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Application for Consent to conduct
Marine Scientific Research
ICELAND

Date: 19th February 2024

1. General Information

1.1 Cruise name and/or number:
JC269 - 22/1850 – BIO-Carbon – autumn cruise

1.2 Sponsoring Institution(s):	
Name:	National Oceanography Centre
Address:	European Way, Southampton, SO143ZH
Name of Director:	Prof Ed Hill

1.3 Principal Investigator in charge of the Project :	
Name:	Adrian Martin
Country:	UK
Affiliation:	National Oceanography Centre
Address:	European Way, Southampton, SO14 3ZH
Telephone:	02380 596342
Fax:	N/A
Email:	adrian.martin@noc.ac.uk
Website (for CV and photo):	https://noc.ac.uk/n/Adrian+Martin

1.4 Entity(ies)/Participant(s) from Iceland involved in the planning of the project:	
Name:	
Affiliation:	None
Address:	
Telephone:	
Fax:	
Email:	
Website (for CV and photo):	

2. Description of Project

2.1 Nature and objectives of the project:
The ocean stores huge amounts of carbon dioxide (CO2) that could otherwise be in the atmosphere. Marine organisms play a critical role, but emerging evidence indicates that climate models are not fully accounting for their impact. This programme will deliver the new understanding of the role of marine life that is needed to make robust predictions of future ocean carbon storage. To do so BIO-Carbon will address 3 major challenges: Challenge 1: How does marine life affect the potential for seawater to absorb CO2, and how will this change? The ability of the oceans to absorb CO2 is determined by alkalinity. Biological production and dissolution of calcium carbonate influence alkalinity but estimates of global ocean calcium carbonate production, vertical transport and dissolution vary considerably. Challenge 2: How will the rate at which marine life converts dissolved CO2 into organic carbon change? CO2 is removed from the ocean by conversion to organic matter through primary production by marine phytoplankton. Estimates of global primary production and how it will be altered by climate change are very uncertain due to insufficient knowledge about key processes and how these processes vary in different ocean environments. Challenge 3: How will climate change-induced shifts in respiration by the marine ecosystem affect the future ocean storage of carbon?

Respiration of marine organisms converts organic carbon back to CO2. To determine the speed at which this CO2 is returned to the atmosphere, we need to understand how respiration varies with depth, location and season and understand how environmental changes affect respiration.

The fieldwork will seek to address these challenges using a combination of ship-based and autonomous activity. This SME covers a ship-based component of that fieldwork including multiple glider and float deployments / recoveries.

2.2 If designated as part of a larger scale project, then provide the name of the project and the Organisation responsible for coordinating the project:

This cruise, float and glider deployments would be carried out by 3 projects (CHALKY, IDAPro and PARTITRICS) as part of the BIO-Carbon programme (https://bio-carbon.ac.uk/) which is funded by NERC. Adrian Martin is the Champion for BIO-Carbon and Jess Surma is the NERC programme manager. The 3 projects within BIO-Carbon include a number of scientists and partner organisations from UK and internationally, many of them in addition to those involved directly in the fieldwork. Within BIO-Carbon the IDAPro project will have the greatest involvement in the cruise with project IDAPro PI Prof Mark Moore due to be cruise Chief Scientist

2.3 Relevant previous or future research projects:

In the preceding spring there will be a cruise to the same area – DY180 22/1849 on RRS Discovery – as part of the same BIO-Carbon programme. Although this cruise will complete in June 2024 it will deploy 4 gliders in the Iceland Basin which it is planned to recover on JC269. DY180 will also deploy a number of ARGO floats in the study area. There are no plans to recover these. Additional floats will be deployed as a component of JC269.

There is also a linked autonomous vehicle (ALR) deployment (22/1854 – BIO-Carbon NZOC science mission). The ALR mission will be contemporary to DY180 and should not overlap in time with JC269. It is planned to deploy the ALR from Iceland from where it will travel to the central study site to rendez-vous with DY180 for ~5 days before continuing to NW Scotland where it would be recovered.

2.4 Previous publications relating to the project:

There is a web-page describing the programme and its component projects: https://bio-carbon.ac.uk/

3. Geographical Areas

3.1 Indicate geographical areas in which the project is to be conducted (with reference in Latitude and longitude, including coordinates of cruise/track/way points)

The precise locations for cruise work cannot be stated at this stage as it partially depends on the location of autonomous floats and gliders being deployed on an earlier cruise (DY180 – see above). For this reason, the chart in 3.2 shows an area encompassing all possible study areas. Only a small number of locations in this area will be sampled.

Nevertheless, it is possible to give some extra information on the most likely places that may be sampled. A focal point for DY180 is 60N -24.5W (in the Iceland Basin, in international waters) where it is planned to deploy the 4 gliders and some floats (see 4.6) in May 2024. Between then and JC269 the floats will be advected by the currents and are likely to move away from 60N -24.5W. It is difficult to predict accurately the locations of the floats by September when JC269 takes place. They are most likely to have remained in the Iceland Basin – most likely having moved to the southwest - but there is a possibility that they might have moved west of Reykjanes Ridge in to the Irminger Sea. The area indicated in 3.2 should cover any potential location for the floats. This broader sampling area indicated in 3.2 extends into EEZ's of Iceland and Greenland.

Between DY180 and the start of JC269 strategic decisions will be made, on the basis of data received from floats, gliders and satellite,

- whether to keep the gliders in the vicinity of the floats or of 60N -24.5W, and,
- the amount of time to allocate to sampling in the vicinity of floats and 60N -24.5W during JC269

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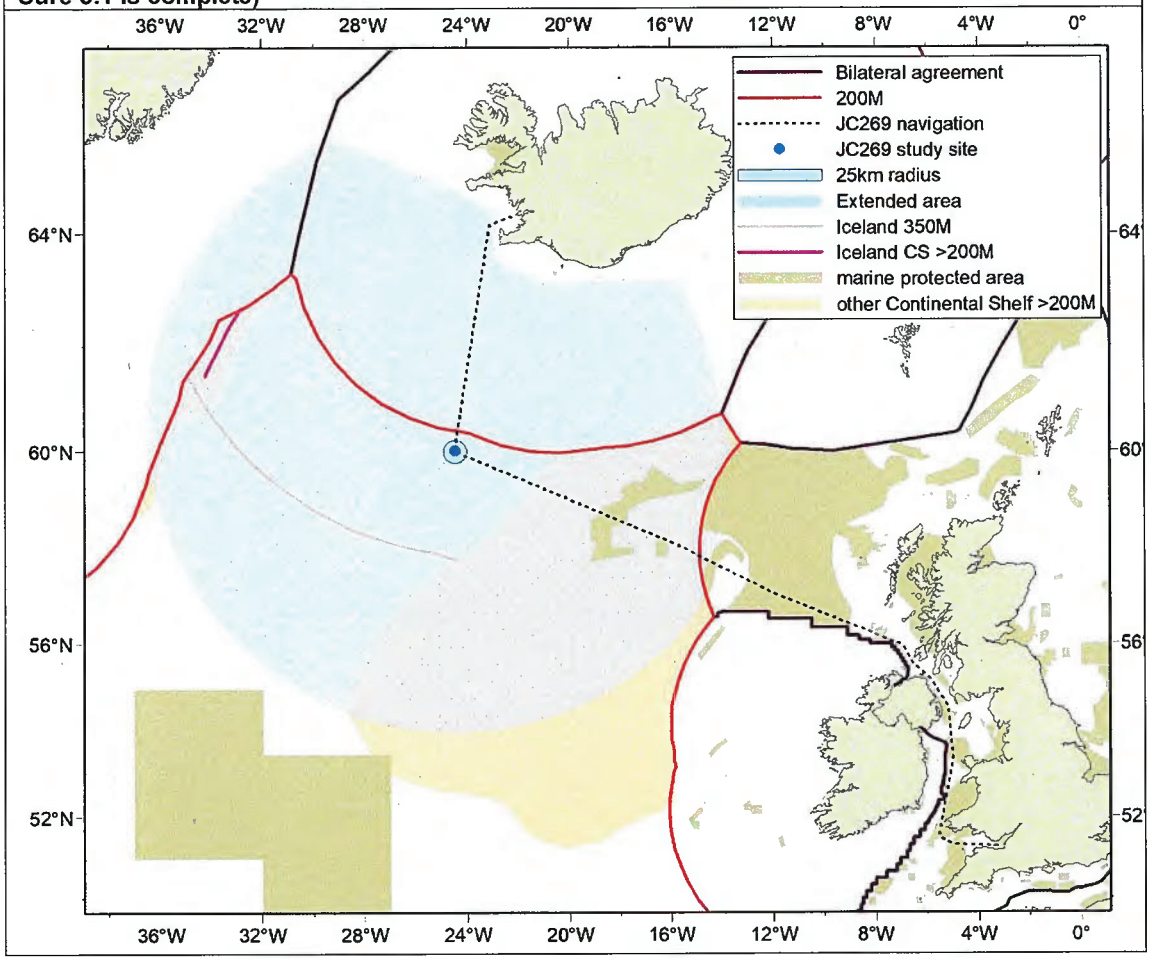
For all ship activities, the majority of sampling will be done over the top 2000m of the water column though deeper, possibly full depth, CTD casts may be taken as reference at the location or in the vicinity of 60N -24.5W and/or the ARGO floats.

3.2 Attach chart(s) at an appropriate scale (1 page, high-resolution) showing the geographical Areas of the intended work and, as far as practicable, the location and depth of sampling Stations, the tracks of survey lines, and the locations of installations and equipment. **(NB: make Sure 3.1 is complete)**



4. Methods and means to be used

4.1 Particulars of vessel:	
Name:	RRS James Cook
Type/Class:	Lloyds +100 A1 Ice Class C1 + LMC, UMS, DP(AM), "Research Vessel"
Nationality (Flag State):	British
Identification Number (IMO/Lloyds No.):	9338242
Owner:	UK Research & Innovation
Operator:	National Marine Facilities Sea Systems
Overall length (meters):	89.20 Metres
Maximum draft:	6.315 Metres
Displacement/Gross Tonnage:	Net Tonnage: 1620 Gross Tonnage: 5401
Propulsion:	Wartsila Diesel Electric
Cruising & maximum speed:	10 Knots
Call sign:	MLRM6

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INMARSAT number and method and capability of communication (including emergency frequencies):	773238783 – Voice 783255430 – Fax 423501712 – Sat C
Name of Master:	TBA
Number of Crew:	23
Number of Scientists on board:	31

4.2 Particulars of Aircraft:	
Name:	N/A
Make/Model:	
Nationality (flag State):	
Website for diagram & Specifications:	
Owner:	
Operator:	
Overall Length (meters):	
Propulsion:	
Cruising & Maximum speed:	
Registration No.:	
Call Sign:	
Method and capability of communication (including emergency frequencies):	
Name of Pilot:	
Number of crew:	
Number of scientists on board:	
Details of sensor packages:	
Other relevant information:	

4.3 Particulars of Autonomous Underwater Vehicle (AUV):	
Name:	Slocum Glider
Manufacturer and make/model:	Teledyne Webb Research Slocum G2
Nationality (Flag State):	UK
Website for diagram & Specifications:	https://www.teledynemarine.com/en-us/products/Pages/slocum-glider.aspx
Owner:	NOC
Operator:	NOC
Overall length (meters):	1.5
Displacement/Gross tonnage:	60kg
Cruising & Maximum speed:	0.3metres/sec & 0.5 metres/sec
Range/Endurance:	4000km/6 months
Method and capability of communication (including emergency frequencies):	RF Modem (902-928MHz), Iridium (RUDICS), ARGOS
Details of sensor packages:	Seabird CTD, Aanderaa Oxygen optode, WETLabs fluorometer, Biospherical PAR
Other relevant information:	

4.4 Particulars of Unmanned Surface Vehicles (USV):	
Name:	N/A
Manufacturer and make/model:	
Nationality (Flag State):	
Website for diagram & Specifications:	
Owner:	
Operator:	
Overall length (meters):	
Displacement/Gross tonnage:	
Cruising & Maximum speed:	
Range/Endurance:	
Method and capability of communication (including emergency frequencies):	
Details of sensor packages:	
Other relevant information:	

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4.5 Particulars of Unmanned Air Vehicles (UAV) :	
Name:	N/A
Make/Model:	
Nationality (flag State):	
Website for diagram & Specifications:	
Owner:	
Operator:	
Overall Length (meters):	
Propulsion:	
Cruising & Maximum speed:	
Registration No.:	
Call Sign:	
Method and capability of communication (including emergency frequencies):	
Name of Pilot:	
Number of crew:	
Number of scientists on board:	
Details of sensor packages:	
Other relevant information:	

4.6 other craft in the project, including its use:

The floats below will be deployed in spring (DY180) at 60N -24.5W. None will be recovered on JC269.

NOC float (x1)

- Full BGC Argo (no non-standard sensors)
- Non-standard profiling strategy (first 6 months):
    - Day 0-2 – 2000 m profiles (Standard)
    - Day 3 – 1000 m profiles (non-standard)
    - Day 4-5 – 2000 m profiles (Standard)
    - Day 6 – 1000 m profiles (non-standard)
    - Day 7-9 – 2000 m profiles (Standard)
    - Day 10 – cycle repeats

LOV floats (x3)

- Standard BGC Argo sensors, plus
    - Hydroptic UVP6 particle and plankton camera
    - Seabird C-Rover Transmissometer
    - (1 of 3 floats) hyperspectral Trios RAMSES ACC-VIS downwelling irradiance
        - Replaces "standard" 4-channel radiometer
    - (1 of 3 floats) Trios RAMSES ARC-VIS hyperspectral upwelling radiance
- Non-standard profiling strategy (full float lifetime)
    - Day 0 – 2000 m profile (Standard)
    - Day 0-2 – Park at 200 m (non-standard)
    - Day 2-5 – Park at 500 m (non-standard)
    - Day 5-10 – Park at 1000 m (standard)
    - Day 10 – Cycle repeats

UoS float 2:

- Full BGC Argo (no non-standard sensors)
- Non-standard profiling strategy (first 6 months):
    - Day 0-2 – 2000 m profiles (Standard)
    - Day 3 – 1000 m profiles (non-standard)
    - Day 4-5 – 2000 m profiles (Standard)
    - Day 6 – 1000 m profiles (non-standard)
    - Day 7-9 – 2000 m profiles (Standard)

Day 10 – cycle repeats

The following float will be deployed on JC269 and not recovered

UoS float 1:

- Standard BGC Argo sensors (CTD plus O2 only)
- Non-standard profiling strategy
  - Dusk-dawn pairs of profiles to 1000 m
  - Profile frequency variable
    - Pair of profiles daily during key periods (e.g. autumn ML deepening)
    - May reduce to one pair of profiles every 2-4 days in winter to conserve energy
  - Expected float lifetime ≤1 year

An additional turbulence profiling float may also be deployed during the Autumn (JC269) cruise.

This will be recovered at the end of the cruise.

Turbulence float:

- Standard BGC Argo sensors (CTD plus O2 only)
- Non-standard profiling strategy
  - Profile frequency variable

4.7 Particulars of methods and scientific instruments:		
Types of samples and Measurements:	Methods to be used:	Instruments to be used:
Measurements of sea surface water characteristics	Underway flow through instrumentation. No physical sampling	SeaBird SBE38 Temperature probe SeaBird SBE45 ThermoSalinoGraph (TSG) Chelsea Instruments Transmissometer CST Fluorometer WS3S
Measurements of atmospheric characteristics	Underway instrumentation. No Physical Sampling	Air temperature and humidity – HMP45/155 Ambient light TIR & PAR sensors Atmospheric pressure PTB110/210 Windspeed Windsonic anemometer
Single beam depth sounding	Acoustic system	Kongsberg EA640
Current measurement	Acoustic system	Teledyne OS75 Teledyne OS150
Salinity, nutrients, inorganic carbon	Water sample	CTD frame bottles (vertical profiles) and underway supply (surface)
Oxygen concentration	Water sample	CTD frame bottles
Salinity, conductivity, oxygen, fluorescence	Electronic sensor	CTD frame (vertical profiles) and underway sensors (surface)
Meteorological data	Electronic sensors	Ship meteorological package
Sinking particulate material - chemical composition (carbon, nitrogen, silicon), biological composition (type, size, morphology)	Water sample	Discrete particle collection device: Marine Snow Catcher, deployed from ship
Plankton and particle images (type, size, morphology), particle concentration,	Camera systems	Optical and imaging systems: Red Camera Frame, deployed from ship.
Microbial respiration	Water sample	Discrete water sampler: ISMI, deployed from ship
Zooplankton composition and biomass	Water samples	Net deployments: Mammoth and Bongo systems, deployed from ship
Plankton composition (inc. viruses, phytoplankton, microzooplankton)	Water samples	flow cytometry, pigments, imaging systems
Primary Production,	Water samples, incubations	incubators, isotopes

Growth and mortality rates	Water samples, nets, incubations	incubators, filtered samples,
Dissolved trace metals	Water samples	CTD frame bottles (vertical profiles) and underway supply (surface)
Nutrient uptake and recycling	Water samples, incubations	incubators, isotopes
Nutrient limitation status	Water samples, incubations	incubators
Microbial community composition and activity through molecular analysis (DNA/RNA/Protein)	Water samples, incubations	CTD frame bottles (vertical profiles), underway supply (surface), incubations
See also sensors on permanently deployed floats and gliders listed in sections 4.3 and 4.6 respectively		

4.8 Indicate nature and quantity of substances to be released into the marine environment:
None

4.9 Indicate whether drilling will be carried out. If yes, please specify:
None

4.9.1 Indicate whether explosives will be used. If yes, please specify type and trade name, Chemical content, depth of trade class and stowage, size, depth of detonation, frequency of Detonation, and position in latitude and longitude:
No

5. Installations and Equipment

Details of installations and equipment (including dates of laying, servicing, method and Anticipated timeframe for recover, as far as possible exact locations and depth, and Measurements):
4 gliders will be recovered, that will have been deployed at 60N -24.5W by DY180 in May 2024. The gliders are covered by a separate application for Diplomatic Clearance associated with DY180.

6. Dates

6.1 Expected dates of first entry into and final departure from the research area by the research vessel and/or other platforms:
First Entry: 6th September 2024 Final Entry: 10th October 2024
6.2 Indicate if multiple entries are expected:
No

7. Port Calls

7.1 Dates and Names of intended ports of call:
30th August – 6th September 2024 – Reykjavik, Iceland

7.2 Any special logistical requirements at ports of call:
None

7.3 Name/Address/Telephone of shipping agent (if available):
Nesskip H.F Nesskip's House Austurstrond 1 172 Seltjarnarnes Reykjavik PC101 Tel: 354 56399000 Email Gisli Thrastarson – Operations@nesskip.is

8. Participation of the representative of the Coastal State

8.1 Modalities of the participation of the representative of the Coastal State in the research Project:
N/A

8.2 Proposed dates and ports for embarkation/disembarkation:
Embark: Reykjavik, Iceland – 30th August – 6th September 2024 Disembark: Cardiff, UK – 13th – 16th October 2024

9. Access to Data, Samples and Research Results

9.1 Expected dates of submission to Coastal State of preliminary report, which should include The expected dates of submission of the data and research results:
6 months after cruise completion

9.2 Anticipated dates of submission to the Coastal State of the final report **(This must be within 1 year of completion of the cruise)**
Within 1 year of cruise completion

9.3 Proposed means for access by Coastal State to data (including formal) and samples as per BODC Weblink: **https://www.bodc.ac.uk/resources/inventories/cruiseinventory/search/**
BODC website

9.4 Proposed means to provide Coastal State with assessment of data, samples and Research results:
Via peer-reviewed publications and BODC website

9.5 Proposed means to provide assistance in assessment or interpretation of data, samples And research results:
Via verbal briefings

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9.6 Proposed means of making results internationally available (to obtain cruise reports these Can be obtained via the BODC weblink see below:
BODC website and peer-reviewed publications

10. Other permits Submitted

10.1 Indicate other types of Coastal State permits anticipated for this research (received or Pending):
Greenland – sampling in the vicinity of the ARGO floats means that it may be required to sample in Greenland EEZ as marked on chart.

11. List of Supporting Documentation

11.1 List of attachments, such as additional forms required by the Coastal State, etc.:
None

Signature: Adrian Martin

Contact information of the focal point:
Name: Dr. Adrian Martin
Country: UK
Affiliation: National Oceanography Centre Southampton
Address: European Way, Empress Dock 4, Southampton SO14 3ZH
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