UNITED KINGDOM RESEARCH AND INNOVATION

Application for Consent to conduct
Marine Scientific Research
ICELAND

Date: __1 February 2024___

1. General Information

1.1 Cruise name and/or number: 22/1854 – BIO-Carbon FMRI science mission

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 Coastal State involved in the planning of the project:	
Name:	Hildur Petursdottir
Affiliation:	Icelandic Marine and freshwater Institute
Address:	Fornubúðir 5, 220 Hafnarfjörður
Telephone:	+354 5752059
Fax:	
Email:	hildur.petursdottir@hafogvatn.is
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 ALR deployment is a collaboration between BIO-Carbon and the UK Future of Marine Research Infrastructure (https://fmri.ac.uk/) programme to highlight the capability of AUVs to make shore-to-shore based missions collecting biogeochemical data. It is planned to rendezvous with the DY180 22/1849 spring cruise en route between Iceland and UK. (nb FMRI was previously known as NZOC)

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:
See 2.1. This deployment is part of the BIO-Carbon programme but also as a joint activity with the FMRI programme. The programme director for FMRI is Kristian Thaller (fmri@noc.ac.uk). Within BIO-Carbon (https://bio-carbon.ac.uk/) this deployment would be carried out in support of 3 projects (CHALKY, IDAPro and PARTITRICS). 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

2.3 Relevant previous or future research projects:
This deployment is linked to cruise DY180 22/ 2024 which is due to take place at a similar time in May-June 2024. It is intended that the ALR will rendez-vous with DY180 at the central study site for DY180 (60N 24.5W) where it will sample for up to ~ 25 days at the location and more widely in adjacent waters before proceeding to NW Scotland. DY180 will also deploy 4 gliders to sample in the vicinity of 60N 24.5W before being collected in autumn by cruise JC269 (22/1850 – BIO-Carbon – autumn)

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 intended shore launch site for the ALR is Vestmannaeyjar, Iceland. On launch it will be necessary to run diagnostic tests and calibrations before proceeding to deep water..For this reason we seek permission to have all sensors on from launch. The ALR would then take a direct line to 60N 24.5W in the Iceland Basin which is the main study site for DY180. The ALR will spend ~25 days at the location and more widely in adjacent waters and then travel directly to northwest Scotland, UK. It is not possible to have environmental sensors running for the full deployment for battery reasons. Aside from immediately after launch (see above), and the 25days sampling at and around the central study site where sensors will be on, the remaining sampling locations will be decided real-time with use of satellite data. Therefore, although battery constraints mean that not all sensors can be on continuously, permission is sought to allow sensors to be turned on along the full route for the ALR including shelf and coastal waters. The area marked on the chart in 3.2 comprises (i) an area of shelf around the launch site where tests and calibrations will be necessary, and (ii) a region roughly equal to 10 days travel for the ALR (average speed ~50 km/day). The precise locations sampled within this larger area will be determined real-time with the use of satellite data.

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)**

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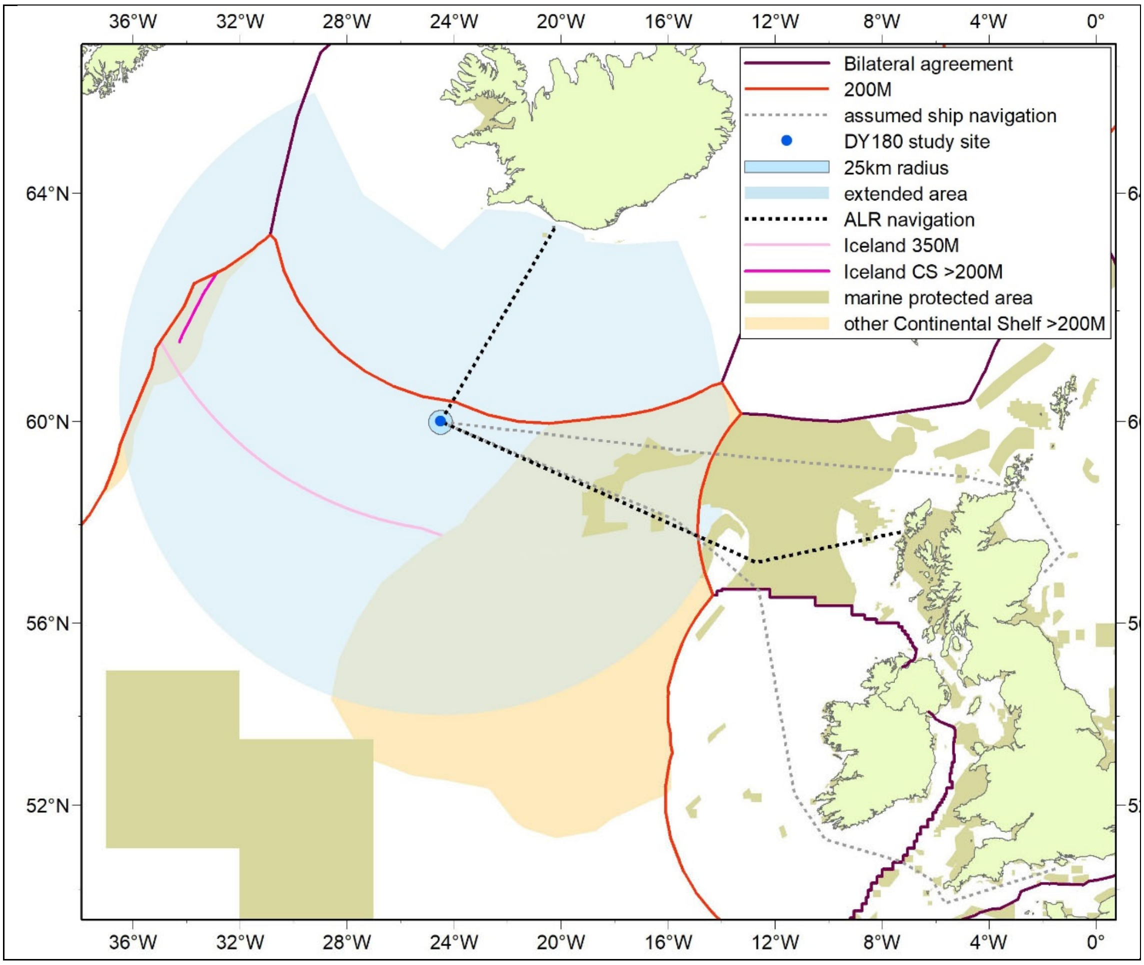

4. Methods and means to be used

4.1 Particulars of vessel:	
Name:	N/A
Type/Class:	
Nationality (Flag State):	
Identification Number (IMO/Lloyds No.):	
Owner:	
Operator:	
Overall length (meters):	
Maximum draft:	
Displacement/Gross Tonnage:	
Propulsion:	
Cruising & maximum speed:	
Call sign:	
INMARSAT number and method and capability of communication (including emergency frequencies):	
Name of Master:	
Number of Crew:	
Number of Scientists on board:	

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:	Autosub Long Range
Manufacturer and make/model:	National Oceanography Centre ALR4 & ALR6
Nationality (Flag State):	UK
Website for diagram & Specifications:	NOC Vehicles: https://noc.ac.uk/technology/technology-development/autonomous-vehicles ALR-6000 Drawing: https://noc.ac.uk/files/documents/facilities/A6600-00-000%20ALR-6000%20A3%20Spec%20Sheet_smallersize.pdf
Owner:	National Oceanography Centre UK
Operator:	National Oceanography Centre UK
Overall length (meters):	3.7
Displacement/Gross tonnage:	800kg
Cruising & Maximum speed:	1.5 knots
Range/Endurance:	2 months
Method and capability of communication (including emergency frequencies):	Iridium satellite comms, Independent Iridium Xeos location beacon
Details of sensor packages:	Conductivity, Temperature Depth, Dissolved Oxygen Fluorometer Total Alkalinity Dissolved Inorganic Carbon pH, Nitrate, Phosphate, Silicate UVP6- water column macro photography Radiance sensor (Trios Ramses) Chlorophyll fluorescence based primary production sensor (microSTAF) Acoustic Doppler Current Profiler Ocean Turbulence (Rockland Microrider) Chlorophyll, particle backscatter
Other relevant information:	

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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:	

4.5 Particulars of Unmanned Air Vehicles (UAV) :	
Name:	
Make/Model:	N/A
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:
N/A

4.7 Particulars of methods and scientific instruments:		
Types of samples and Measurements:	Methods to be used:	Instruments to be used:
Salinity, conductivity, inorganic carbon, inorganic nutrients, turbulence, oxygen, fluorescence, backscatter	Electronic sensor	Installed on ALR. Permission is sought to have sensors on for transit through EEZ.

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):
None

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:
1 June 2024 - 31 August 2024
6.2 Indicate if multiple entries are expected:
N/A

7. Port Calls

7.1 Dates and Names of intended ports of call:
None planned

7.2 Any special logistical requirements at ports of call:
N/A

7.3 Name/Address/Telephone of shipping agent (if available):
N/A

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:
Hildur Petursdottir of the Icelandic Marine and freshwater Institute is a project partner for two of the projects (PARTITRICS and IDAPro) in the BIO-Carbon fieldwork of which this ALR deployment forms a part

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8.2 Proposed dates and ports for embarkation/disembarkation:
N/A

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 w 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

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

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 – as sampling within the larger area indicated in 3.2 may bring the ALR into Greenland waters Ireland – as may transit through Ireland EEZ and may want to be running sensors in transit

11. List of Supporting Documentation

11.1 List of attachments, such as additional forms required by the Coastal State, etc.:
N/A

Signature:

Contact information of the focal point:
Name:
Country:
Affiliation:
Address:
Telephone:
Email:

UPLOAD YOUR FINAL CRUISE REPORT: https://www.bodc.ac.uk/resources/inventories/cruise inventory/search/

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SEND YOUR FINAL CRUISE REPORT: msrapplications@fcdo.gov.uk