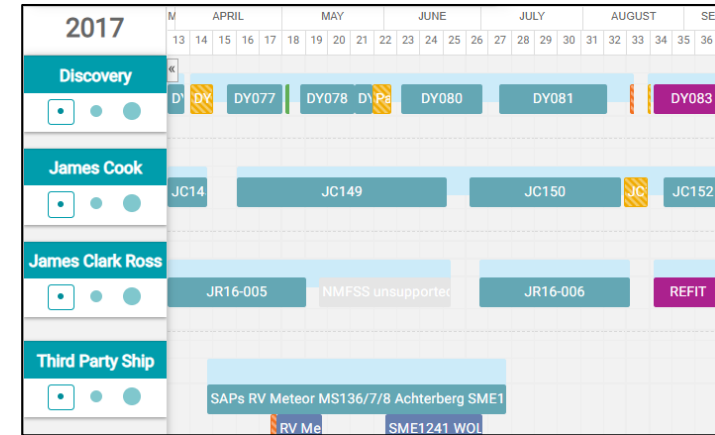
January...



...April...



...continue....



...Autumn  
(CPEB review)

- Prioritisation criteria
- Operational constraints
- Science team constraints
- Pandemic constraints/uncertainty!
- Lots of conversations



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# Constructing the Marine Facilities Programme

Barter partnerships

- Bilateral with NSF
- Ocean Facilities Exchange Group

Pre-arranged barter

Opportunistic assistance





# Chief Scientists' Workshop

- All those requesting shiptime in the following year
- Anyone wanting to know more about requesting shiptime for future applications



- Marine Planning
- Research cruise operations
  - Pre-sail
  - At sea
  - Post-sail
- Discuss specific requests

[marineplanning@nerc.ac.uk](mailto:marineplanning@nerc.ac.uk)



# The future

- Integrated NERC fleet programming
  - SDA and new capabilities
  - Move from two ships to one
  - Collaborations with international partners – ship operators as well as funding bodies
  - Communications of future programmes and wider capabilities available
- 
- Marine Planning [marineplanning@nerc.ac.uk](mailto:marineplanning@nerc.ac.uk)



## Science and operations. The dual role of the RRS *Sir David Attenborough*

Simon Garrod

*Director of Operations, British Antarctic Survey*

# Two Ships into One Ship?



Demands

Challenges

Solutions





# SDA Role

Enables the UK's presence in the Antarctic

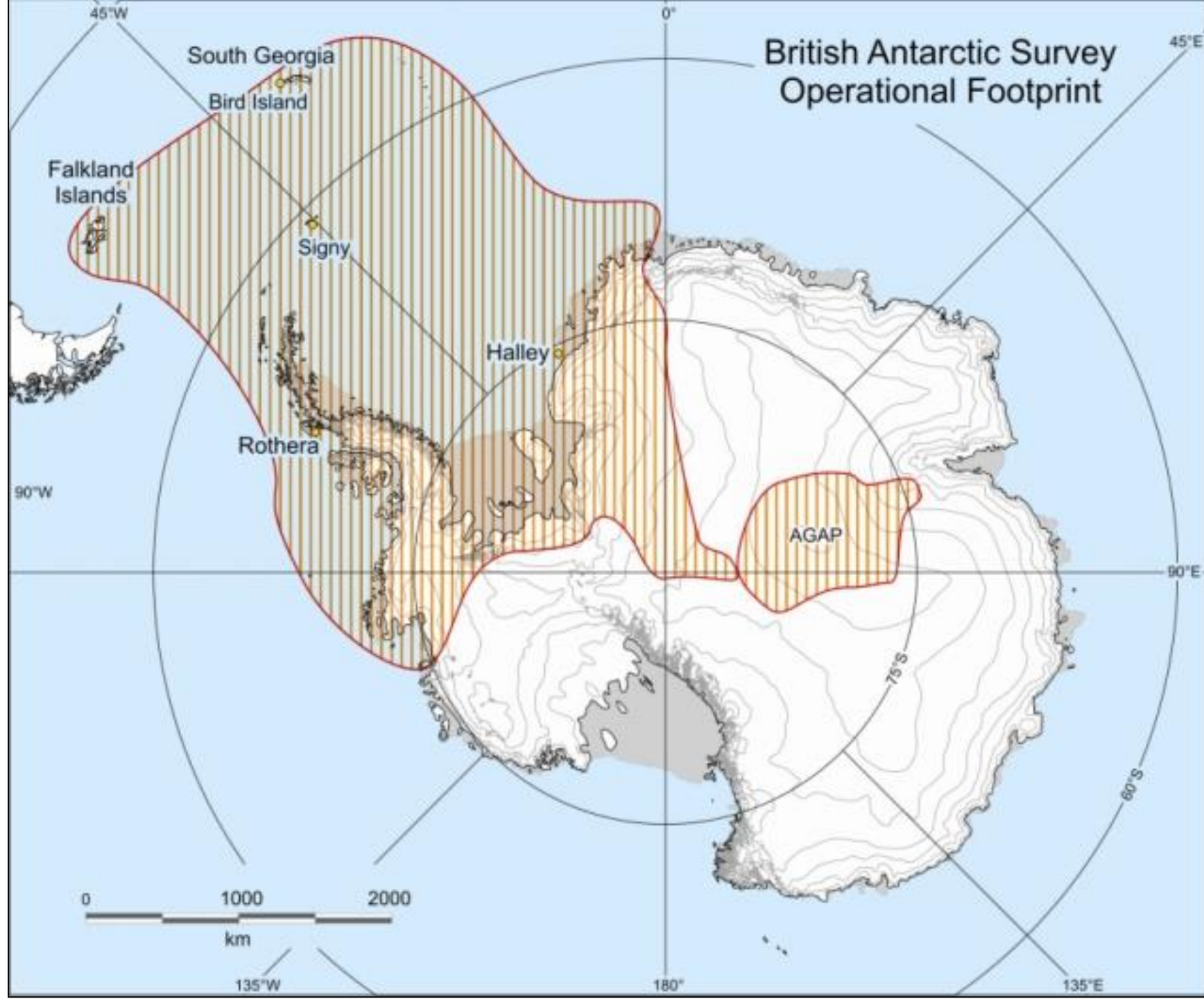
Marine science platform for the Polar regions

Diplomatic role in fostering mutually beneficial science and operational partnerships with other national programmes

Flagship/Ambassador for UK polar research during port calls/visits







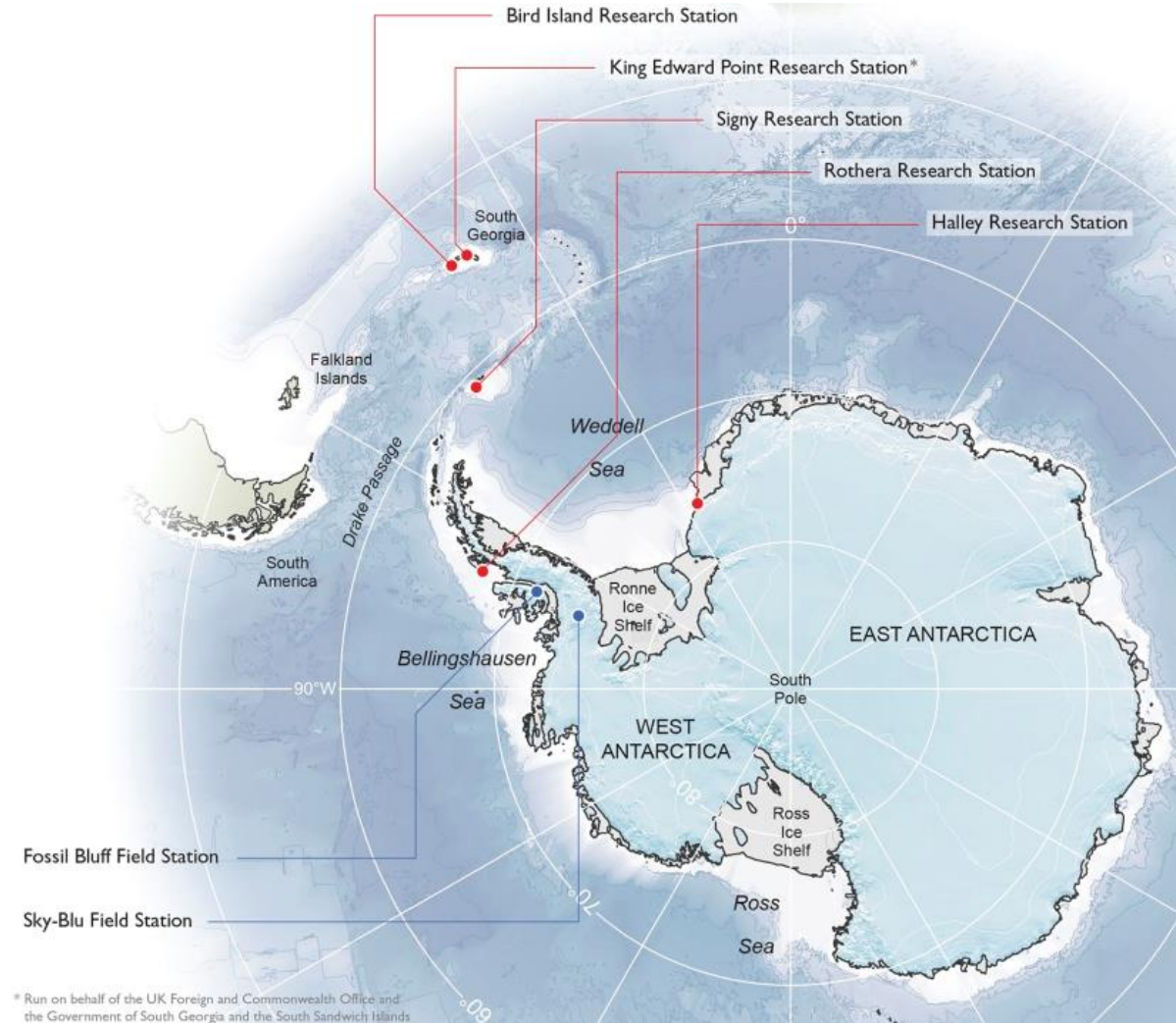
# *Demands* - Annual Station resupply

Terrestrial and marine science at stations, deep field science support from Rothera

- Bird Island – 2 calls
- King Edward Point – 2 calls
- Signy – 2 calls
- Rothera – 2 calls

Tri-annual Station support

- Halley – 1 call





# *Demands*

## Deep Field Science Support (Ice Shelf Offload)

Frequency – tri-annual

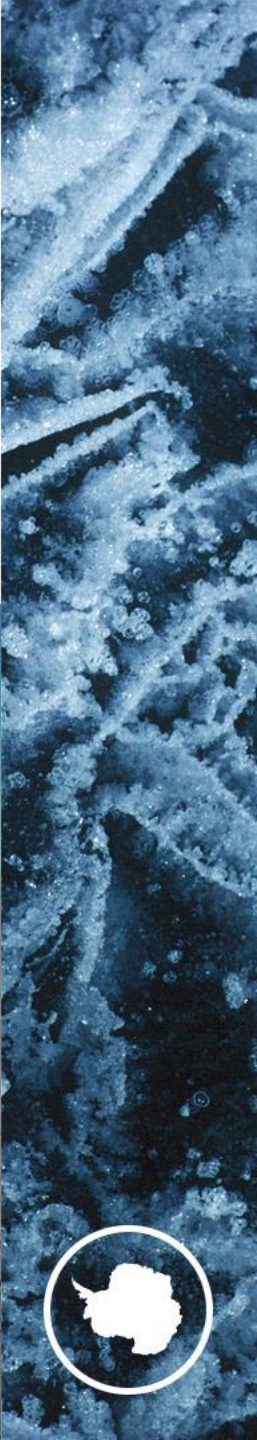




# *Demands* - Deep Field Science Support

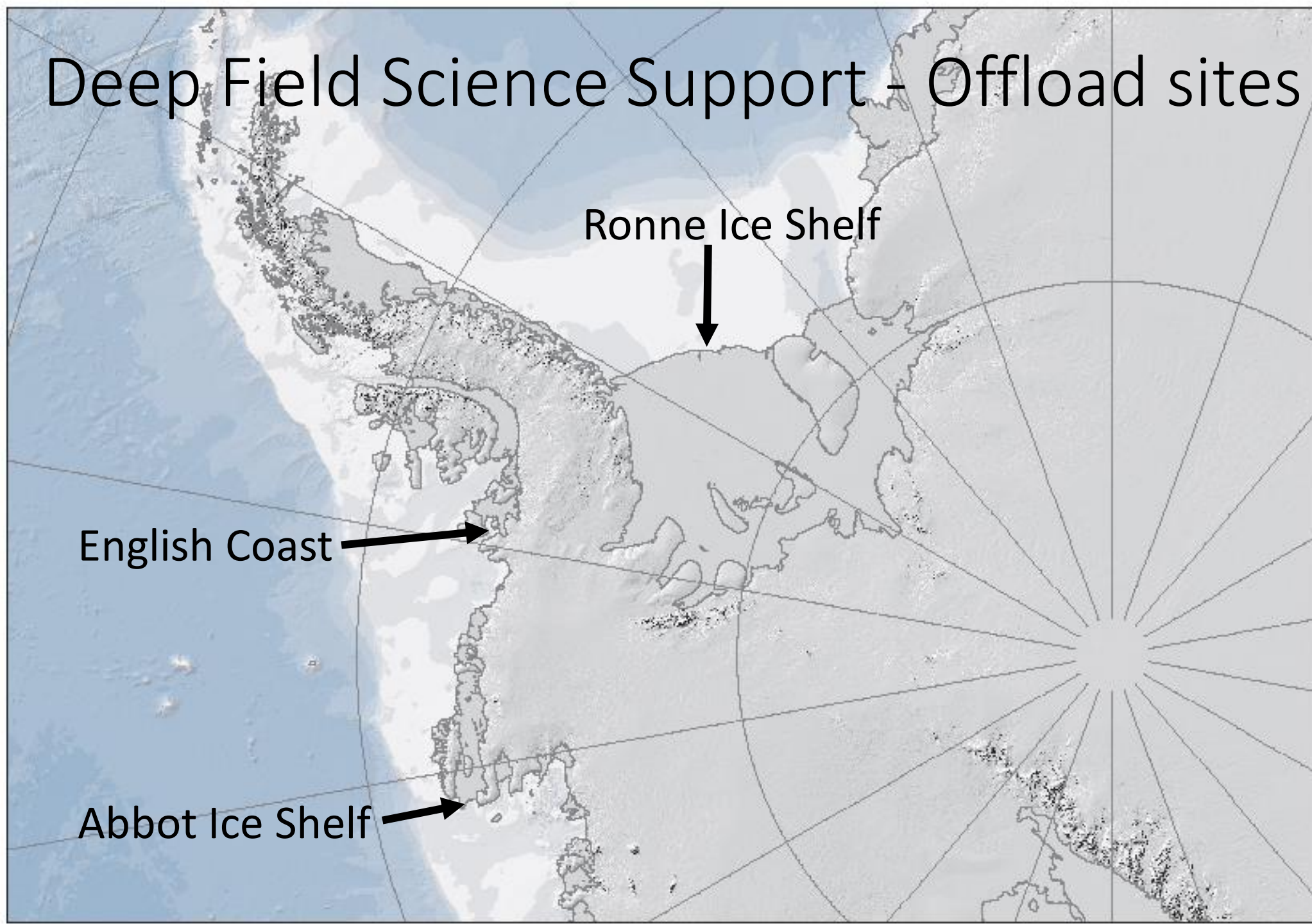
Required for:

- Fuel delivery
- Science equipment input and uplift
- Tractor Traverse equipment replacement cycles





# Deep Field Science Support - Offload sites

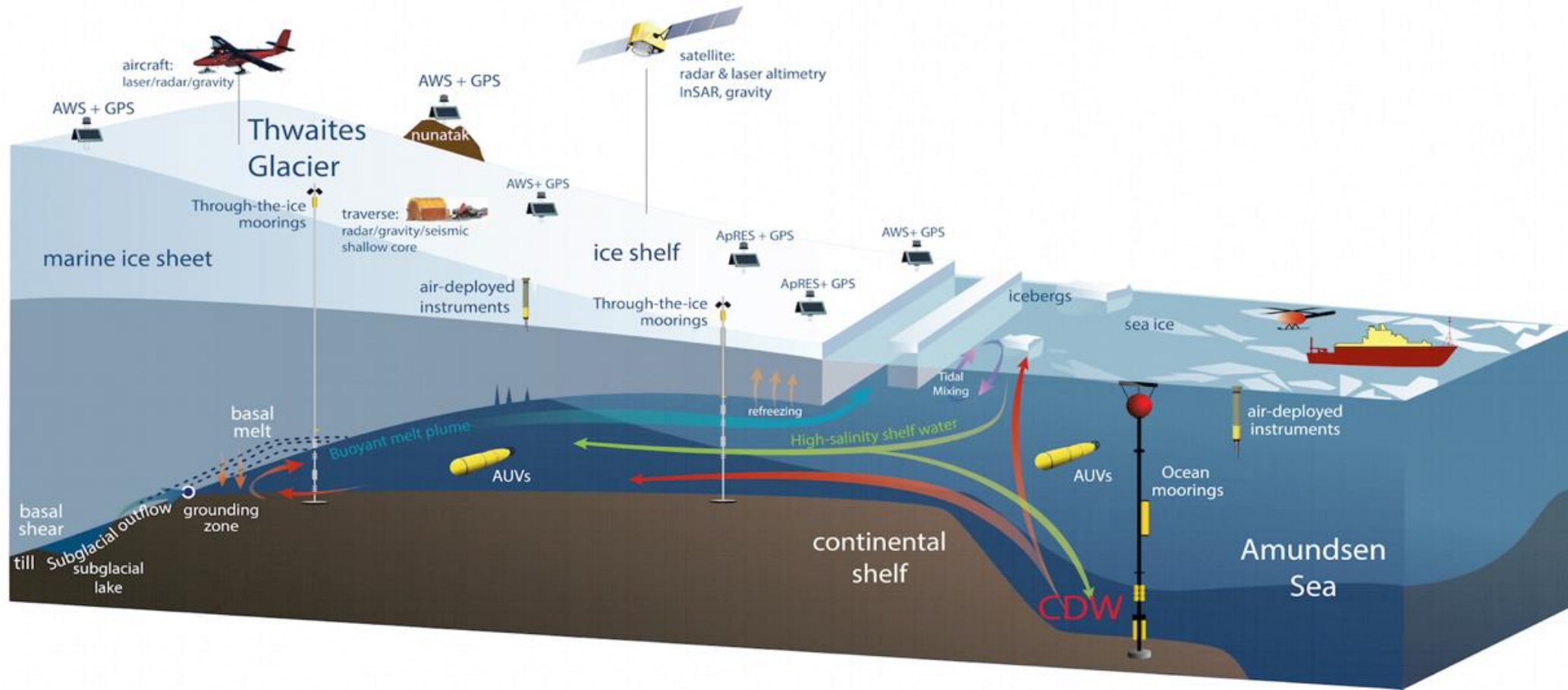








# NERC+NSF International Thwaites Glacier Collaboration



SB9 Depot– fuel bladders, drums, field/science/traverse kit, explosives...





# *Demands - Other*

Antarctic Modernisation Project  
Support

Medevac



Annual refit and maintenance regime

New Rothera  
Science & Operations Building



# Marine Science

## Arctic

Historically has averaged around 60 days/year

## Antarctica

1 x long multidisciplinary, 2/3 targeted shorter cruises

## Underway systems

Atmospheric/sea water/acoustics mapping

## Science of opportunity on transit

Deploying buoys/gliders/ctd/xbt & xctd surveys



# *Challenges* - Delivering science and logistics with a single vessel

## Operations requirements

- Annual Station support
- Halley call - every 3 years
- Ice shelf offload – every 3 years (minimum)

Challenging to do a Halley call and ice shelf offload in a single season without limiting marine science in that season

## What does this mean?

- Heavy logistics seasons?
- Heavy science seasons?





# SDA 5 year trials and logistics plan DRAFT

## Key

Port call

Yard / Re-fit

Trials

Set Logistics

Flexible logistics

Opportunity for science

All activity in this plan is provisional and subject to change.

	September	October		November		December		January		February		March		April		May		June		July		August						
20/21	Cammell Laird		Interim Acceptance	Cammell Laird. 1 <sup>st</sup> 50 days alongside A/S work up, stowing, MCA/Class, OEM training, safety drills, familiarisation / Helideck certification			1 <sup>st</sup> 30 days at sea Anchor testing, manoeuvring, DP testing, proving procedures, engine testing, Helideck trials with aircraft Western approaches			Acoustic trials Scapa Flow		Deep Acoustic trials <4000m Norwegian Trough		Trials package still being developed				Ice trials part 1				Winch trials part 1		Snags remediation / re-trialling		Full depth acoustics / winch trials		Snags remediation / mob science trials
21/22	Science trials		Harwich. Mob for South	Portsmouth - Bunkering	Transit South		Falklands	Open islands (Signy, KEP, Bird Island)		Rothera	Punta – mob rehearsal cruise		Halley relief (min 2 weeks on site)		Rehearsal cruise – Northern Peninsular		Close islands (Signy, KEP, Bird Island)	Falklands – demob cruise	Rothera final call	Transit North		Harwich/Felixstowe Demob		Ship yard – re-fit / snags		Arctic science?		
22/23		Harwich. Demob Science Trials / Mob South	Transit South	Open islands (Signy, KEP, Bird Island)				Rothera first call / Project logistics					Close islands (Signy, KEP, Bird Island)		Rothera project & season demob		Transit North	Harwich. Demob	Science Trials?		2 <sup>nd</sup> year Re-fit							
23/24		Harwich. Demob Science. Mob South	Transit South	Open islands (Signy, KEP, Bird Island)				Rothera first call / Project logistics			Ronne entrance or English cost tractor uplift & fuel input		Close islands (Signy, KEP, Bird Island)		Rothera project & season demob		Transit North	Harwich. Demob			Re-fit							
24/25		Harwich. Mob South	Transit South	Open islands (Signy, KEP, Bird Island)				Rothera first call / Project logistics			Halley relief		Close islands (Signy, KEP, Bird Island)		Rothera project & season demob		Transit North	Harwich. Demob			Re-fit							

# *Solutions* - maximising time at sea for the SDA

## Containerisation

Move from break bulk to containerisation will speed up station relief



## Halley Automation



When the single ship model was conceived we did two annual ship calls to Halley – now 1 in 3 years releasing significant ship time





# *Solutions* - other ship support options

## HMS Protector

- Cargo, fuel, people

## MV Pharos - South Georgia Government vessel

- Limited cargo, fuel, people

## Naval vessels on passage to South Georgia

- People

## Collaboration with other National Programmes

- Logistics and science support

## Commercial charter vessel

- Logistics resupply

## NOC – James Cook, Discovery

- Science



# *Solutions*

Efficient scheduling to minimise unproductive passage time/maximise outputs

Forward planning to enable efficient scheduling

Technology – ROV/AUV - SDA is the 'hub' for data collection?

Opportunistic marine science when transiting to stations/ice shelf sites

Alternative logistics solutions for deep field science

- Air drop (commercial/RAF)

- Commercial logistics support







# RRS *Sir David Attenborough* – *science users' workshop*

SDA arriving  
Holyhead 16<sup>th</sup>  
November 2020



Thank you  
for listening