

NOTIFICATION OF PROPOSED RESEARCH CRUISE

PART A: GENERAL

1. NAME OF RESEARCH SHIP CRUISE NO.:AR59-02
R/V Neil Armstrong
2. DATES OF CRUISE From: 5 Aug 2021...To: 23 Oct 2021
3. OPERATING AUTHORITY: Woods Hole Oceanographic Institution
TELEPHONE: +1-530-340-0500
TELEFAX: +1-508-457-2185
TELEX: NA
4. OWNER (if different from no. 3) Office of Naval Research (ONR)
5. PARTICULARS OF SHIP:
Name: R/V Neil Armstrong
Nationality: USA
Overall length: (in metres) 72.5 m
Maximum draught: (in metres) 4.6 m
Net tonnage: 3240 LT
Propulsion e.g. diesel/steam: Two diesel electric Seimens AC motors
Call sign: WARL
Registration port and number (if registered fishing vessel) NA
6. CREW
Name of master: Kent Sheasley
Number of crew: 20
7. SCIENTIFIC PERSONNEL
Name and address of scientist in charge: Dr. Luc Rainville Applied Physics Lab, Univ. of Washington
lucrain@uw.edu 1013 NE 4th St, Seattle, WA 98105, USA
Tel/telex/fax no.: +1-206-685-4058 (voice), +1-206-543-6785 (fax)
No. of scientists: 20
8. GEOGRAPHICAL AREA IN WHICH SHIP WILL OPERATE (with reference to latitude and longitude)
Within the box defined by (1) 65° N, 12°30' W (2) 73°45' N, 7°30' E Excluding the Faroes EEZ
9. BRIEF DESCRIPTION OF PURPOSE OF CRUISE
This cruise will serve as a pilot for the main field program, and will focus on testing instruments and observational approaches, and on gathering preliminary data on meso- and submeso-scale upper ocean processes.
10. DATES AND NAMES OF INTENDED PORTS OF CALL
26 Aug - 3 Sep 2021: Reykjavik, Iceland
7-9 Oct, 2021: Reykjavik, Iceland
11. ANY SPECIAL REQUIREMENTS AT PORTS OF CALL
None

9. NAMES AND ADDRESSES OF SCIENTISTS OF THE COASTAL STATE(S) IN WHOSE WATERS THE PROPOSED CRUISE TAKES PLACE WITH WHOM PREVIOUS CONTACT HAS BEEN MADE

Norway: Ilker Fer (Ilker.Fer@uib.no)
Iceland: Angel Ruis-Angulo (angel@vedur.is)

10. STATE

a) Whether visits to the ship in port by scientists of the coastal state concerned will be acceptable
(Yes/No)

Yes

b) Participation of an observer from the coastal state for any part of the cruise together with the dates and the ports for embarkation and disembarkation

Yes, if requested. Embark 3 Sep 2021 (Reykjavik, Iceland), Disembark 7 Oct 2021 (Reykjavik, Iceland)

c) When research data from the intended cruise are likely to be made available to the coastal state and by what means

Preliminary cruise report within 30 days of the end of research.

Data will be provided through official channels at no cost to the coastal State(s).

Samples will be provided upon request.

Cruise reports and data will be made available for direct download in electronic format and supplied to science collaborators from the coastal states. Science result will be published in the open (publicly available), peer-reviewed scientific literature and presented at professional meetings and conferences.

PART C. SCIENTIFIC EQUIPMENT

Complete the following table using a separate page for each coastal state

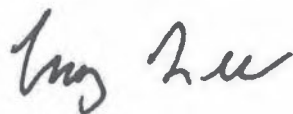
Coastal state Norway

Port of call none

Dates N/A

Indicate "YES" or "NO"

<u>List scientific work by function</u> e.g.	Water column including sediment sampling of the seabed	Fisheries research within fishing limits	Research concerning the natural resources of the continental shelf or its physical characteristics	DISTANCE FROM COAST		
				Within 4 nm	Between 4-12 nm	Between 12-200 nm
Near surface ocean turbulence, directional wave spectra, surface winds, salinity, water temperature, air temperature, and surface images from surface floats	No samples - all measurements are sensor-based	no	no	no	no	yes
Near surface ocean turbulence, directional wave spectra, surface winds, salinity, water temperature, air temperature, and surface images from vertically profiling floats	No samples - all measurements are sensor-based	no	no	no	no	yes
surface currents, ocean temperature, ocean conductivity (salinity), wind velocity, atmospheric pressure, surface waves and underwater sound from surface drifters	No samples - all measurements are sensor-based	no	no	no	no	yes
Profiles of temperature, salinity, turbulence, oxygen, optical backscatter, chlorophyll fluorescence, acoustics from long-endurance underwater gliders	No samples - all measurements are sensor-based	no	no	no	no	yes
Profiles of temperature and salinity from tow-yo CTD system towed behind the ship	No samples - all measurements are sensor-based	no	no	no	no	yes
Profiles of oceanographic properties from CTD system lowered from the ship	No samples - all measurements are sensor-based	no	no	no	no	yes
Upper ocean velocity, sea surface temperature and salinity, meteorological parameters (e.g. wind velocity, barometric pressure, relative humidity, short- and long-wave radiation) from sensors mounted on the ship.	No samples - all measurements are sensor-based	no	no	no	no	yes



(On behalf of the Principal Scientist)

Dated 10 Feb 2021

NB IF ANY DETAILS ARE MATERIALLY CHANGED REGARDING DATES/AREA OF OPERATION AFTER THIS FORM HAS BEEN SUBMITTED, THE COASTAL STATE AUTHORITIES MUST BE NOTIFIED IMMEDIATELY

PART C. SCIENTIFIC EQUIPMENT

Complete the following table using a separate page for each coastal state


Coastal state Iceland

Port of call Reykjavik

Dates 3 Sep - 7 Oct 2021

Indicate "YES" or "NO"

<u>List scientific work by function</u> e.g.	Water column including sediment sampling of the seabed	Fisheries research within fishing limits	Research concerning the natural resources of the continental shelf or its physical characteristics	DISTANCE FROM COAST		
				Within 4 nm	Between 4-12 nm	Between 12-200 nm
Near surface ocean turbulence, directional wave spectra, surface winds, salinity, water temperature, air temperature, and surface images from surface floats	No samples - all measurements are sensor-based	no	no	no	no	yes
Near surface ocean turbulence, directional wave spectra, surface winds, salinity, water temperature, air temperature, and surface images from vertically profiling floats	No samples - all measurements are sensor-based	no	no	no	no	yes
surface currents, ocean temperature, ocean conductivity (salinity), wind velocity, atmospheric pressure, surface waves and underwater sound from surface drifters	No samples - all measurements are sensor-based	no	no	no	no	yes
Profiles of temperature, salinity, turbulence, oxygen, optical backscatter, chlorophyll fluorescence, acoustics from long-endurance underwater gliders	No samples - all measurements are sensor-based	no	no	no	no	yes
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Upper ocean velocity, sea surface temperature and salinity, meteorological parameters (e.g. wind velocity, barometric pressure, relative humidity, short- and long-wave radiation) from sensors mounted on the ship.	No samples - all measurements are sensor-based	no	no	no	no	yes

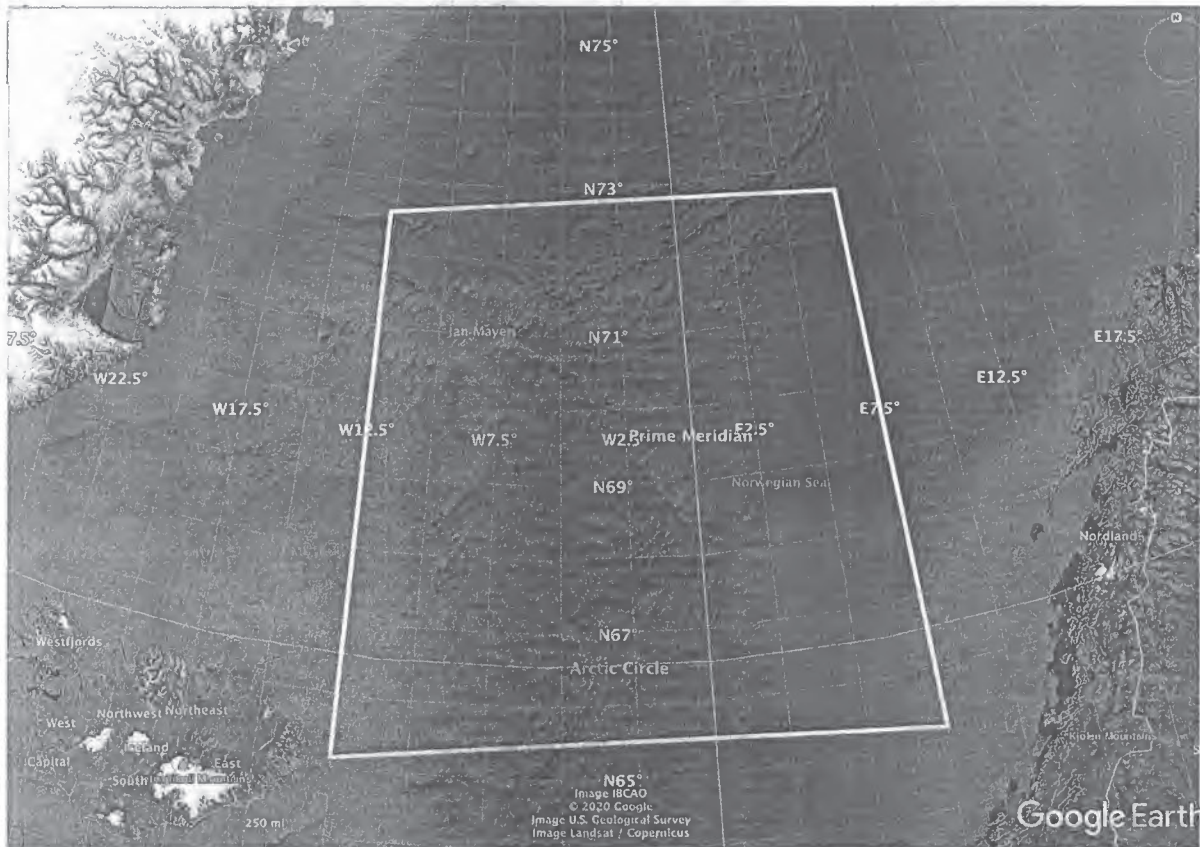


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The white box delineates the NORSE sampling region – all operations will take place within this box. NORSE science goals require observations focused on specific oceanographic phenomenon, including fronts and eddies. Actual cruise track and deployment locations for autonomous instruments thus depend on the locations and evolution of such features, and will this be determined in real time, in response to environmental variability.

Additional Information – Research Vessel Neil Armstrong – Marine Scientific Research

1. General Information

1.1 Cruise name and/or number:	NORSE Pilot - F2021-010
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1.2 Sponsoring institution(s):		
Name	Address	Name of Director
Office of Naval Research, Code 32, Physical Oceanography	Dr. Scott Harper scott.l.harper@navy.mil (703) 696-4721	Dr. Scott Harper

1.3 Scientist in charge of the project:	
Name:	Luc Rainville
Country:	US
Affiliation:	Applied Physics Laboratory, University of Washington
Address:	, US
Telephone:	+1-206-685-4058
Email:	lucrain@uw.edu

1.4 Entity(ies) /Participant(s) from coastal State involved in the planning of the project:	
Name:	See Section 6.2.
Country:	
Affiliation:	
Address:	
Telephone:	
Fax:	
Email:	
Website (for CV and photo):	

2. Description of Project

2.1 Nature and objectives of the project:
The NORSE program will focus on characterizing the key physical parameters and processes that govern the predictability of upper-ocean rapid evolution events occurring in the ice-free high latitudes. Program goals include identifying the observable parameters that are most influential in improving model predictability through inclusion by assimilation, and fielding an autonomous observing network that optimizes sampling of those high-priority fields. The program aims to demonstrate improvements in the predictability of the upper ocean physical fields associated with velocity and acoustic propagation.

2.2 Relevant previous or future research projects:
None.

2.3 Previous publications relating to the project:
None.

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):
Box defined by: (1) 65°N, 12°30' W (2) 73°45' N, 7°30' E Excluding the Faroes EEZ

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.
Chart provided - see Section 10.1.

4. Methods and Means to be Used

4.1 Particulars of vessel:	
Name:	NEIL ARMSTRONG

Type/Class:	Ship
Nationality (Flag state):	United States
Identification Number (IMO/Lloyds No.):	9688946
Owner:	United States Navy
Operator:	Woods Hole Oceanographic Institution
Overall length (meters):	72.50
Maximum draught (meters):	4.60
Displacement/Gross tonnage:	2603.00
Propulsion:	2 Siemens AC Electric Motors, 2350 HP
Cruising:	11.00
Maximum speed:	14.00
Call sign:	
INMARSAT number and method and capability of communication (including emergency frequencies):	INMARSAT C- (IMN#) 436903967
Name of master:	Captain Kent Sheasley
Number of crew:	20
Number of scientists on board:	24

4.2 Other craft in the project, including its use:	
None	

4.3 Particulars of methods and scientific instruments:		
Types of samples and measurements	Methods to be used	Instruments to be used
Near surface ocean turbulence, directional wave spectra, surface winds, salinity, water temperature, air temperature, and surface images	Surface Wave Instrument Float with Tracking (SWIFT) surface drifters http://www.apl.uw.edu/swift	2 MHz Nortek Aquadopp HR velocity profiler Airmar PB200 or RM Young 8100 Met package Microstrain 3DM-GX3-35 IMU Aanderaa 4319 CT sensor 123 Camera Y201-TTL
Profiles of ocean temperature, salinity and microstructure.	Marine Robotic Vehicles (MRV) ALAMO profiling floats. Floats operate autonomously, collecting profiles over the course of months.	RBR CTD (conductivity, temperature, depth sensor) Rockland Scientific microstructure package
surface currents, ocean temperature, ocean conductivity (salinity), wind velocity, atmospheric pressure, surface waves and underwater sound	Four models of surface drifters: SVP Drifter (https://gdp.ucsd.edu/dl/svp/) 35 cm ABS sphere surface float GPS-based tracking Iridium Short Burst Data (SBD) telemetry Sea surface temperature (± 0.05 K accuracy) Holey sock drogue centered at 15 m depth Variable sampling rate down to 5 minutes 56AH alkaline primary battery pack Two-year lifespan Minimet drifter (https://gdp.ucsd.edu/dl/minimet/) Standard 35 cm sphere or modified spheroid surface float GPS-based tracking Iridium Short Burst Data (SBD) telemetry Sea surface temperature (± 0.05 K accuracy) Sea level wind speed and direction (wind speed: 2% accuracy FS) Sea level barometric pressure sensor (± 0.4 hPa accuracy) Conductivity 2 hydrophones Holey sock drogue centered at 15 m depth 56AH alkaline primary battery pack Variable sampling rate down to 5 minutes ADOS drifter (https://gdp.ucsd.edu/dl/ados/) Modified 35 cm spheroid surface float GPS based tracking Iridium Short Burst Data (SBD) telemetry Sea surface temperature (± 0.05 K accuracy) Sea level wind speed and direction (wind speed: 2% accuracy FS) Sea level barometric pressure sensor (± 0.4 hPa accuracy) Conductivity 2 hydrophones Temperature and water pressure sensor chain up to 200 m depth User-customizable node configuration Compatible with third-party inductive protocol instruments Variable sampling rate down to 5 minutes DWSD drifter (https://gdp.ucsd.edu/dl/dwsd/) 35 cm sphere surface float GPS-based tracking and wave engine Iridium Short Burst Data (SBD) telemetry Onboard datalogger with up to 16	Thermistor chain (T profiles) Seabird Electronics SBE37 (temperature and conductivity (salinity) Gill Wind sonic anemometer

	GB of storage Fourier coefficients a_0, a_1, b_1, a_2, b_2 1/256 Hz bandwidth from 0.03 to 0.50 Hz User-programmable sampling window Sea surface temperature (± 0.05 K accuracy) Freely drifting or restrained mooring configurations One-year lifespan	
Profiles of temperature, salinity, turbulence, oxygen, optical backscatter, chlorophyll fluorescence, acoustics	Long-endurance autonomous underwater gliders: APL-UW Seaglider https://apl.uw.edu/project/project.php?id=seaglider Webb-Teledyne Slocum http://www.teledynemarine.com/slocum-glider Gliders will be used to sample survey patterns, profiling from the sea surface to 1000-m depth in a saw-tooth pattern to collect data while transiting along designated sampling lines.	Seabird Electronics SBE-CTD41CP (temperature and salinity) RBR Legato CTD (temperature and salinity) Wetlabs BB2F (optical backscatter and fluorescence) Aanderaa optode (oxygen) Towed array (acoustics) APL-UW microstructure package
Profiles of temperature and salinity	Underway tow-yo CTD system Collect profiles of ocean temperature and salinity by repeatedly paying out and reeling in a CTD package while ship is steaming. This allows quasi-synoptic sampling of a larger spatial domain.	Ocean Sciences UCTD system or similar.
Profiles of oceanographic properties.	Seabird 911+ CTD & rosette system Collection of discrete profiles at designated stations. Profiles extend from sea surface to depths up to full ocean depth.	SBE CT and oxygen sensors Wetlabs optics (backscatter, fluorescence) Light (PAR, spectral upwelling/downwelling irradiance) Velocity (DRI ADCP or equivalent)
Upper ocean velocity, sea surface temperature and salinity, meteorological parameters (e.g. wind velocity, barometric pressure, relative humidity, short- and long-wave radiation)	Underway sampling from sensors permanently installed on the ship.	RDI ADCPs (ocean velocity profiles) various meteorological sensors.

4.4 Indicate nature and quantity of substances to be released into the marine environment:
No

4.5 Indicate whether drilling will be carried out. If yes, please specify:
No

4.6 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

4.7 Indicate whether protected species be studied. If yes, please specify:
No

5. Installations and Equipment

Details of installations and equipment (including dates of laying, servicing, method and anticipated timeframe for recovery, locations and depth, and measurements):
No

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:
Project Start Date: Aug 05, 2021
Project End Date: Oct 23, 2021

6.2 Coastal State-specific details:

Coastal Area	Estimated Entry Date	Estimated Departure Date
Iceland	Sep 03, 2021	Oct 07, 2021

Explanation of multiple entries:
Depending on environmental conditions during the cruise, we may follow oceanographic features that lead us repeatedly in and out of the Icelandic EEZ.

Research will be performed: between 12-200 nm

Extent to which Iceland will be enabled to participate or to be represented in the research project:

Participation is welcome, and we have reached out to Icelandic colleagues regarding collaboration.		
Name, affiliation and contact information for all participants from Iceland: Angel Ruis-Angulo (angel@vedur.is)		
Coastal Area	Estimated Entry Date	Estimated Departure Date
Norway	Sep 06, 2021	Oct 05, 2021
Explanation of multiple entries: Depending on environmental conditions during the cruise, we may follow oceanographic features that lead us repeatedly in and out of the Norwegian EEZ.		
Research will be performed: between 12-200 nm		
Extent to which Norway will be enabled to participate or to be represented in the research project: Collaboration is encouraged and we will reach out to colleagues at Norwegian research institutions and universities.		
Name, affiliation and contact information for all participants from Norway: Ilker Fer (Ilker.Fer@uib.no)		

7. Port Calls

Port	Arrival Date	End Date	Special Logistical Requirements	Shipping Agent
Reykjavik	8/26/2021	9/3/2021	None	TBD
Reykjavik	10/7/2021	10/9/2021	None	TBD

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: See Section 6.2.

8.2 Proposed dates and ports for embarkation/disembarkation: See Section 6.2.
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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: No more than 60 days from the end date of the research as provided in Section 6.1.
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9.2 Anticipated dates of submission to the coastal State of the final report: No more than 2 years from the end date of the research as provided in Section 6.1.

9.3 Proposed means for access by coastal State to data (including format) and samples: Data will be provided through official channels at no cost to the coastal State(s). Samples will be provided upon request.
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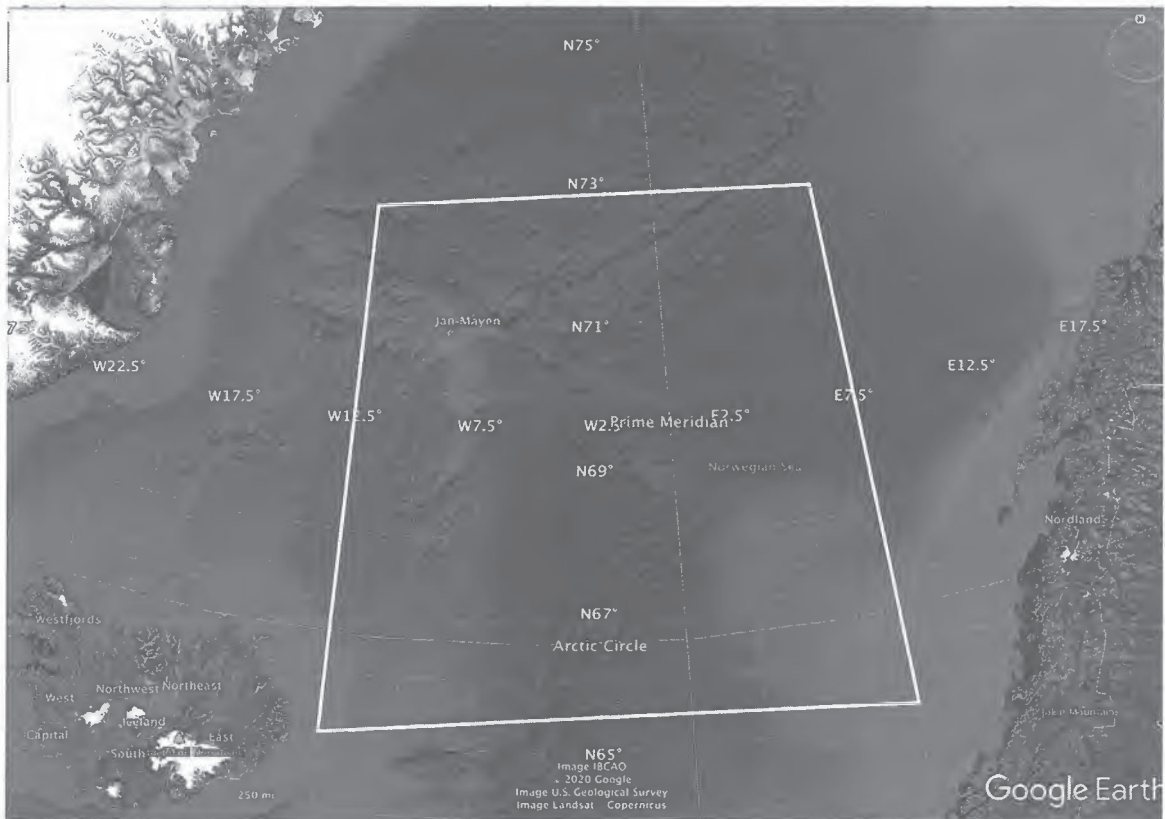
9.4 Proposed means to provide coastal State with assessment of data, samples and research results: Assessment of data, samples and research results will be provided at no cost to the coastal State(s).

9.5 Proposed means to provide assistance in assessment or interpretation of data, samples and research results: Assistance in further assessment or interpretation will be provided upon request.
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9.6 Proposed means of making results internationally available: Cruise reports and data will be made available for direct download in electronic format and supplied to science collaborators from the coastal states. Science result will be published in the open (publicly available), peer-reviewed scientific literature and presented at professional meetings and conferences.
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10. List of Supporting Documentation

10.1 List of attachments, such as additional forms required by the coastal State, etc.:			
Attachment Type	Description	Attachment	Submission Date
Proposed Cruise Track	Chart of NORSE sampling region	9624820244_NORSEchart.pdf	Feb 04, 2021
Supplemental Material	Norwegian Form	2575903139_NORSE_Norwegian.pdf	Feb 12, 2021



The white box delineates the NORSE sampling region – all operations will take place within this box. NORSE science goals require observations focused on specific oceanographic phenomenon, including fronts and eddies. Actual cruise track and deployment locations for autonomous instruments thus depend on the locations and evolution of such features, and will this be determined in real time, in response to environmental variability.