NOTIFICATION OF PROPOSED RESEARCH CRUISE

PART A: GENERAL

1. NAME OF RESEARCH SHIP : “Fridtjof Nansen”

2. DATES OF CRUISE: 4th May – 25th September 2025

3. OPERATING AUTHORITY: Hurtigruten Expeditions (HX)

TELEPHONE: + 47 51 00 53 20

TELEFAX: N/A

TELEX: 425901035

4. OWNER (if different from no. 3)

5. PARTICULARS OF SHIP:

Name: “Fridtjof Nansen”
Nationality: Norway (NIS)
Overall length: 140,0 m
Maximum draught: 5,5 m
Net tonnage: 7545
Propulsion e.g. diesel/steam: diesel-electric
Call sign: LACN8
Registration port and number: Longyearbyen, IMO-9813084

6. CREW

Name of master: Raymond Andre Martinsen

Number of crew: 175

7. SCIENTIFIC PERSONNEL

Dr. Clemens von Scheffer
GEOMAR Helmholtz Centre for Ocean Research
Wischhofstraße 1-3
24148 Kiel
Phone: +49 431 600 1724
Email: cvonscheffer(at)geomar.de

No. of scientists in total (details relevant for Icelandic passages in bold letters and underlined see below): 8

- FNEUR2503: Hamburg to **Reykjavík**, 04/05-10/05/25: 1
- **FNICE2504: Reykjavík to Reykjavík, 10/05-17/05/25: 1**
- **FNICE2504: Reykjavík to Reykjavík, 17/05-24/05/25: 1**
- **FNICE2504: Reykjavík to Reykjavík, 24/05-31/05/25: 1**
- **Reykjavík** to Nuuk, 31/05-12/06/25: 0
- FNGRE250X: Nuuk to Nuuk, 12/06-22/06/25: 0
- FNGRE2506: Nuuk to Nuuk, 22/06-02/07/25: 1
- FNGRE2507: Nuuk to Nuuk, 02/07-16/07/25: 1

- FNGRE2507: Nuuk to Nuuk, 16/06-30/07/25: 1
- FNGRE2508: Nuuk to Nuuk, 30/07-17/08/25: 1
- Nuuk to Nome, 18/08-09/09/25: 0
- FNALA2510: Nome to Vancouver, 09/09-25/09/25: 2

8. GEOGRAPHICAL AREA IN WHICH SHIP WILL OPERATE
(with reference to latitude and longitude)

Germany, Norway, UK, Faroe Islands, Iceland, Greenland, Canada, USA (63 °N– 75°N, 13°W – 174°W)

9. BRIEF DESCRIPTION OF PURPOSE OF CRUISE

In addition to the regular tourist program of the cruise ship, a scientific program will be carried out. The measurements onboard this vessel take place within the framework of "SOOP – Shaping an Ocean Of Possibilities". SOOP (https://www.soop-platform.earth/) is an initiative of the Helmholtz Association of German Research Centres, the largest scientific organization in Germany. SOOP is a technology platform under participation of AWI Bremerhaven, (www.awi.de/en), GEOMAR Kiel (www.geomar.de/en) and Hereon Geesthacht (www.hereon.de/index.php.en), aiming to improve ocean observations by involving citizens and engage with industry. SOOP activates the knowledge, awareness and interest of science, society, business and politics. It develops reliable, cost-efficient and user-friendly, standardized measurement systems and services and provides a data platform to collect, provide and use ocean data, and establishes an innovation-based value creation to strengthen ocean observation.

10. DATES AND NAMES OF INTENDED PORTS OF CALL

Hamburg, Germany: 4th of May 2025
Reykjavík, Iceland: 10th ,17th, 24th, 31st of May 2025
Nuuk, Greenland: 12th and 22nd of June, 2nd,16th and 20th of July, 17th of August 2025
Nome, Alaska, USA: 9th of September 2025
Vancouver, Canada on 25th of September 2025
Please refer to attachment: Fridtjof-Nansen_SOOP_040525-250925.xlsx

11. ANY SPECIAL REQUIREMENTS AT PORTS OF CALL NOTIFICATION OF PROPOSED RESEARCH CRUISE

No

PART B: DETAILS

1. NAME OF RESEARCH SHIP: "Fridtjof Nansen"

2. DATES OF CRUISE : 4th of May – 25th of September 2025

3. a) PURPOSE OF RESEARCH
This vessel does measurements to support the mission of SOOP. The program on board involves chemical, meteorological, physical, and biological measurements in the ocean and the atmosphere. Surface water will be continuously from the ship's water intake at

approximately 5 m depth with approximately 100 l/min. The water will be pumped through different instruments to measure various parameters (see below). After passing through the instruments, that water will be pumped back outside. **NOTE:** The water will not be contaminated with any chemicals or other substances. Some measurements need referencing measurements. For this purpose, a small amount of surface water will be filled in sample containers for analysis in the laboratories on land.

b) GENERAL OPERATIONAL METHODS
(including full description of any fish gear, trawl type, mesh size, etc.)

Temperature and Salinity - **Instrument**: Seabird SBE45
The water temperature will be measured as close to the water inlet as possible and again close to the setup of the measurement setup. Also the salinity of the seawater will be measured.
Partial pressure of CO2 -**Instrument:** 4H-Jena Contros HydroC-FT
While the seawater is pumped through the instrument it is passing a membrane. The membrane allows gases that are dissolved in the water to pass through it, without letting the water through. This way the same amount of gases will be present on the water side and air side of the membrane. The air side is measured using an infra-red detector for its CO2 content. The water remains unaltered. The data can be used to estimate the exchange of CO2 between the ocean and the atmosphere and this help to constraint the ocean carbon sink.
Dissoved Oxygen - **Instrument:** Seabird SBE63
The seawater is passing a membrane and dissolved oxygen is dissolving in a foil that is constantly exposed to the water. The amount of oxygen dissolved in the foil is equivalent to the amount of oxygen dissolved in the seawater. The oxygen in the foil changes its structure, which can be measured by diodes. The data will give insight to gas exchange at the sea surface (together with CO2) and biological productivity
Microplastic - **Instrument:** Geesthacht Inert Microplastic Fractionator V3
Seawater is pumped through a cascade of stainless-steel cartridge filters (300, 100 and 10 µm). Microplastic particles and interfering matrix constituents (organic and sediment particles) are retained on the filters. After sampling, the particles are removed from the cartridge filters using ultrasound and detergent, stabilized and stored until the sample purification and subsequent final IR microspectroscopic analysis in the laboratory. Microplastic particles and fibers are omnipresent and persistent environmental pollutants and subjected to long-range transport. Microplastic number concentrations (10 µm – 5000 µm, particles per cubic meter) However, there are still many data gaps that need to be filled to enable a better understanding of the environmental fate of microplastics as well as a more accurate assessment of the corresponding risks.
eDNA - **Instrument:** Particle and Phytoplankton Sampler (McLance; USA)
The automated filtration system is equipped with a set of 24 membrane filters with a pore-size of 0.4 µm. Seawater is passing the filter and particulate organic matter, including eDNA is collected on the filters. Subsequent to filtration, filters are stored frozen until further molecular analyses in the laboratory to identify the biodiversity of the ocean.
Hyperspectral (HyperSpecBox) - **Instrument:** Seabird AC-S
The seawater passes two tubes where it is illuminated by an LED light source. Two detectors measure the attenuation and absorption of the water passing through the instrument between 400 nm and 730 nm. The data are used to determine the particulate organic matter and the composition of different phytoplankton groups.
Atmospheric box - **Instrument:** PAMOS (Portable Atmospheric Measuringnbox On Sea)
The system is installed on the helicopter deck and measures continuously different trace gas concentrations and aerosol parameters, such as number concentration and black carbon. An air inlet is used for the measurements and simultaneously weather parameters are collected, like wind speed and direction, to identify critical situations for the airflow. If there is rain or the

wind is too strong, the airflow will be stopped. The data will allow to investigate the impact of ships on the lower atmosphere and improve the atmospheric data coverage over the oceans.

4. ATTACH CHART showing (on an appropriate scale) the geographical area of intended work, positions of intended stations, tracks of survey lines, positions of moored/seabed equipment, areas to be fished.

Figures 1 – 6 show the different routes during the voyages of the Nansen, with Figures 1 and 2 showing legs of the cruise where research will be conducted.

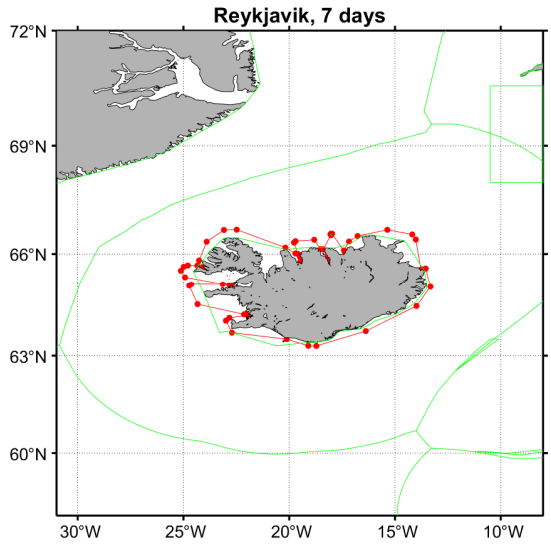

Figure 1: Iceland round trip, Reykjavik – Reykjavik, Iceland

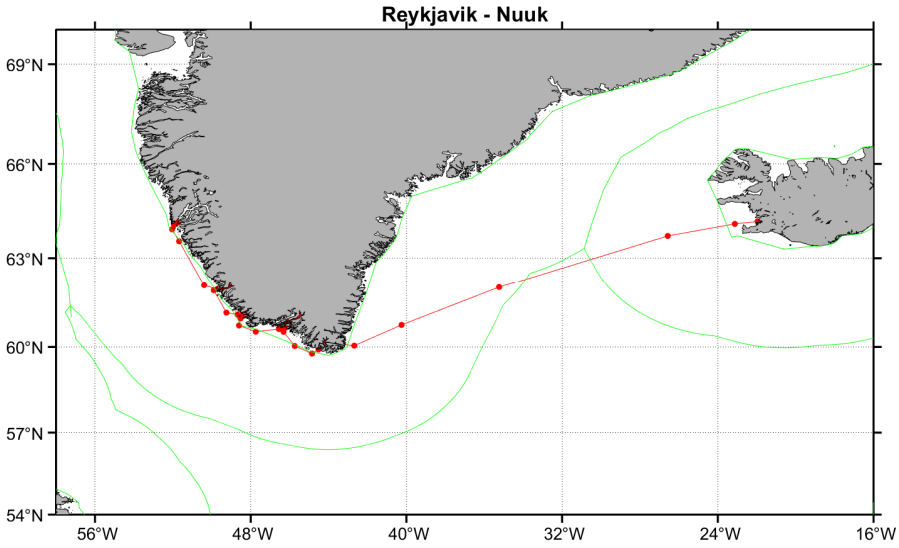

Figure 2: Reykjavik, Iceland – Nuuk, Greenland

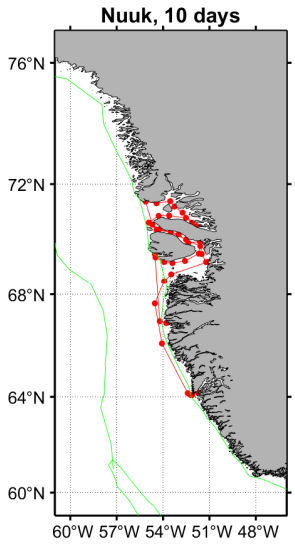

Figure 3: Greenland round trip 10 days, Nuuk – Nuuk

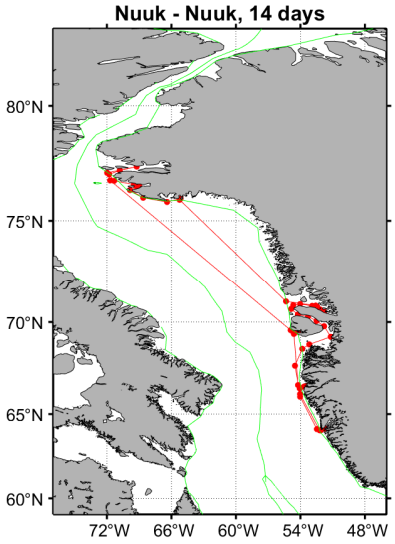

Figure 4: Greenland round trip 14 days, Nuuk – Nuuk

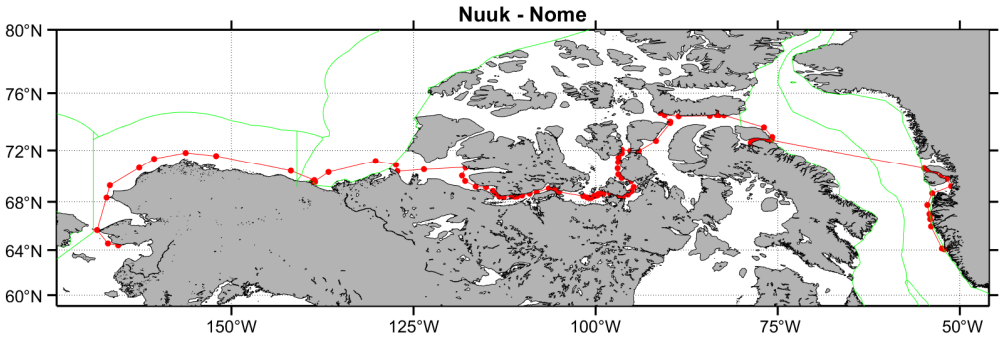

Figure 5: Iceland – NWP – Nome, Alaska, USA

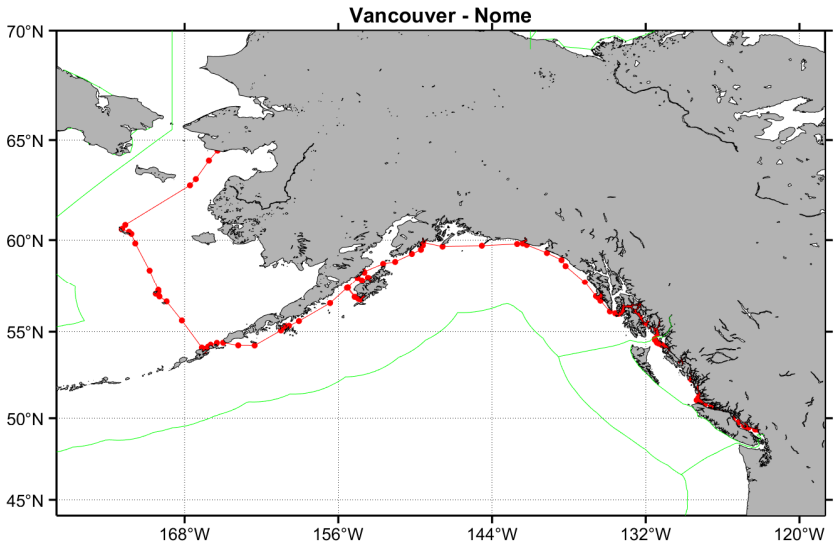

Figure 6: Nome, Alaska, USA – Vancouver, Canada

5. a) TYPES OF SAMPLES REQUIRE
(e.g.,geological/water/plankton/fish/radionuclide):
Seawater samples and atmospheric measurements, including weather data

b) METHODS OF OBTAINING SAMPLES
(e.g., dredging/coring/drilling/fishing, etc. When using fishing gear, indicate fish stocks being worked, quantity of each species required, and quantity of fish to be retained- on board).

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Partial pressure of CO2 -**Instrument:** 4H-Jena Contros HydroC-FT
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6. DETAILS OF MOORED EQUIPMENT

N/A

7. ANY HAZARDOUS MATERIALS
(chemicals/explosives/gasses/radioactives, etc., (Use separate sheet if necessary)

For eDNA sampling is needed:
a) Type and trade name
Ethanol, 99%
b) Chemical content (and formula)
C_2H_6O
c) IMO IMDG code (reference and UN no.)
IMO 3/II UN-Code UN 1170
d) Quantity and method of storage on board
1000 ml (storage in lab)

e) If explosives give dates of detonation: N/A

- Method of detonation
- Position of detonation
- Position of detonation
- Frequency of detonation
- Depth of detonation
- Size of explosive charge in kg.

8. DETAIL AND REFERENCE OF

a) Any relevant previous/future cruises
A voyage of the 'Fridtjof Nansen' (Hurtigruten Expeditons), on a similar route from Reykjavik (16th of May 2024) to Vancouver (18th of September 2024) was the first one. Further expeditions on the Hurtigruten Expeditions' vessels are planned.

b) Any previously published research data relating to the proposed cruise

Friedlingstein, P., O'Sullivan, M., Jones, M. W., Andrew, R. M., Gregor, L., Steinhoff, T., et al., (2022) Global Carbon Budget 2022, Earth Syst. Sci. Data, 14, 4811 4900, https://doi.org/10.5194/essd-14-4811-2022

Hansen, J., Hildebrandt, L., Zimmermann, T., Gareb, G., Fischer, E., Pröfrock, D., (2023) Quantification and characterization of microplastics in surface water samples from the Northeast Atlantic Ocean using laser direct infrared imaging, Marine Pollution Bulletin, Vol. 190, 114880

Hildebrandt, L., Gareb, F., Zimmermann, T., Klein, O.,Kerstan, A., Emeis, K., Pröfrock, D., (2022) Spatial distribution of microplastics in the tropical Indian Ocean based on laser direct infrared imaging and microwave-assisted matrix digestion, Environmental Pollution, Vol. 307, 119547

Hildebrandt, L., Zimmermann, Primpke, S., Fischer, D., Gerdts, G., Pröfrock, D., (2021) Comparison and uncertainty evaluation of two centrifugal separators for microplastic sampling, Journal of Hazardous Materials, Vol. 414, 125482

Liu, Y., Röttgers, R., Ramírez-Pérez, M., Dinter, T. Steinmetz, F., Nöthig, E.M., Hellmann, S., Wiegmann, S., Bracher, A. Underway spectrophotometry in the Fram Strait (European Arctic Ocean): A highly resolved chlorophyll a data source for complementing satellite ocean color. Opt. Exp. 2018, 26, A678–A696. https://doi.org/10.1364/OE.26.00A678

Liu, Y., Boss, E., Chase, A. P., Xi, H., Zhang, X., Röttgers, R., et al. (2019). Retrieval of phytoplankton pigments from underway spectrophotometry in the Fram Strait. Remote Sens. 11:318. https://doi.org/10.3390/rs11030318

Oldenburg, E., Popa, O., Wietz,M., von Appen, W., Torres-Valdes, S., Bienhold, C., Ebenhöh, O., Metfies (2024), Sea-ice melt determines seasonal phytoplankton dynamics and delimits the habitat of temperate Atlantic taxa as the Arctic Ocean atlantifies, *ISME Communications*, Volume 4, https://doi.org/10.1093/ismeco/ycae027

Seelmann K., Steinhoff T., Aßmann S. and Körtzinger A (2020). Enhance Ocean Carbon Observations: Successful Implementation of a Novel Autonomous Total Alkalinity Analyzer on a Ship of Opportunity. Front. Mar. Sci. 7:571301. doi: 10.3389/fmars.2020.571301.

Weiß, J.F., von Appen, WJ., Niehoff, B. et al. Unprecedented insights into extents of biological responses to physical forcing in an Arctic sub-mesoscale filament by combining high-resolution measurement approaches. Sci Rep 14, 8192 (2024).https://doi.org/10.1038/s41598-024-58511-y

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

- Prof. Henrik Skov, Professor, Dep. of Environmental Science Aarhus University, Frederiksborgvej 399, 4000 Roskilde, Roskilde, Denmark (AtmoBox)
- Dr. Roxana Sühring, Assistant Professor, Department of Chemistry and Biology, Toronto Metropolitan University, 350 Victoria St., Toronto, ON M5B 2K3,Canada (Microplastic)
- Michael Wieser, Professor, University of Calgary, 2500 University Dr. NW, Calgary, Alberta, Canada, T2N 1N4 (Microplastic)
- Maycira Costa, Professor Department of Geography, University of Victoria David Turpin Bldg, 3800 Finnerty Road, Victoria, BC, V8P 5C2, Canada (HyperSpecBox)
  Steven Ray, Ph.D., FRSC Associate Professor of Chemistry
  State University of New York at Buffalo, Buffalo, NY 14260 (Microplastic)
- Prof. Simon Bélanger, Département de biologie, chimie et géographie, University of Québec, Campus de Rimouski 300, allée des Ursulines, C.P. 3300, succ. A, Rimouski (Québec) G5L 3A1 Canada (HyperSpecBox)
- Katja Fennel, Professor, Department of Oceanography, Faculty of Science, Dalhousie University Room 3633, LSC Ocean Wing, 1355 Oxford St, PO Box 15000, Halifax, Nova Scotia, B3H 4R2 Canada (HyperSecBox)

- Prof. Emmanuel Boss, School of Marine Sciences, University of Maine
  5706 Aubert Hall, Orono, ME 04469-5706, US (HyperSpecBox)

10. STATE

a) Whether visits to the ship in port by scientists of the coastal state concerned will be acceptable

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

The voyages with the Nansen are fully booked. Therefore, it is not possible for an observer to travel with the ship

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

If relevant, data and findings of the cruise will be published in international, scientific, peer-reviewed journals and at international conferences. After quality control, all cruise data will be made available through the German research portal www.pangaea.de.

PART C. SCIENTIFIC EQUIPMENT
Complete the following table using a separate page for each coastal state
Coastal state: Iceland Port of call: Reykjavík Dates: 10th ,17th, 24th, 31st of May 2025

Indicate ”YES” or ”NO”

				distanc e	from the	Coast
List scientific work by function e.g.	Water column ~~includin g sedimen t~~ samplin g ~~of the seabed~~	Fisheries research within fishing limits	Research concerning the natural resources of the continental shelf or its physical characteristics	Within 3 NM	between 3-12 NM	between 12-200 NM
pCO2	Yes	No	No	Yes	Yes	Yes
Temperature and Salinity	Yes	No	No	Yes	Yes	Yes
Microplastic	Yes	No	No	Yes	Yes	Yes
Hyperspectral	Yes	No	No	Yes	Yes	Yes
eDNA	Yes	No	No	Yes	Yes	Yes
Atmospheric Box	No	No	No	Yes	Yes	Yes

Dated 17.02.2025
(on behalf of the Principal Scientist)

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

Attached are also following files:

- Detailed list of the route and stops from 4th of May to 25th of September 2025: Fridtjof-Nansen_SOOP_040525-250925.xlsx
- Waypoints for the different voyages as text files in zip-file (waypoints): **Reykjavik-Reykjavik.txt**; **Reykjavik**-Nuuk.txt, Nuuk-Nuuk 10 days.txt; Nuuk-Nuuk 14 days.txt; Nuuk-Nome.txt; Nome-Vancouver.txt