

Proposed Plan: R/V Sanna Davis Strait

The Arctic Observing Network: Renewing Observations at the Davis Strait Gateway

1 July –5 August 2021

Aasiat, Greenland – Aasiat, Greenland

Version 0, 11 Jan 2021

1. Objectives

- Deploy the Davis Strait moorings BI-2 and BI-4.

2. Background

This cruise will complete the deployment of the Davis Strait mooring array, restarting the integrated observational program at Davis Strait, matching ongoing collections at Bering Strait, Utqiagvik, Alaska, and Fram Strait to extend the time series of concurrent measurements across the major Arctic Gateways, to allow the analysis of several important science questions. This system operated continuously from 2004 – 2017, with the last moored (hydrographic) measurements collected in autumn, 2017 (2015). Recently observed changes in Arctic outflow at Fram Strait impart significant urgency to restarting the climate time series at Davis Strait, as simultaneous observations of both gateways are required to understand the mechanisms behind the shift and its potential impacts.

The backbone system relies on the tested combination of moorings and biennial biogeochemical sampling that have successfully delivered core measurements for the past decade. Bottom pressure sensors augment the system to quantify sea surface height gradients, which will support investigations of the primary forcing mechanisms. Integrated marine ecosystem observing includes ongoing biogeochemical and marine mammal passive acoustic measurements augmented with tracking of key fish species, and zooplankton and phytoplankton observations. These observations are part of the GO-SHIP, Synoptic Arctic Survey and ECOTIP programs. They will also launch the Atlantic Distributed Biological Observatory (DBO) in Davis Strait as a complement to the DBO newly planned for Fram Strait and the existing Pacific DBO. The full suite of observations from physics to top predators will be integrated into a multi-model approach to provide context to the measurements, as well as helping to understand the dynamics driving the observed variability.

Davis Strait Gateway observations are crucial to address several high-priority science objectives, including: (1) Quantifying change in Arctic freshwater and heat balances, (2) Understanding the interactions between Arctic change and global climate, (3) Documenting changes in Arctic Ocean acidification and potential impacts on subpolar oceans and (4) Establishing a sustained, international integrated Arctic Observing Network. These observations will quantify, with robust error estimates, changes in water mass characteristics, volume and freshwater fluxes, freshwater constituents and carbon variables at interannual (weekly for physical properties) and longer timescales. The measurements will also be used to investigate the mechanisms that control transport variability through the Canadian Arctic Archipelago (CAA), and the impacts of these exchanges on deepwater formation rates, Atlantic Meridional Overturning Circulation strength, ocean acidification, and the heat and freshwater balances of the Arctic Ocean. Acoustic recorders will document atmospheric, anthropogenic and biogenic (marine mammal) seasonal and interannual variability in ambient noise in Davis Strait. Marine ecosystem

components from plankton to whales will explore how environmental changes influence the presence and phenology of multiple trophic levels including how such changes impact Greenlandic peoples who rely on subsistence hunting of marine mammals.

3. Operations and Timeline

Embarkation and Debarkation Port

Operations are currently planned out of Aasiat, Greenland. Depending in R/V Sanna's schedule, this could shift to work from Nuuk or Sisimiut, Greenland.

Other Considerations

Staffing will depend on the status of the COVID-19 pandemic and travel restrictions as we approach summer, 2021. If the pandemic remains severe and vaccination is not widespread, it is highly likely that the mooring deployments will be conducted solely by our Greenlandic colleagues, meaning that no personnel from outside Greenland would be involved in loadout or in the seagoing work. Should conditions improve by summertime, we will consider sending a single engineer from the Applied Physics Laboratory, University of Washington (Seattle, USA) to join the cruise.

Personnel from R/V Sanna will not come ashore in Nunavut. In the event of a shipboard emergency, R/V Sanna will return to Greenland.

Operations

R/V Sanna will cross Baffin Bay, deploy moorings BI2 and BI4 (Fig. 1), and return to Greenland.

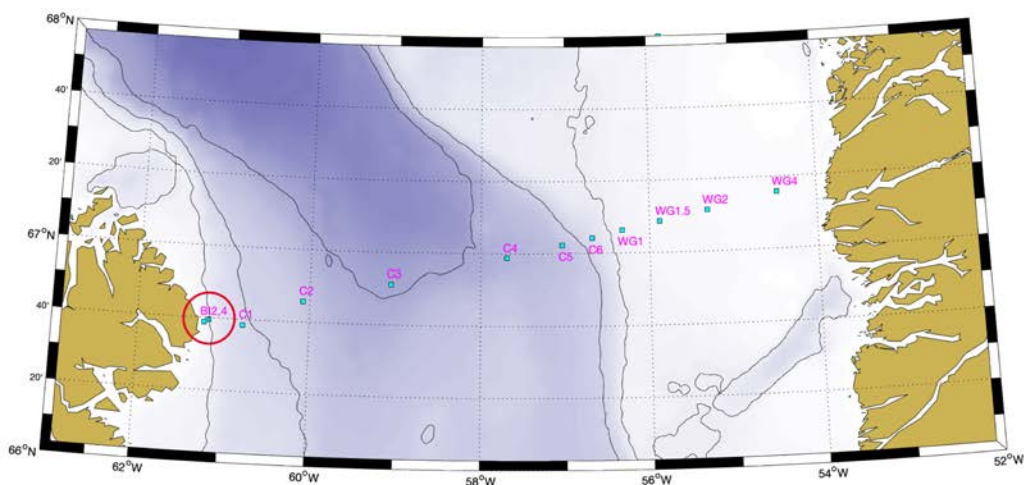


Figure 1. Davis Strait mooring sites (light blue squares). Only the two moorings in the red circle (BI2 and BI4) are proposed for deployment in 2021.

R/V Sanna Sailing Schedule

30 July – 5 August, 2021 Davis Strait operations window. The mooring deployments will require only 3-4 days of this time, but we have reserved a larger window to accommodate delays associated with ice and weather.

Table 1. Davis Strait Mooring Sites

| | Lat (N) | Lon (W) | Bottom (m) | Notes |
|--------------|-----------|-----------|------------|----------------------------|
| BI2 | 66° 38.8' | 61° 13.4' | 79 m | Deploy 2021 from R/V Sanna |
| BI4 | 66° 39.5' | 61° 10.2' | 152 m | Deploy 2021 from R/V Sanna |
| WG1 | 67° 06.4' | 56° 19.7' | 144 m | Deployed in 2020 |
| WG1.5 | 67° 08.7' | 55° 52.7' | 111 m | Deployed in 2020 |
| WG2 | 67° 11.6' | 55° 18.6' | 73 m | Deployed in 2020 |
| WG4 | 67° 15.8' | 54° 28.5' | 65 m | Deployed in 2020 |
| C1 | 66° 38.5' | 60° 46.5' | 441 m | Deployed in 2020 |
| C2 | 66° 45.8' | 60° 04.7' | 656 m | Deployed in 2020 |
| C3 | 66° 51.2' | 59° 03.3' | 1032 m | Deployed in 2020 |
| C4 | 66° 58.8' | 57° 41.5' | 866 m | Deployed in 2020 |
| C5 | 67° 02.3' | 57° 02.2' | 685 m | Deployed in 2020 |
| C6 | 67° 04.2' | 56° 40.9' | 385 m | Deployed in 2020 |
| BPR | 72° 00.0' | 65° 30.0' | 2000+ m | Deployed in 2020 |

DS2020 nominal BI-2
xxxxm depth (CTD) (xxxxm multibeam)
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nominal:

0m

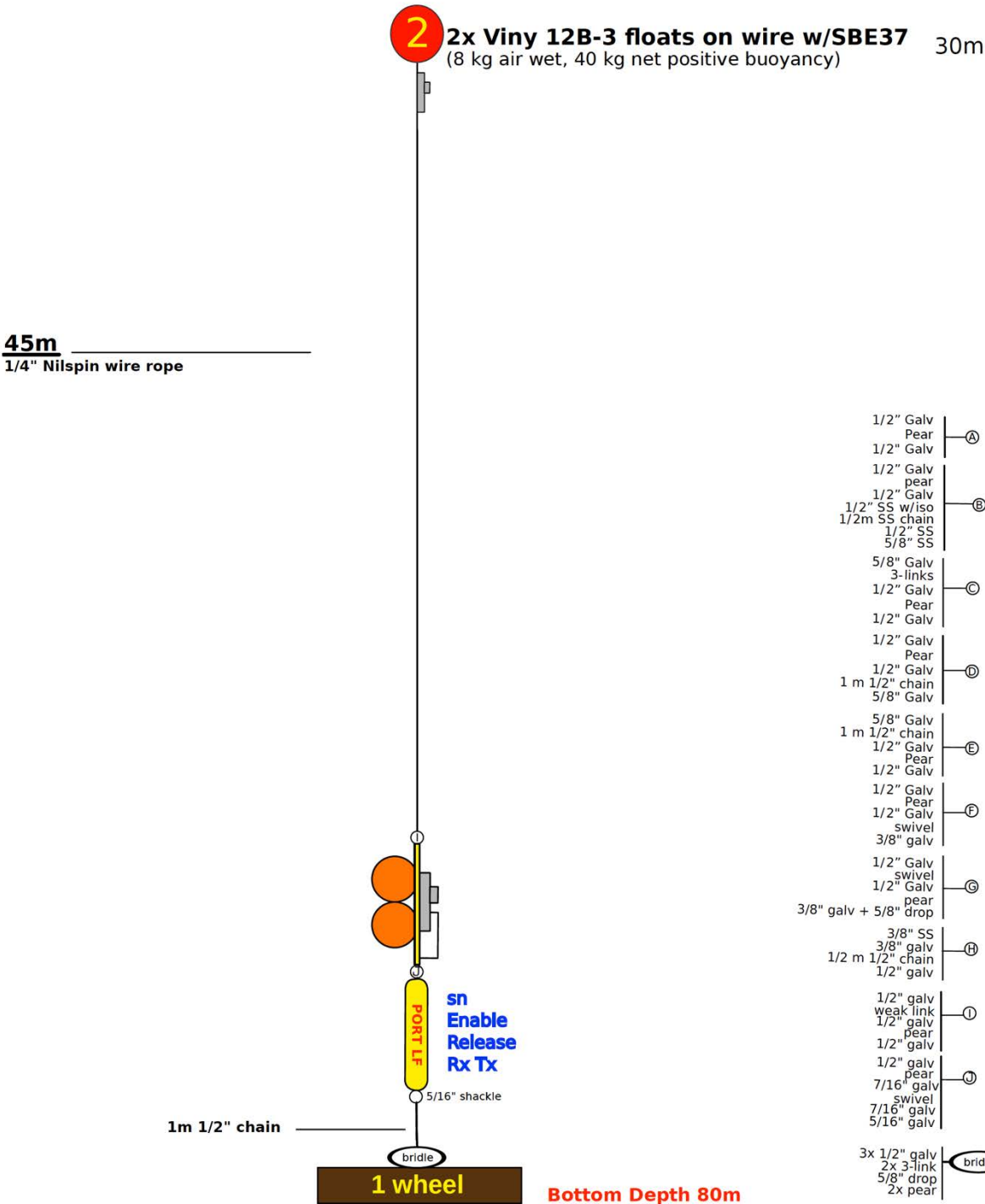


Figure 2. BI2 Mooring diagram (Baffin Shelf).

nominal:

