Upstream Pathways of the Faroe Overflow (UFO)

RR2506-07 Cruise Report

Photo by Andrew Naslund

Cruise Summary

Vessel: R/V *Roger Revelle*

Cruise ID: RR2506-07

RR2506: Reykjavík, Iceland – Tórshavn, Faroe Islands. Dates: 15 – 25 August 2025

RR2507: Tórshavn – Tórshavn, Faroe Islands. Dates: 25 August – 18 September 2025

Chief Scientist: Robert Pickart, Woods Hole Oceanographic Institution

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A: Overview & Objectives

A1: Overview

The overflow of dense water across the Greenland-Scotland Ridge, and its subsequent entrainment, is a fundamental component of the Atlantic Meridional Overturning Circulation (AMOC) which helps maintain Earth's climate. It is critically important to determine the mechanisms, forcing, and variability of the AMOC. The project entitled "Upstream Pathways of the Faroe Overflow" (UFO) is multi-institutional, interdisciplinary effort to study the origin and pathways of the dense water that feeds the Faroe Bank Channel overflow. This overflow is the densest component of the AMOC and accounts for a significant portion of the composite overflow across the Greenland-Scotland Ridge. The UFO program includes a mooring array, gliders, hydrographic surveys, and modeling. Together, this will help determine where the densest water is formed in the Nordic Seas, how this water progresses to the Greenland-Scotland Ridge, and how it is modified along the way including the role of atmospheric forcing. This in turn will provide a better understanding of the means by which the warming climate may impact the AMOC. The different institutions participating in UFO are the Woods Hole Oceanographic Institution (WHOI), the Faroe Marine Research Institute (FAMRI), the University of Bergen (UIB) Norway, NORCE Research AS, and the Marine and Freshwater Research Institute of Iceland (MFRI).

This report summarizes operations carried out aboard the R/V *Roger Revelle* during RR2506-07 in August-September 2025 as part of the second field stage of UFO. In addition to RR2506-07, there were two other cruises contributing to UFO that took place during the same time frame: JS-2542 on the R/V *Jákup Sverri* (FAMRI) and Þ7-2025 on the R/V Þórunn Þórðardóttir (MFRI).

RR2506-07 Scientific Objectives

The primary objectives of the *Revelle* cruise were as follows:

(1) To recover the 10 UFO moorings across the northern flank of the Iceland-Faroe Ridge that were deployed in summer 2024 to measure the two branches of the Iceland-Faroe Slope Jet (IFSJ) as well as the rim of the Norwegian Sea Gyre.

(2) To carry out a detailed hydrographic/velocity/tracer survey downstream of the mooring array to investigate the fate of the IFSJ as it encounters the Faroe-Shetland Channel.

(3) To provide a platform for ancillary measurements that are complimentary to UFO.

Table A1: RR2506 Science Party

Surname	Name	Affiliated Institution	Role
Pickart	Robert	Woods Hole Oceanographic Institution	Chief Scientist

McRaven	Leah	Woods Hole Oceanographic Institution	CTD/logistics coordinator
Ryder	James	Woods Hole Oceanographic Institution	Mooring tech (lead)
Hogue	Brian	Woods Hole Oceanographic Institution	Mooring tech
Hutt	Eric	Woods Hole Oceanographic Institution	Mooring tech
Brakstad	Ailin	University of Bergen	Mooring tech
Huang	Jie	Woods Hole Oceanographic Institution	Postdoc
Lago	Loreley	Woods Hole Oceanographic Institution	Postdoc
Sun	Yan	Woods Hole Oceanographic Institution	Postdoc
Cunill I Saez	Anna	University of Las Palmas de Gran Canaria	Graduate student
Pickart	Matthew	Woods Hole Oceanographic Institution	Scientist
Howes	Fiona	Hobart and William Smith Colleges	Undergraduate
Zhou	Ziyi	Shanghai Jiao Tong University	Graduate student
Houghton	Leah	Woods Hole Oceanographic Institution	Hydrographic tech
Jeansson	Emil	NORCE	Scientist
Burkhardt	Annalena	Swiss Federal Institute of Technology	Graduate student
Gammeter	Daan	Swiss Federal Institute of Technology	Graduate student
Lin	Peigen	Shanghai Jiao Tong University	Scientist
Murphy	Dallas	Writer	Outreach

Table A2: RR2507 Science Party.

Surname	Name	Affiliated Institution	Role
Pickart	Robert	Woods Hole Oceanographic Institution	Chief Scientist
McRaven	Leah	Woods Hole Oceanographic Institution	CTD/logistics coordinator
Bahr	Frank	Woods Hole Oceanographic Institution	ADCP Tech
Huang	Jie	Woods Hole Oceanographic Institution	Postdoc
Lago	Loreley	Woods Hole Oceanographic Institution	Postdoc
Sun	Yan	Woods Hole Oceanographic Institution	Postdoc
Cunill I Saez	Anna	University of Las Palmas de Gran Canaria	Graduate student
Pickart	Matthew	Woods Hole Oceanographic Institution	Scientist
Howes	Fiona	Hobart and William Smith Colleges	Undergraduate
Zhou	Ziyi	Shanghai Jiao Tong University	Graduate student
Houghton	Leah	Woods Hole Oceanographic Institution	Hydrographic tech
Jeansson	Emil	NORCE	Scientist
Dale	Duncan	Swiss Federal Institute of Technology	Graduate student
Gammeter	Daan	Swiss Federal Institute of Technology	Graduate student
Lin	Peigen	Shanghai Jiao Tong University	Scientist

Aluwihare	Lihini	Scripps Institution of Oceanography	Scientist
Nguyen	Tran	Scripps Institution of Oceanography	Technician
Murphy	Dallas	Writer	Outreach

A2: Cruise Narrative

RR2506 (hereafter Leg 1) departed Reykjavík on 15 August with the primary aim of recovering the mooring array. Before mooring operations began, we did a test cast of the conductivity-temperature-depth (CTD) system. All 10 moorings were successfully recovered over a period of six days, and a CTD section was occupied concurrently along the mooring line. Following the recovery of the final mooring, we did CTD calibration casts for all of the mooring T-S sensors. During the remainder of the leg we occupied the first three CTD sections of the broad-scale hydrographic survey. Leg 1 finished on 25 August in Tórshavn.

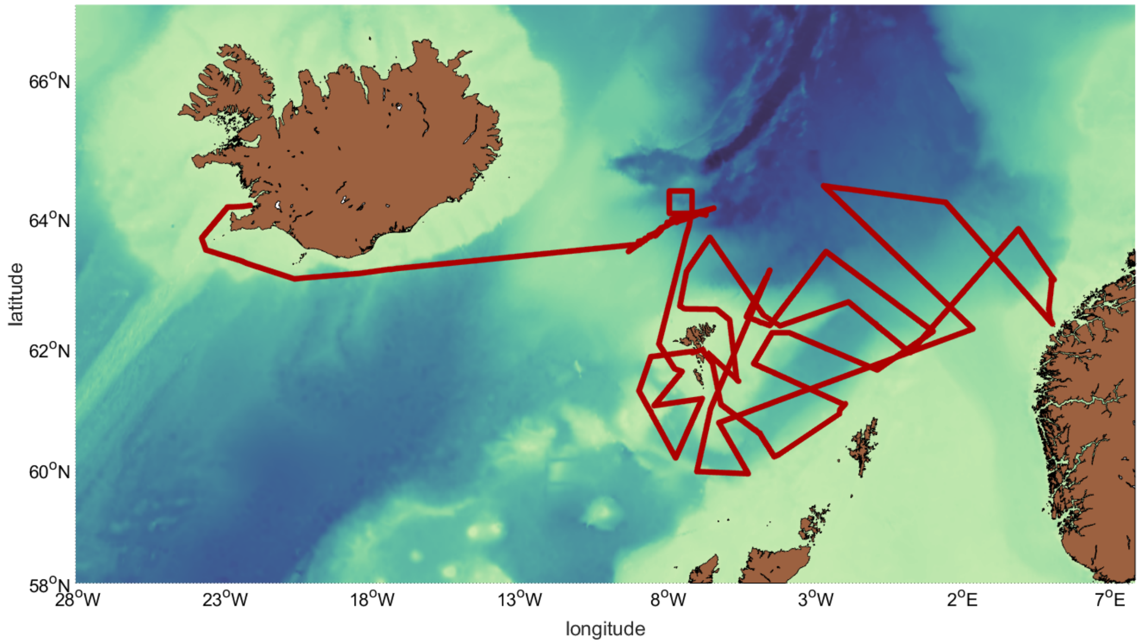


Figure A1: Cruise track of Leg 1 and Leg 2.

RR2506 (hereafter Leg 2) departed Tórshavn on 25 August. Over the course of the leg we carried out a detailed survey throughout the Faroe-Shetland Channel, including surveying the region of the channel's mouth (Figure A1). The purpose of this was to shed light on how much of the IFSJ flows directly into the channel versus how much overshoots the channel and subsequently retroflects back into it, as suggested by model studies. We occupied three sections across the north side of the Iceland-Faroe Ridge downstream of the mooring array and also occupied two transects across the Norwegian continental slope to look for evidence of dense water flowing southward into the Faroe-Shetland Channel, which is also suggested by modeling studies. At the end of the cruise we did a final transect across the channel southeast of the Faroe Islands, in part to see if/how the current system changed over roughly a 10-day period.

Throughout the survey, underway measurements were made using *Revelle's* shipboard acoustic Doppler current profilers (ADCPs), thermosalinograph (TSG), and met sensors. Tracer measurements were made at select stations and depths during each of the transects as part of the ancillary projects that joined the cruise. The CTD survey was completed on 17 September, and we arrived in Tórshavn on 18 September.

A timeline of all cruise activities is archived in the Event Log found in Appendix A.

B: Moorings

B1: Mooring Operations

Contributed by Bob Pickart (rpickart@whoi.edu) & Leah McRaven (lmcraven@whoi.edu)

The UFO mooring array consisted of 10 moorings (UFO-1 through UFO-10, Figure B1). The moorings were deployed in August 2024 from R/V *Armstrong* and R/V *Jákup Sverri* and were recovered in August 2025 during Leg 1 of the RR2506 cruise on R/V *Revelle*. UFO-1 through UFO-8 were designed and fabricated by WHOI, UFO-9 by UIB, and UFO-10 by FAMRI. During RR2506, mooring operations were led by Jim Ryder of the WHOI Mooring Operations and Engineering group.

Mooring operations began on August 17th and were completed on August 21st. A summary of mooring recoveries appears in Appendix A. Mooring diagrams are included in Appendix B. All recoveries were completed without issue. Of note, some moorings were recovered by bottom floatation first (in reverse of typical recovery) due to the ship's approach to the resurfaced floatation. UFO-9 and UFO-10 were tangled impacting the order in which the instrumentation was recovered (information recorded in recovery logs).

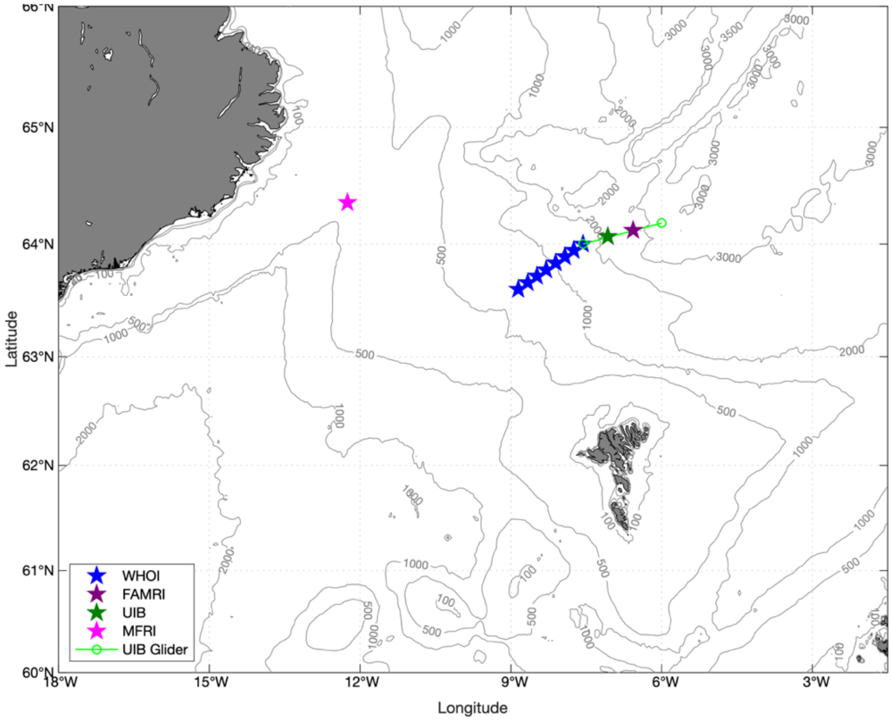


Figure B1: Locations of the UFO moorings (see the legend). Included on the map is the UIB glider track that covered the offshore part of the mooring array (top 1000 m). Also included is the mooring deployed by MFRI to measure the Western Valley overflow. The bathymetry is from ETOPO-2.

Figure B2: Photos of mooring recoveries

B2: Mooring Data

Moored ADCPs

Contributed by Frank Bahr (fbahr@whoi.edu)

Eight moored acoustic Doppler current profilers (MADCP) were recovered during RR2506. All were TRDI 75KHz Workhorse models. The collected data were downloaded early during RR2507. All but one instrument operated for the full year-long deployment, while the UFO-3 ADCP stopped recording on June 30 at 23:00. Since it was easily downloaded using an external power supply, we presume that it had exhausted its battery power.

The eight ADCP records were processed during RR2507. Using standard MADCP Matlab software, their magnetic compass readings were corrected for magnetic deviation and basic editing was then applied. The sound speed used to convert measured frequency shifts into oceanic velocity was adjusted using the hydrographic measurements of the co-mounted SeaBird MicroCATs. Since the UFO-3 microCAT had flooded, we used the LR75-collected pressure- and temperature records together with a constant salinity setting to calculate sound speed there.

All eight ADCP datasets included strong signals with a semi-diurnal period. We tried two approaches to remove them. First, we calculated tides using (1) the OSU tidal prediction software (OTPS) with the TPXO9-v5-atlas tidal model employed during shipboard ADCP processing, and (2) the Matlab t_tide software package to calculate tides directly from each MADCP dataset. The results from these methods agreed well with each other. However, the de-tided datasets still showed significant energy at roughly semi-diurnal periods. We therefore decided to low-pass filter the data instead, using a Butterworth filter with a 36-hour cutoff period. The example below shows the filtered zonal and meridional velocity for UFO-4.

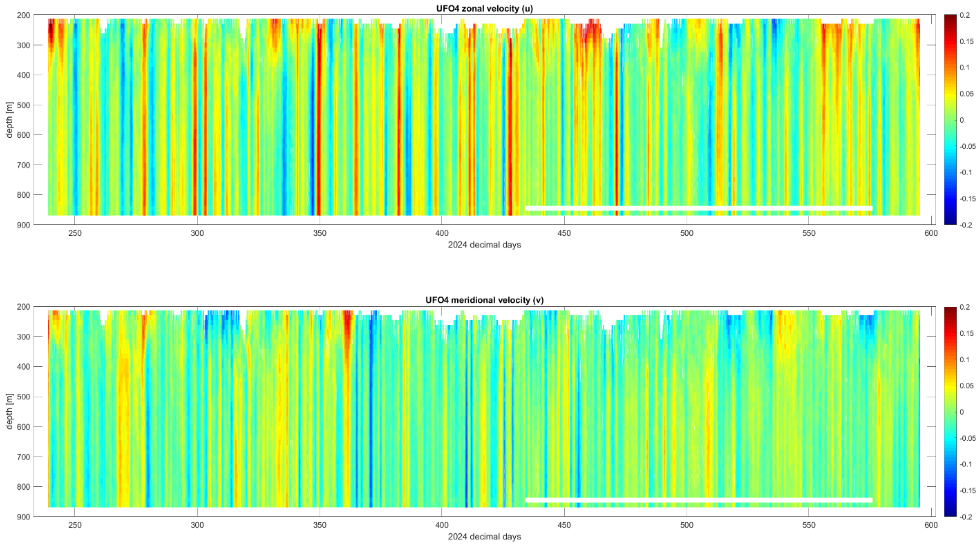


Figure B3: Data return from the moored ADCP on the UFO-4 mooring.

McLane Moored Profilers
Contributed by Leah McRaven (lmcraven@whoi.edu)

Each of the eight WHOI moorings had a McLane Moored Profiler (MMP) configured with an SBE52-MP measuring ocean pressure, temperature, and conductivity, and an FSI ACM-plus-MP measuring ocean velocity. The MMP on UFO-1 was programed to profile four times per day (one direction each profile) and the MMPs deployed on the UFO-2 through UFO-8 moorings were programed to profile twice per day (one direction each profile).

Each mooring included top floatation near 100m. The MMPs were programmed to profile between approximately 110m and within 50m of the bottom on each mooring, except for UFO-8, which stopped approximately 215m above the bottom (to preserve battery power). SBE37 instruments measuring ocean pressure, temperature, and conductivity were deployed within 1m of each MMP bumper stop and will be used as fixed points of calibration for the MMP CTD profile data once processed and calibrated. Additionally, RDI Longranger 75 kHz ADCPs were deployed below each MMP bumper stop to measure the deep flow at hourly resolution. These data will provide velocity calibration information for the ACM in the part of the water column where the two velocity profiles overlap.

The following table includes an overview of the overall MMP performance. Additional instrument calibrations and edits are required before final measurement accuracies are achieved. Overall, the MMP data return from the moored array was excellent.

Table B1: Summary of MMP Performance

UFO Mooring	Percentage of scheduled profiles completed	Additional comments
UFO-1	98%	Profiling metrics show no major issues and unit was active upon recovery.
UFO-2	99%	Profiling metrics show no major issues and unit was active upon recovery.
UFO-3	100%	Profiling metrics show no major issues and unit was active upon recovery.
UFO-4	99%	Profiling metrics show no major issues and unit was active upon recovery.
UFO-5	100%	Profiling metrics show no major issues and unit was active upon recovery.
UFO-6	73%	Battery voltage dropped earlier than anticipated based on mission planning. Starting around profile 400, this impacted the unit's ability to reach its programmed pressure limits. On 16 May 2025, the error log file recorded that the battery voltage fell below the minimum operational value (7.5 V) and profiles stopped.
UFO-7	94%	Battery voltage dropped slightly earlier than anticipated based on mission planning. On 28 July 2025, the error log file recorded that the battery voltage fell below the minimum operational value (7.5 V) and profiles stopped.
UFO-8	75%	Battery voltage dropped earlier than anticipated based on mission planning. On 24 May 2025, the error log file recorded that the battery voltage fell below the minimum operational value (7.5 V) and profiles stopped.

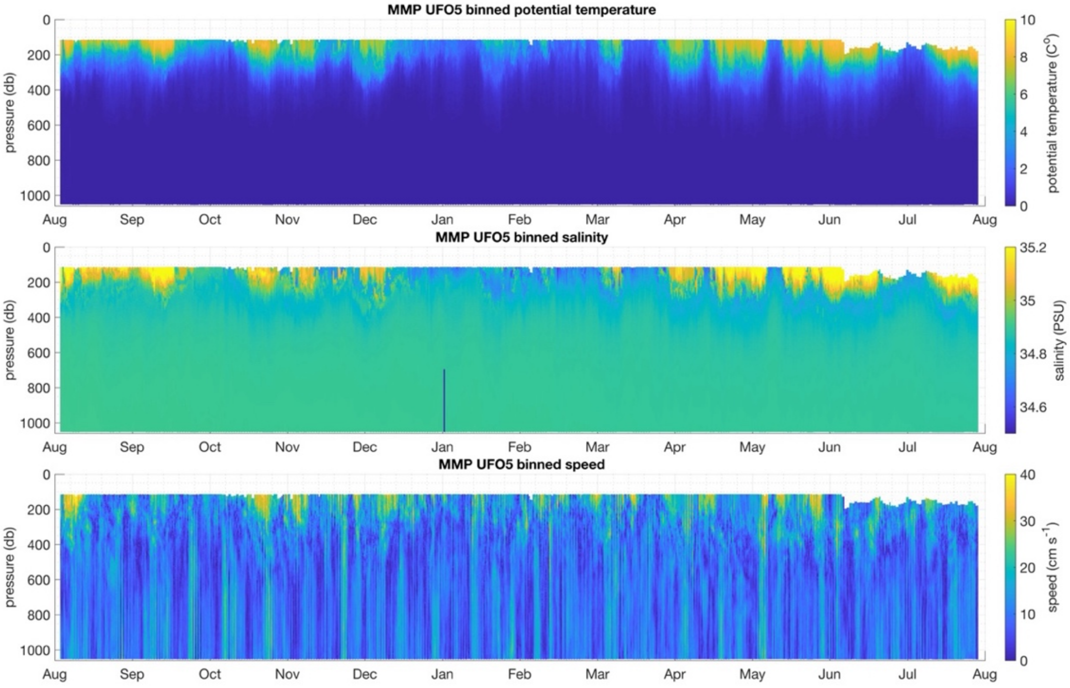


Figure B4: Data return from the MMP instrument on the UFO-5 mooring. Top, middle, and bottom panels show MMP temperature, salinity, and speed, respectively, as a function of pressure and time.

C: Shipboard Hydrographic Survey

C1: CTD Operations

Contributed by Bob Pickart (rpickart@whoi.edu) & Leah McRaven (lmcraven@whoi.edu)

A total of 348 CTD casts were carried out on RR2506-07 (Figure C1) using a Sea-Bird 911plus CTD and deck unit configured to measure pressure, temperature (dual sensors), conductivity (dual sensors), dissolved oxygen, beam transmission, and chlorophyll fluorescence. The bottom approach was controlled by real time altimeter data together with the ship's multibeam data. Discrete water samples were collected using a rosette frame holding 24 10-L Niskin bottles. Calibrations of all CTD sensors were performed by the manufacturer before the start of the field season.

The CTD data were processed using Sea-Bird software. The raw CTD data were lag corrected, edited for large spikes, smoothed according to sensor, and pressure averaged into 2-db bins for final data quality control and analysis. CTD salinity data were then further quality controlled and calibrated using Niskin water measurements. The overall CTD performance was excellent with the exception of a few biofouling events. A detailed outline of important events, problems encountered, and data processing can be found in the RR2506_07 _CTD_Calibration_Report.pdf document.

Eighteen transects were occupied by *Revelle* during the combined legs of the cruise. Sampling from the Niskin bottles was done for a suite of tracers on select casts at select depths (see sections C3 and Appendix A). Shortly after the completion of each transect, vertical sections were constructed of potential temperature, practical salinity, potential density, and absolute geostrophic velocity. The latter was referenced using the de-tided shipboard ADCP data. This information helped guide the planning of future transects. Figure C2 shows the vertical sections for transect E across the Faroe-Shetland Channel. This revealed the presence of two deep jets flowing towards the Faroe Bank Channel overflow (the two jets are seen in other sections as well). The jet on the eastern side of the channel is the Faroe-Shetland Channel Jet that has been previously established. The jet on the western side of the channel is presumably a portion of the IFSJ that flowed directly into the channel.

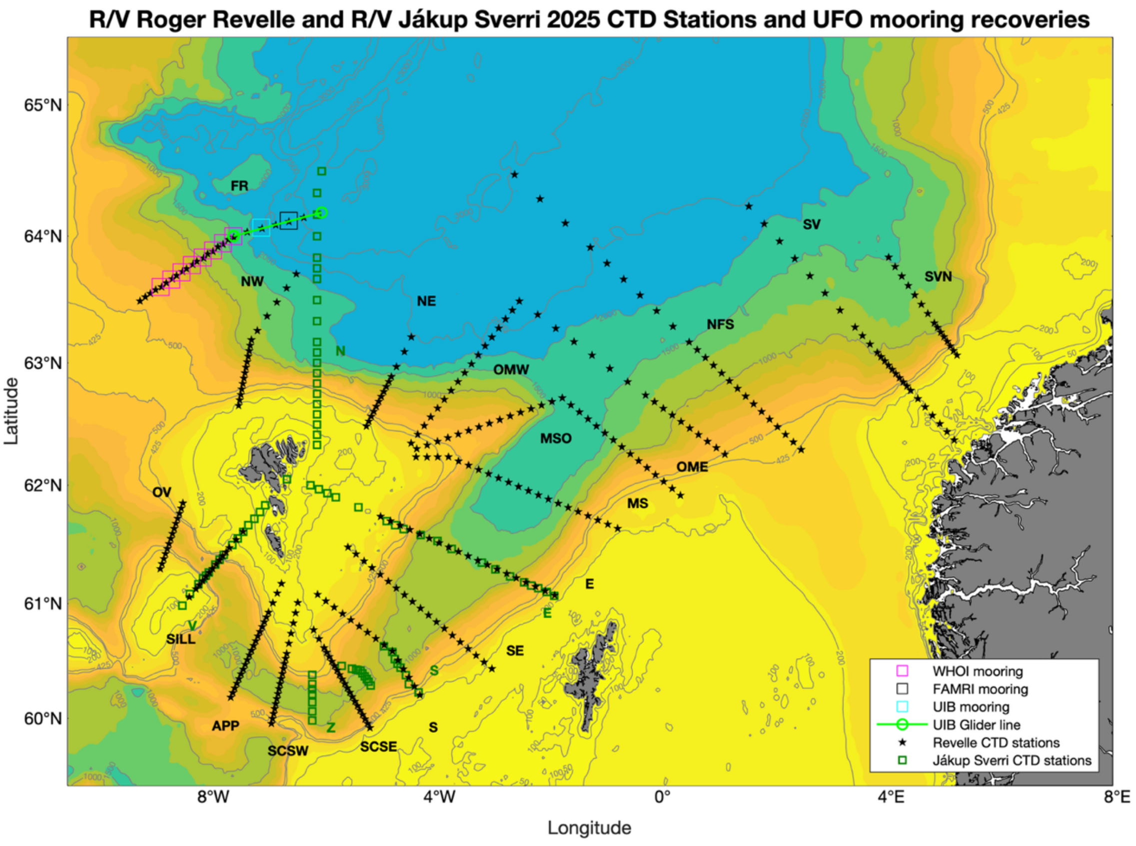


Figure C1: UFO hydrographic survey carried out by R/V *Roger Revelle* and R/V *Jákup Sverri* in Aug-Sep 2025 (see the legend). Also included are the positions of the 10 moorings that were recovered. Transect abbreviations are listed in Table C1. The bottom topography is from ETOPO-2.

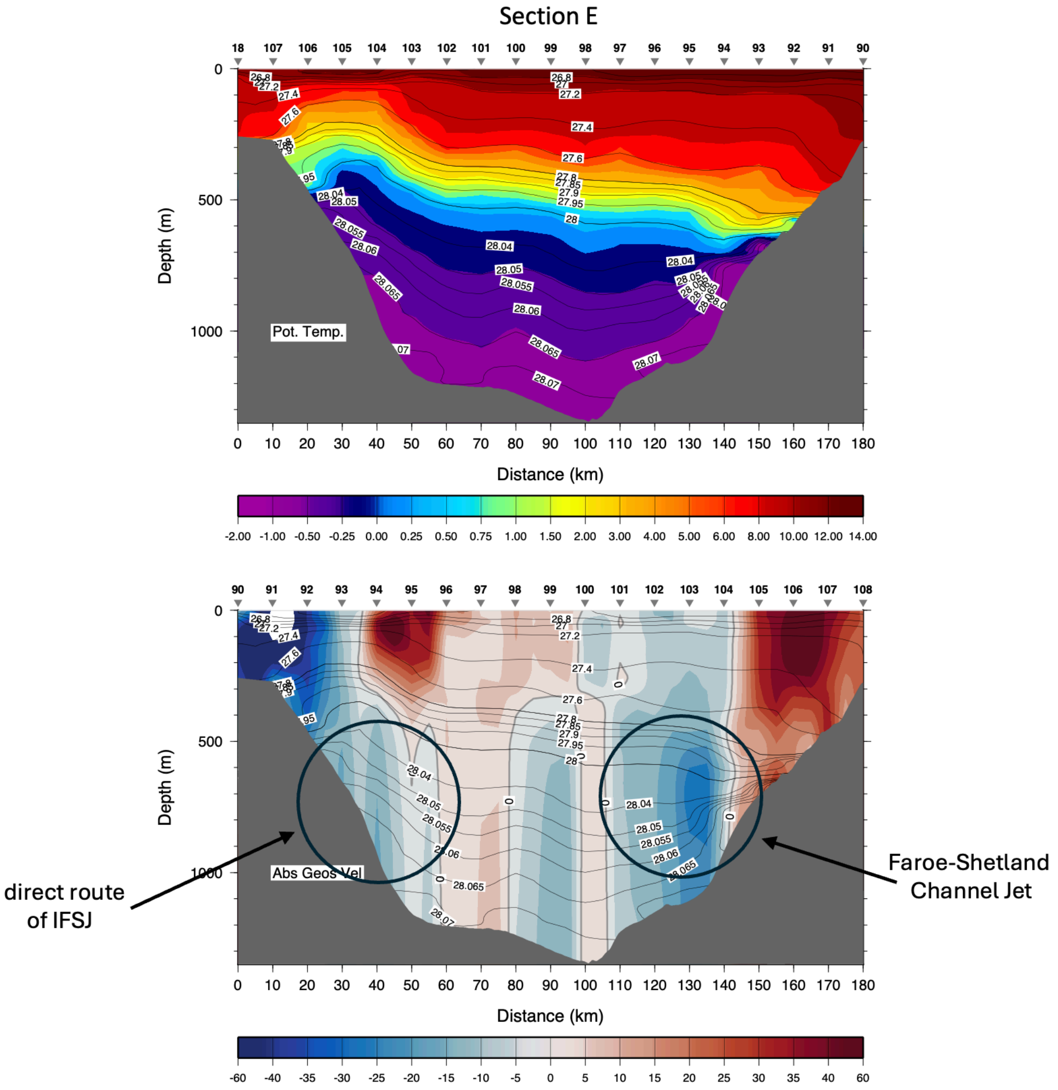


Figure C2: Vertical sections for transect E across the Faroe-Shetland Channel (see Figure C1 for location of the transect). (top) Potential temperature (°C, color) overlain by potential density (kg m^{-3}, contours) The viewer is looking to the northeast (the Faroe Islands are on the left). (bottom) Absolute geostrophic velocity (cm s^{-1}, color) overlain by potential density (contours). The deep jets on the two sides of the channel are indicated. The bottom topography is from *Revelle's* multibeam.

Table C1: Transect abbreviations for the *Revelle* and *Jákup Sverri* hydrographic surveys (see Fig. C1).

RR2506-07 Abbreviation	**Transect Name**
FR	Faroe Ridge
SILL	Faroe Bank Channel sill
APP	Faroe Bank approach
OV	Faroe Bank overflow
S	South (FAMRI standard section S)
E	East (FAMRI standard section E)
MS	Shetland mouth
OME	Outer mouth east
OMW	Outer mouth west
NE	Northeast Iceland Faroe Ridge
SCSW	Faroe-Shetland southwest
SCSE	Faroe-Shetland southeast
NFS	Norwegian-Faroe slope
SV	Svinøy
SVN	Svinøy north
MSO	Shetland mouth outer
NW	Northwest Iceland-Faroe Ridge
SE	Southeast

JS2542 Abbreviation	**Transect Name**
N	North
E	East
S	South
V	West
Z	Z

C2: SADCP survey
Contributed by Frank Bahr (fbar@whoi.edu)

Shipboard acoustic Doppler current profiler (SADCP) data were collected throughout the cruise by *Revelle's* two hull-mounted Ocean Surveyor ADCPs operating at 150 and 75 kHz, respectively.

Data were collected using UHDAS (University of Hawaii Data Acquisition System). The two Ocean Surveyors were configured for narrowband mode with vertical bin sizes of 16m (OS75) and 8m (OS150). Both sonars collected 300-second profiles. Bottom tracking, typically used for calibration verifications, was collected during the departures from Reykjavik and after the port stop in Tórshavn, but otherwise turned off to collect more water track pings.

Aside from occasional checks, we primarily relied on the deeper-reaching OS75. Its data were processed throughout the cruise. The typical UHDAS post-processing steps were performed, which included manual removal of bad data. The calibration was verified via the water track method but required no adjustments. The averaged ensemble data were exported to Matlab format for de-tiding and further analysis. Tidal corrections to the current data were made using the OSU tidal prediction software (OTPS) with the TPXO9-v5-atlas tidal model.

Both ADCPs performed well throughout the cruise. Minor data glitches were removed for one transit period during poor weather conditions as well as from a few CTD stations where the CTD profiling package may have drifted into the ADCP beams.

References for UHDAS and OTPS:

- Firing, E., J.M. Hummon, and T.K. Chereskin. 2012. Improving the quality and accessibility of current profile measurements in the Southern Ocean. Oceanography 25(3):164–165, https://doi.org/10.5670/oceanog.2012.91.
- Egbert, Gary D., and Svetlana Y. Erofeeva. "Efficient inverse modeling of barotropic ocean tides." Journal of Atmospheric and Oceanic Technology 19.2 (2002): 183-204.

C3: Discrete water sampling

Salinity

Contributed by Leah Houghton (lhoughton@whoi.edu)

Salinity samples were analyzed throughout the cruise using a WHOI-provided salinometer. A total of 667 salinity samples were collected in 200 ml glass bottles. The bottles were rinsed three times, then filled to the neck. After the samples reached the lab temperature of approximately 24°C, they were analyzed for salinity using a Guildline Portasal model 8410 A. Accuracies of salinity measurements were ±0.002 psu when a good standardization was achieved. Bottle salinity values were then merged with CTD bottle files to be used in further calibrating the CTD's conductivity sensors.

Organic Carbon

Contributed by Lihini Aluwihare (Scripps Institution of Oceanography, UC San Diego)
Project Lead: Margot White (University of British Columbia, Vancouver)
Cruise participants: Lihini I. Aluwihare and Tran Nguyen (SIO)

Characterizing the radiocarbon and chemical signature of dissolved organic matter (DOM) in the Nordic Seas.

Background. The dissolved organic carbon (DOC) reservoir is the largest store of reduced carbon in the ocean and of a similar size to the atmospheric CO_2 reservoir. It has been proposed that changes to the marine DOC reservoir are linked to major climate events in the geologic record, but it is unknown how this reservoir has changed in the past and how, and on what timescale, it is likely to change in the future. Radiocarbon (^{14}C) measurements show that on average the molecules that make up the marine DOC pool are several thousand years old, implying that they may have persisted in the ocean over the course of multiple mixing cycles of global overturning circulation. Different theories have been proposed to explain this persistence, each with very different implications for the potential response of this large reservoir of carbon to anthropogenic climate change.

Objectives and methods. The main objective of this project is to isolate the most persistent fraction of marine DOC and to compare the concentration and the chemical and isotopic composition of this component across different water masses in the North Atlantic, where deep water formation functions as the “engine” driving the global overturning circulation of the oceans.

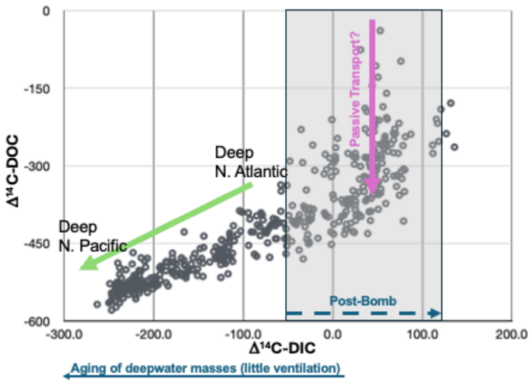


Figure C3. The Δ^{14}C-DOC vs Δ^{14}C-DIC relationship is characterized by two distinct slopes. Within the shaded gray region variations in Δ^{14}C-DOC are primarily controlled by the addition and removal of contemporary DOC (pink arrow denotes removal). Outside of this region, Δ^{14}C-DOC varies linearly with Δ^{14}C-DIC indicating that ^{14}C decay (aging; green arrow) and water mass mixing are the primary controls on Δ^{14}C-DOC. The grey box delineates the range of pre- and post-bomb surface DIC values expected for the global ocean. Data from Hansell et al. 2021.

We know that DOC is more depleted in ^{14}C than dissolved inorganic carbon (DIC) at all depths in the ocean (Figure C3). This is because there exists a long-lived, persistent DOC component that is presumed to be well-mixed throughout the world's ocean and the water column. This means that at every depth in the ocean, even at the surface, persistent DOC confers a depleted ^{14}C-signature to DOC (Figure C3) even though recent primary production adds biodegradable (labile) DOC to the surface ocean. We can see this "hidden cycle" of labile DOC in Figure C3 (pink arrow): the ^{14}C-DOC become strongly depleted in ^{14}C within recently ventilated waters (i.e., little change in ^{14}C-DIC). As the deepwater masses age (signified by the depletion in ^{14}C-DIC), we observe that DOC also ages and seems to age passively as water masses move through the deep ocean (linear relationship between DIC and DOC in this part of the graph). We have an extensive dataset of DOC from the deep Pacific Ocean, and on this cruise, our primary objective was to collect samples from the Nordic Seas for DOC concentration ([DOC]), bulk ^{14}C-DOC, ^{14}C-DIC, and DOC isolated onto solid phase extraction resins for further chemical studies. With these datasets we hope to accomplish the following goals:

(1) Determine the ^{14}C signature of bulk DOC available to enter the lower limb of AMOC circulation in the Nordic seas (e.g., does it fit with what we expect from Figure C3).

(2) Determine the distribution of ^{14}C signatures in DOC. Can we identify labile, young DOC (DOC with a ^{14}C signature that signifies recent production from DIC by surface ocean biota), entrained into the deep ocean and what is the most depleted ^{14}C signature we observe within DOC? This latter value will set the "age" of DOC that enters the deep ocean.

(3) The ^{14}C signature of DOC in the deep ocean implies passive aging from the deep North Atlantic to the deep North Pacific Ocean. But do the thousands of individual compounds that are contained in the DOC pool persist as this water travels through the deep ocean or is there another hidden cycle that we can uncover by focusing on the composition of the ^{14}C depleted DOC? We have examined the composition of "aged" DOC in the oldest water masses of the North Pacific, hence, using data from the UFO cruise, our goal is to isolate DOC for similar compositional measurements from the Nordic seas.

In addition to measuring bulk properties including ^{14}C-DOC via UV oxidation, to address Objective 1, we will separate the labile and persistent fractions from the isolated DOC using a chemical degradation method to determine the distribution of ^{14}C in DOC (Objective 2). To address Objective 3, we will examine the chemical composition of the persistent fraction using high resolution mass spectrometry to link turnover time with the chemical characteristics of these compounds. These results will be interpreted in the context of water mass circulation information gained from the tracers employed by the Casacuberta Lab.

We sampled 9 stations during leg 2 for all the components necessary to address these objectives. At 5 additional stations we collected a subset of these samples. In addition to collecting samples for the DOC parameters, we also collected nutrient samples and isolated DNA from a restricted subset of depths and at several stations, to determine the composition of microbial communities being entrained in these waters along with DOC.

The sequencing of this DNA will be done in collaboration with Anni Djurhuus at the University of the Faroe Islands, who is an eDNA expert. We hope to interpret these data in the context of the database that she is already building in the region.

For our overall sampling design we worked with Duncan Dale of the ETH Zurich group and Emil Jeansson from NORCE, to target newly formed deep water masses, which mostly appeared in the top 1000 meters of the water column. We also tried to sample some different water masses when we were close to the Norwegian Basin. Our large volume extraction samples (LVE or XLVE) are between 10-15 L and they underwent a 2-4 days solid phase extraction onboard.

Planned processing and publications. Some of the radiocarbon samples will be analyzed over the coming year in the Biogeoscience group at ETH Zurich and some at the National Ocean Sciences Accelerator Mass Spectrometer (NOSAMS) Facility at Woods Hole. Additional sample processing will take place at UBC, Vancouver, where Margot White is a new Assistant Professor and at SIO for DOC compositional studies. We will continue to work on data interpretation and manuscript writing, including combining with results from the 2024 UFO cruise.

References

Hansell, Dennis A.; Carlson, Craig A.; Amon, Rainer M. W.; Álvarez-Salgado, X. Antón; Yamashita, Youhei; Romera-Castillo, Cristina; Bif, Mariana B. (2021). Compilation of dissolved organic matter (DOM) data obtained from the global ocean surveys from 1994 to 2020 (NCEI Accession 0227166).

Radionuclides

Contributed by D. Dale

Group: TITANICA – Physical and Tracer Oceanography

Institute of Biogeochemistry and Pollutant Dynamics - ETH Zurich, Switzerland

Contribution: Application of artificial radionuclides as tracers to resolve water-mass mixing and transport pathways in the seas around the Faroe Islands and within the Faroe–Shetland Channel.

This cruise has provided a rare opportunity to sample the approaches to the Faroe overflow in detail, with an emphasis on resolving the distinct pathways by which water reaches the Faroe–Shetland Channel and crosses the sill south of the Faroes. Radionuclide sampling was integrated with the hydrographic survey and targeted both the major inflow and overflow branches as well as key "boundary" water masses such as the deep Norwegian Basin and the Atlantic/Norwegian inflows. Together, these measurements will provide a tracer-based snapshot of all the water masses contributing to the overflow system.

Iodine-129 (^{129}I) (n=200): Released mainly by European nuclear reprocessing plants since the 1970s, ^{129}I enters the Nordic Seas via the Norwegian Coastal Current. Its near-point-source character makes it a powerful tracer for following circulation and lateral transport from the North Sea into high latitudes.

Uranium-236 (^{236}U) (n=200): Produced in reactors and released alongside ^{129}I but with a distinct input history. In addition, a global atmospheric bomb-test signal was delivered to the surface oceans in the 1950s–60s. Used together with ^{129}I, the dual-tracer approach is particularly effective for distinguishing upstream origins and mixing regimes[1].

Dissolved inorganic ^{14}C (DI14C) (n=80): Radiocarbon (^{14}C) is produced continuously in the atmosphere by cosmic rays and taken up by the ocean in dissolved inorganic carbon (DIC). In the Nordic Seas, this natural cosmogenic signal has been largely overprinted by the bomb spike, so DI^{14}C primarily traces the penetration and redistribution of that signal. By comparing DI^{14}C with the artificial tracers, we can both map transport pathways and potentially identify the oldest waters, where the bomb influence is least pronounced.

Samples will be returned to Switzerland for purification and measurement at the Laboratory of Ion Beam Physics (ETH Zurich) using accelerator mass spectrometry. A first dataset is expected within one year, providing one of the most detailed tracer-based perspectives yet for this region and forming the basis for a forthcoming publication.

1) Dale, Duncan, et al. "Tracing ocean circulation and mixing from the Arctic to the subpolar North Atlantic using the ^{129}I–^{236}U dual tracer." *Journal of Geophysical Research: Oceans* 129.7 (2024): e2024JC021211

Transient tracers

Contributed by Emil Jeansson, Annalena Burkhardt (Leg 1) and Daan Gammeter (Leg 2)

During the RR2506/07 cruise we took samples for the transient tracers chlorofluorocarbon-12 (CFC-12) and sulphur hexafluoride (SF_6) at about one third of the CTD stations. In addition, one station (#241) was sampled for inorganic carbon (total dissolved inorganic carbon (DIC) and total alkalinity (TA)), to be used for calibrating BGC-Argo buoys.

In total, 134 stations were collected for tracer data. The transient tracers were analyzed on board, while we took 12 samples for inorganic carbon to be analyzed in Bergen. More details on the transient tracers are given below.

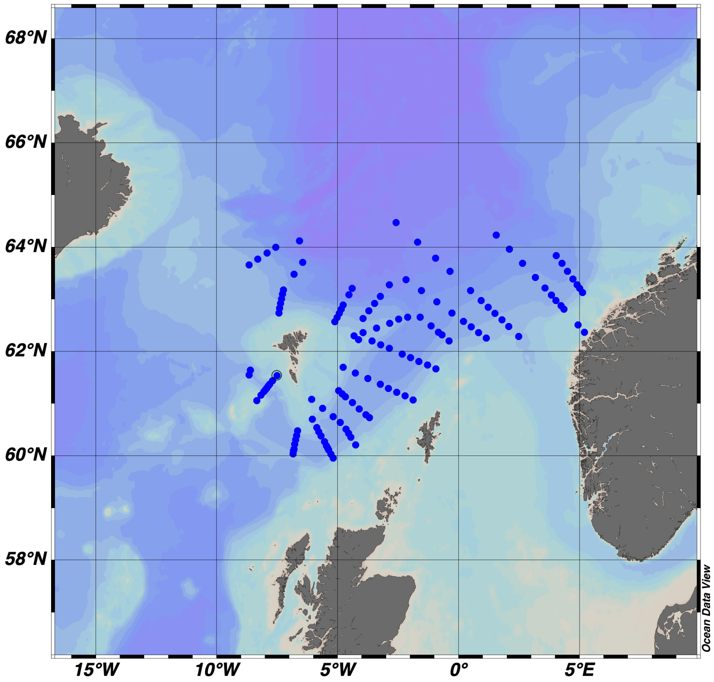


Figure. C4: Location of stations sampled for SF_6 and CFC-12 during the 2025 UFO cruise.

Analysis of SF_6 and CFC-12

SF_6 and CFC-12 are anthropogenic compounds with a known atmospheric history. Relating the measured concentrations of these tracers at different depths to their atmospheric evolution provides a mean to assess the time passed since they were in contact with the atmosphere. This time is estimated as the age of the measured water parcel. Due to the change in the atmospheric evolution of CFC-12 since the early 2000s, with first a slowdown followed by a significant decline, the usefulness of this tracer for recently ventilated water masses is limited, such as the mixed layer. However, the higher concentrations in seawater, compared with SF_6, makes CFC-12 the preferred tracer for the deeper part of the water column. SF_6 is still increasing in the atmosphere and is most valuable for the upper ocean, with recently ventilated water masses.

Samples for analysis of CFC-12 and SF_6 were taken from the Niskin bottles in 250-ml glass syringes, which were stored cold in a climate-controlled room that was kept just above 0°C, and analysis took place within six hours after sampling. The analysis is based on purge-and-trap work-up of the water samples followed by gas chromatographic separation and electron capture detection of the different compounds; the analytical technique is described by Bullister et al. (2008) and Stöven and Tanhua (2014). The standardization was achieved by calibration gas prepared at Deuste Steininger GmbH, Mühlhausen, Germany, and cross-calibrated against gas prepared at Scripps Institute of Oceanography. The standard gases were calibrated against the SIO-05 scale.

Overall, the instrument worked very well during the cruise, although a few samples were lost due to different analytical issues. In total, 1278 samples were collected for transient tracers.

References

Bullister, J. L., and D. P. Wisegarver (2008), The shipboard analysis of trace levels of sulfur hexafluoride, chlorofluorocarbon-11 and chlorofluorocarbon-12 in seawater, *Deep-Sea Res. I*, *55*(8), 1063-1074.

Stöven, T., and T. Tanhua (2014), Ventilation of the Mediterranean Sea constrained by multiple transient tracer measurements, *Ocean Sci.*, *10*(3), 439-457.

D: Outreach

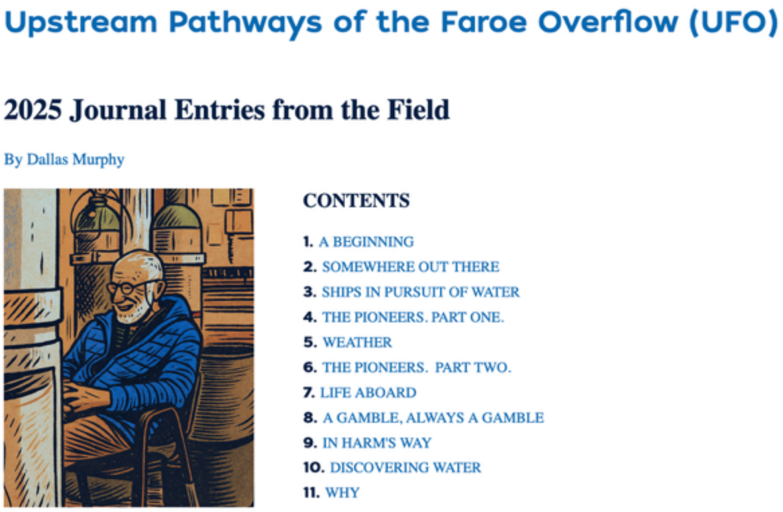
Contributed by Dallas Murphy (dallas.murphy4@icloud.com)

I wrote ten essays, an average of 1,100 words each, to our dedicated website https://www2.whoi.edu/site/picarctic/ufo/.

The subject matter varied: glimpses into the history of physical oceanography, stories about previous expeditions supplying context for the present one, a piece about life aboard *Roger Revelle*, and explanations of the scientific objectives and practices on this cruise.

This cruise, for me, is tinged with melancholy. It spells the end of a long, rewarding, and happy collaboration with Bob Pickart, as his retirement draws near. It was he who first brought me to these northern waters, who first trusted me as a writer to record his science and the at-sea practice of physical oceanography more generally. This was our seventh cruise together. Each was a pleasure. I will miss him and never forget the opportunities he afforded me to witness and to understand the ocean in ways I never imagined.

Dallas Murphy, 16 September 2025 aboard *Roger Revelle*



Upstream Pathways of the Faroe Overflow (UFO)

2025 Journal Entries from the Field

By Dallas Murphy

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Figure D1: Screen shot from the UFO outreach webpage
(https://www2.whoi.edu/site/picarctic/2025_journal_entries/)

Appendix A: Event Log

UFO 2025 Event Log									
CTD Number	**Station Name**	**Time (UTC)**	**Latitude**	**Longitude**	**Latitude**		**Latitude**		**Additional notes**
			(decimal N)	**(decimal W)**	**(deg N)**	**(min N)**	**(deg W)**	**(min W)**	
Transit									Departed Reykjavik
0	test								
Section FR									
1	FR-5	8/17/24 9:08	63.6035	8.8325	63	36.21	8	49.95	UFO-1 calibration cast, salts
Recover UFO-1									
2	FR-7	8/17/24 13:30	63.6667	8.6437	63	40	8	38.62	UFO-2 calibration cast, tracers, salts
Recover UFO-2									
3	FR-1	8/17/24 18:36	63.4923	9.2155	63	29.54	9	12.93	
4	FR-2	8/17/24 19:40	63.5247	9.1225	63	31.48	9	7.35	
5	FR-3	8/17/24 20:40	63.552	9.033	63	33.12	9	1.98	
6	FR-4	8/17/24 21:42	63.5808	8.9397	63	34.85	8	56.38	
7	FR-6	8/17/24 22:55	63.636	8.7517	63	38.16	8	45.1	
8	FR-8	8/18/24 0:11	63.694	8.5703	63	41.64	8	34.22	
9	FR-9	8/18/24 1:19	63.7235	8.4642	63	43.41	8	27.85	UFO-3 calibration cast, salts
10	FR-10	8/18/24 2:33	63.7463	8.3923	63	44.78	8	23.54	
11	FR-11	8/18/24 3:44	63.7795	8.2808	63	46.77	8	16.85	UFO-4 calibration cast, tracers, salts
Recover UFO-3									
Recover UFO-4									
12	FR-13	8/18/24 12:53	63.8293	8.09	63	49.76	8	5.4	UFO-5 calibration cast, salts
Recover UFO-5									
13	FR-12	8/18/24 17:16	63.8043	8.2105	63	48.26	8	12.63	
14	FR-14	8/18/24 18:50	63.8625	8.019	63	51.75	8	1.14	
15	FR-15	8/18/24 20:09	63.8807	7.926	63	52.84	7	55.56	UFO-6 calibration cast, tracers, salts
16	FR-16	8/18/24 21:53	63.9173	7.8385	63	55.04	7	50.31	
17	FR-17	8/18/24 23:11	63.9368	7.7467	63	56.21	7	44.8	UFO-7 calibration cast, salts
18	FR-18	8/19/24 0:55	63.974	7.6547	63	58.44	7	39.28	
19	FR-19	8/19/24 2:26	63.9908	7.5572	63	59.45	7	33.43	UFO-8 calibration cast, tracers, salts
20	FR-20	8/19/24 4:36	64.0323	7.3172	64	1.94	7	19.03	
Recover UFO-6									
Recover UFO-7									
21	FR-21	8/19/24 16:37	64.0602	7.0557	64	3.61	7	3.34	UFO-9 calibration cast, salts
22	FR-22	8/19/24 19:18	64.0873	6.8142	64	5.24	6	48.85	
23	FR-23	8/19/24 21:44	64.1123	6.5798	64	6.74	6	34.79	UFO-10 calibration cast, tracers, salts
24	FR-24	8/20/24 0:37	64.1443	6.3177	64	8.66	6	19.06	
Recover UFO-8									
Recover UFO-10									
SADCP calibration box									
Recover UFO-9									
Section SILL									
25	SILL-1	8/22/24 0:18	61.6132	7.3932	61	36.79	7	23.59	
26	SILL-2	8/22/24 1:19	61.5442	7.5142	61	32.65	7	30.85	tracers
27	SILL-3	8/22/24 2:23	61.4758	7.6343	61	28.55	7	38.06	
28	SILL-4	8/22/24 3:12	61.4395	7.6927	61	26.37	7	41.56	tracers
29	SILL-5	8/22/24 4:06	61.406	7.753	61	24.36	7	45.18	
30	SILL-6	8/22/24 5:05	61.3705	7.8113	61	22.23	7	48.68	tracers, salts
31	SILL-7	8/22/24 6:46	61.3353	7.8718	61	20.12	7	52.31	tracers
32	SILL-8	8/22/24 8:01	61.2993	7.9323	61	17.96	7	55.94	tracers, U236/I129, [DOC], DO14C, salts, XLVE
33	SILL-9	8/22/24 9:46	61.2657	7.9903	61	15.94	7	59.42	tracers, 14C, U236/I129

34	SILL-10	8/22/24 11:09	61.2305	8.0483	61	13.83	8	2.9	tracers, salts
35	SILL-11	8/22/24 12:19	61.1955	8.107	61	11.73	8	6.42	
36	SILL-12	8/22/24 13:17	61.1602	8.1668	61	9.61	8	10.01	tracers
37	SILL-13	8/22/24 14:01	61.1255	8.2255	61	7.53	8	13.53	
38	SILL-14	8/22/24 15:00	61.057	8.3443	61	3.42	8	20.66	tracers
Section APP									
39	APP-1	8/22/24 19:32	61.1723	6.7125	61	10.34	6	42.75	
40	APP-2	8/22/24 20:28	61.0903	6.7872	61	5.42	6	47.23	
41	APP-3	8/22/24 21:22	61.007	6.8652	61	0.42	6	51.91	
42	APP-4	8/22/24 22:15	60.9257	6.9405	60	55.54	6	56.43	
43	APP-5	8/22/24 22:57	60.8843	6.9775	60	53.06	6	58.65	
44	APP-6	8/22/24 23:38	60.8428	7.0153	60	50.57	7	0.92	
45	APP-7	8/23/24 0:30	60.8008	7.0528	60	48.05	7	3.17	
46	APP-8	8/23/24 1:26	60.759	7.0918	60	45.54	7	5.51	
47	APP-9	8/23/24 2:25	60.7197	7.1292	60	43.18	7	7.75	
48	APP-10	8/23/24 3:25	60.6788	7.1653	60	40.73	7	9.92	
49	APP-11	8/23/24 4:30	60.6372	7.2052	60	38.23	7	12.31	
50	APP-12	8/23/24 5:46	60.5968	7.2417	60	35.81	7	14.5	
51	APP-13	8/23/24 7:00	60.5562	7.2797	60	33.37	7	16.78	
52	APP-14	8/23/24 8:10	60.5143	7.3162	60	30.86	7	18.97	
53	APP-15	8/23/24 9:40	60.4742	7.3522	60	28.45	7	21.13	cal-dip cast for WHOI instruments, salts
54	APP-16	8/23/24 11:46	60.4323	7.3885	60	25.94	7	23.31	
55	APP-17	8/23/24 13:18	60.3908	7.4263	60	23.45	7	25.58	
56	APP-18	8/23/24 14:35	60.3492	7.4642	60	20.95	7	27.85	
57	APP-19	8/23/24 18:33	60.3092	7.5012	60	18.55	7	30.07	cal-dip cast for UiB and FAMRI instruments
58	APP-20	8/23/24 20:35	60.2667	7.5382	60	16	7	32.29	
59	APP-21	8/23/24 21:37	60.227	7.5737	60	13.62	7	34.42	
60	APP-22	8/23/24 22:39	60.1863	7.6103	60	11.18	7	36.62	
Section OV									
61	OV-1	8/24/24 5:29	61.2982	8.858	61	17.89	8	51.48	
62	OV-2	8/24/24 6:19	61.3407	8.8272	61	20.44	8	49.63	
63	OV-3	8/24/24 7:09	61.3835	8.7948	61	23.01	8	47.69	
64	OV-4	8/24/24 7:58	61.4257	8.7652	61	25.54	8	45.91	
65	OV-5	8/24/24 8:42	61.4682	8.7337	61	28.09	8	44.02	
66	OV-6	8/24/24 9:31	61.5105	8.7027	61	30.63	8	42.16	
67	OV-7	8/24/24 10:27	61.5537	8.6727	61	33.22	8	40.36	tracers, U236/I129, salts
68	OV-8	8/24/24 11:46	61.5955	8.6422	61	35.73	8	38.53	
69	OV-9	8/24/24 12:57	61.6378	8.6123	61	38.27	8	36.74	tracers, salts
70	OV-10	8/24/24 14:20	61.6805	8.5818	61	40.83	8	34.91	
71	OV-11	8/24/24 15:29	61.7228	8.5513	61	43.37	8	33.08	
72	OV-12	8/24/24 16:30	61.7655	8.5178	61	45.93	8	31.07	
73	OV-13	8/24/24 17:17	61.8082	8.4877	61	48.49	8	29.26	
74	OV-14	8/24/24 18:06	61.8513	8.4575	61	51.08	8	27.45	
Section S									
75	S-1	8/25/24 20:51	61.0785	6.0723	61	4.71	6	4.34	tracers
76	S-2	8/25/24 21:59	61.0227	5.9272	61	1.36	5	55.63	
77	S-3	8/26/24 1:38	60.9687	5.7788	60	58.12	5	46.73	
78	S-4	8/26/24 2:45	60.9145	5.6313	60	54.87	5	37.88	tracers
79	S-5	8/26/24 3:59	60.8607	5.484	60	51.64	5	29.04	
80	S-6	8/26/24 5:32	60.8058	5.3355	60	48.35	5	20.13	
81	S-7	8/26/24 7:23	60.7528	5.189	60	45.17	5	11.34	tracers
82	S-8	8/26/24 9:18	60.699	5.0427	60	41.94	5	2.56	
83	S-9	8/26/24 10:56	60.6445	4.895	60	38.67	4	53.7	tracers, salts
84	S-10	8/26/24 12:53	60.5902	4.7483	60	35.41	4	44.9	
85	S-11	8/26/24 14:33	60.5113	4.651	60	30.68	4	39.06	tracers, U236/I129, salts
86	S-12	8/26/24 16:24	60.434	4.555	60	26.04	4	33.3	tracers, 14C, U236/I129, [DOC], DO14C, LVE

87	S-13	8/26/24 18:38	60.3605	4.4582	60	21.63	4	27.49	tracers, U236/I129, nutrients, nucleic acids
88	S-14	8/26/24 20:03	60.2832	4.3595	60	16.99	4	21.57	
89	S-15	8/26/24 21:22	60.2067	4.2625	60	12.4	4	15.75	tracers, 14C, U236/I129
Section E									
90	E-1	8/27/24 9:15	61.0717	1.8777	61	4.3	1	52.66	tracers, U236/I129
91	E-2	8/27/24 10:19	61.1092	2.0447	61	6.55	2	2.68	
92	E-3	8/27/24 11:21	61.146	2.2148	61	8.76	2	12.89	tracers
93	E-4	8/27/24 12:39	61.1832	2.3852	61	10.99	2	23.11	
94	E-5	8/27/24 13:56	61.22	2.5555	61	13.2	2	33.33	tracers
95	E-6	8/27/24 15:33	61.2575	2.7257	61	15.45	2	43.54	
96	E-7	8/27/24 17:06	61.295	2.896	61	17.7	2	53.76	tracers, salts
97	E-8	8/27/24 18:54	61.3317	3.0665	61	19.9	3	3.99	tracers
98	E-9	8/27/24 20:22	61.3677	3.2365	61	22.06	3	14.19	tracers, 14C, U236/I129, [DOC], DO14C, salts, nutrients, nucleic acids
99	E-10	8/27/24 22:15	61.4055	3.4082	61	24.33	3	24.49	
100	E-11	8/27/24 23:47	61.4428	3.5795	61	26.57	3	34.77	
101	E-12	8/28/24 1:25	61.4807	3.7518	61	28.84	3	45.11	tracers, salts
102	E-13	8/28/24 3:25	61.5173	3.9222	61	31.04	3	55.33	
103	E-14	8/28/24 5:09	61.555	4.0953	61	33.3	4	5.72	
104	E-15	8/28/24 6:54	61.5923	4.2662	61	35.54	4	15.97	tracers
105	E-16	8/28/24 8:28	61.6288	4.4397	61	37.73	4	26.38	
106	E-17	8/28/24 9:39	61.6648	4.6117	61	39.89	4	36.7	
107	E-18	8/28/24 10:44	61.7017	4.7827	61	42.1	4	46.96	tracers, U236/I129
108	E-19	8/28/24 11:59	61.7395	4.958	61	44.37	4	57.48	
Section MS									
109	MS-1	8/28/24 15:39	62.234	4.3307	62	14.04	4	19.84	
110	MS-2	8/28/24 16:51	62.233	4.1362	62	13.98	4	8.17	tracers, [DOC], nucleic acids
111	MS-3	8/28/24 18:11	62.234	3.9473	62	14.04	3	56.84	
112	MS-4	8/28/24 19:25	62.2345	3.7552	62	14.07	3	45.31	
113	MS-5	8/28/24 20:34	62.1998	3.5778	62	11.99	3	34.67	tracers
114	MS-6	8/28/24 21:44	62.165	3.4002	62	9.9	3	24.01	
115	MS-7	8/28/24 22:56	62.129	3.2218	62	7.74	3	13.31	tracers, 14C, U236/I129, nucleic acids, [DOC], DO14C, salts, nutrients, LVE
116	MS-8	8/29/24 0:41	62.0947	3.0465	62	5.68	3	2.79	
117	MS-9	8/29/24 2:20	62.0595	2.8698	62	3.57	2	52.19	tracers
118	MS-10	8/29/24 4:24	62.0245	2.6923	62	1.47	2	41.54	
119	MS-11	8/29/24 6:12	61.9883	2.5162	61	59.3	2	30.97	
120	MS-12	8/29/24 8:22	61.9538	2.3405	61	57.23	2	20.43	tracers, salts
121	MS-13	8/29/24 10:17	61.9183	2.164	61	55.1	2	9.84	
122	MS-14	8/29/24 12:02	61.8837	1.9883	61	53.02	1	59.3	tracers, salts
123	MS-15	8/29/24 13:57	61.8487	1.8127	61	50.92	1	48.76	
124	MS-16	8/29/24 15:36	61.8137	1.6372	61	48.82	1	38.23	tracers, 14C, U236/I129, [DOC], DO14C, nutrients, nucleic acids
125	MS-17	8/29/24 17:18	61.7793	1.4612	61	46.76	1	27.67	
126	MS-18	8/29/24 18:41	61.7442	1.2865	61	44.65	1	17.19	tracers
127	MS-19	8/29/24 20:00	61.7085	1.1132	61	42.51	1	6.79	
128	MS-20	8/29/24 21:05	61.6733	0.93583	61	40.4	0	56.15	tracers
129	MS-21	8/29/24 22:05	61.638	0.762	61	38.28	0	45.72	
Section OME									
130	OME-1	8/30/24 3:49	62.2557	-1.1368	62	-15.34	-2	51.79	tracers
131	OME-2	8/30/24 5:05	62.3093	-0.985	62	-18.56	-1	0.9	
132	OME-3	8/30/24 6:15	62.3618	-0.829	62	-21.71	-1	10.26	tracers
133	OME-4	8/30/24 7:47	62.4172	-0.66933	62	-25.03	-1	19.84	
134	OME-5	8/30/24 8:57	62.4705	-0.51433	62	-28.23	-1	29.14	tracers
135	OME-6	8/30/24 10:20	62.5242	-0.3605	62	-31.45	-1	38.37	

136	OME-7	8/30/24 11:37	62.5775	-0.204	62	-34.65	-1	47.76	tracers, 14C, U236/I129, nucleic acids, [DOC], DO14C, SVDI14C, nutrients, LVE
137	OME-8	8/30/24 13:26	62.6312	-0.046167	62	-37.87	-1	57.23	
138	OME-9	8/30/24 14:57	62.6853	0.10983	62	41.12	0	6.59	
139	OME-10	8/30/24 16:38	62.7397	0.26767	62	44.38	0	16.06	tracers, salts
140	OME-11	8/30/24 19:07	62.847	0.58433	62	50.82	0	35.06	
141	OME-12	8/30/24 21:09	62.9543	0.9005	62	57.26	0	54.03	tracers, salts
142	OME-13	8/30/24 23:33	63.0613	1.2162	63	3.68	1	12.97	
143	OME-14	8/31/24 1:53	63.169	1.5347	63	10.14	1	32.08	tracers
144	OME-15	8/31/24 4:35	63.2757	1.8565	63	16.54	1	51.39	
145	OME-16	8/31/24 7:13	63.3845	2.1768	63	23.07	2	10.61	
Section OMW									
146	OMW-1	8/31/24 9:51	63.4915	2.5018	63	29.49	2	30.11	tracers, 14C, U236/I129
147	OMW-2	8/31/24 12:51	63.4203	2.626	63	25.22	2	37.56	
148	OMW-3	8/31/24 15:12	63.3495	2.747	63	20.97	2	44.82	
149	OMW-4	8/31/24 17:34	63.277	2.8673	63	16.62	2	52.04	tracers, nucleic acids, [DOC]
150	OMW-5	8/31/24 19:57	63.2057	2.9887	63	12.34	2	59.32	
151	OMW-6	8/31/24 22:01	63.1352	3.1077	63	8.11	3	6.46	
152	OMW-7	9/1/24 0:24	63.0633	3.229	63	3.8	3	13.74	tracers, salts
153	OMW-8	9/1/24 2:52	62.9913	3.349	62	59.48	3	20.94	
154	OMW-9	9/1/24 4:46	62.92	3.4687	62	55.2	3	28.12	tracers, salts
155	OMW-10	9/1/24 6:55	62.848	3.5885	62	50.88	3	35.31	
156	OMW-11	9/1/24 8:22	62.777	3.7095	62	46.62	3	42.57	tracers, 14C, U236/I129, [DOC], DO14C, SVDI14C, nutrients, nucleic acids, LVE
157	OMW-12	9/1/24 10:03	62.7042	3.8293	62	42.25	3	49.76	
158	OMW-13	9/1/24 11:21	62.6332	3.9483	62	37.99	3	56.9	tracers
159	OMW-14	9/1/24 13:38	62.5612	4.0703	62	33.67	4	4.22	
160	OMW-15	9/1/24 15:24	62.4907	4.1848	62	29.44	4	11.09	
161	OMW-16	9/1/24 17:02	62.4198	4.3005	62	25.19	4	18.03	
162	OMW-17	9/1/24 18:26	62.3472	4.4177	62	20.83	4	25.06	
Section NE									
163	NE-1	9/1/24 21:13	62.4868	5.209	62	29.21	5	12.54	
164	NE-2	9/1/24 21:52	62.5268	5.1655	62	31.61	5	9.93	
165	NE-3	9/1/24 22:36	62.5665	5.1222	62	33.99	5	7.33	tracers
166	NE-4	9/1/24 23:34	62.6075	5.0777	62	36.45	5	4.66	
167	NE-5	9/2/24 0:34	62.6475	5.0335	62	38.85	5	2.01	tracers
168	NE-6	9/2/24 1:45	62.6882	4.9897	62	41.29	4	59.38	
169	NE-7	9/2/24 2:52	62.7278	4.9452	62	43.67	4	56.71	tracers
170	NE-8	9/2/24 4:09	62.7682	4.9005	62	46.09	4	54.03	
171	NE-9	9/2/24 5:25	62.8087	4.8558	62	48.52	4	51.35	tracers
172	NE-10	9/2/24 7:08	62.8482	4.8107	62	50.89	4	48.64	
173	NE-11	9/2/24 8:20	62.8885	4.767	62	53.31	4	46.02	tracers
174	NE-12	9/2/24 10:12	62.9692	4.6773	62	58.15	4	40.64	
175	NE-13	9/2/24 12:42	63.0895	4.5365	63	5.37	4	32.19	tracers
176	NE-14	9/2/24 15:43	63.207	4.4138	63	12.42	4	24.83	tracers, nucleic acids, [DOC], nutrients
Section SCSW									
177	SCSW-1	9/3/24 7:19	61.0087	6.4232	61	0.52	6	25.39	
178	SCSW-2	9/3/24 8:12	60.9205	6.4633	60	55.23	6	27.8	
179	SCSW-3	9/3/24 9:01	60.8332	6.5017	60	49.99	6	30.1	
180	SCSW-4	9/3/24 9:51	60.7443	6.543	60	44.66	6	32.58	
181	SCSW-5	9/3/24 10:59	60.6575	6.582	60	39.45	6	34.92	
182	SCSW-6	9/3/24 11:57	60.569	6.62	60	34.14	6	37.2	
183	SCSW-7	9/3/24 12:39	60.5257	6.6383	60	31.54	6	38.3	
184	SCSW-8	9/3/24 13:23	60.4817	6.6595	60	28.9	6	39.57	tracers
185	SCSW-9	9/3/24 14:16	60.4378	6.6782	60	26.27	6	40.69	
186	SCSW-10	9/3/24 15:09	60.3937	6.6973	60	23.62	6	41.84	tracers, U236/I129

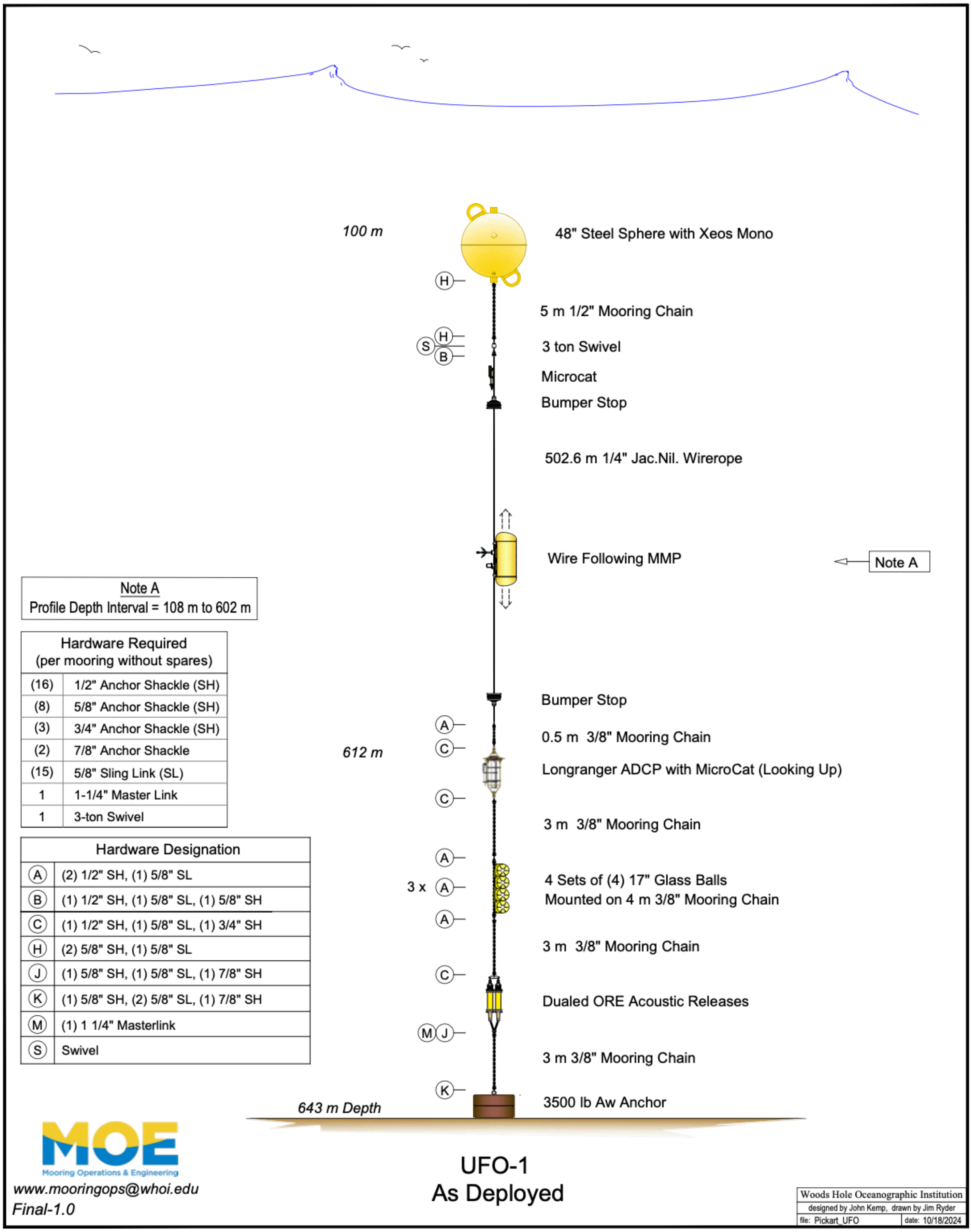
187	SCSW-11	9/3/24 16:27	60.3497	6.7163	60	20.98	6	42.98	
188	SCSW-12	9/3/24 17:54	60.306	6.737	60	18.36	6	44.22	tracers, salts
189	SCSW-13	9/3/24 19:16	60.2618	6.7567	60	15.71	6	45.4	
190	SCSW-14	9/3/24 20:26	60.2177	6.7747	60	13.06	6	46.48	tracers, salts
191	SCSW-15	9/3/24 21:52	60.1738	6.7953	60	10.43	6	47.72	
192	SCSW-16	9/3/24 23:02	60.1298	6.8143	60	7.79	6	48.86	tracers, 14C, U236/I129, [DOC], DO14C, SVDI14C, salts, nutrients, nucleic acids, LVE
193	SCSW-17	9/4/24 0:40	60.086	6.8332	60	5.16	6	49.99	tracers, salts
194	SCSW-18	9/4/24 1:55	60.0422	6.8515	60	2.53	6	51.09	tracers
195	SCSW-19	9/4/24 3:02	59.9987	6.8712	59	59.92	6	52.27	
196	SCSW-20	9/4/24 3:52	59.9547	6.8905	59	57.28	6	53.43	tracers (incorrectly labeled as SCSW-19 in log)
Section SCSE									
197	SCSE-1	9/4/24 9:09	59.917	5.1458	59	55.02	5	8.75	
198	SCSE-2	9/4/24 9:50	59.9558	5.1895	59	57.35	5	11.37	tracers
199	SCSE-3	9/4/24 10:46	59.9948	5.2345	59	59.69	5	14.07	
200	SCSE-4	9/4/24 11:39	60.0337	5.279	60	2.02	5	16.74	tracers
201	SCSE-5	9/4/24 12:42	60.0722	5.3238	60	4.33	5	19.43	
202	SCSE-6	9/4/24 13:44	60.1122	5.3685	60	6.73	5	22.11	tracers, salts
203	SCSE-7	9/4/24 15:02	60.1505	5.4135	60	9.03	5	24.81	tracers, U236/I129
204	SCSE-8	9/4/24 16:30	60.1903	5.4607	60	11.42	5	27.64	tracers, salts
205	SCSE-9	9/4/24 17:55	60.2292	5.5035	60	13.75	5	30.21	
206	SCSE-10	9/4/24 19:20	60.268	5.5488	60	16.08	5	32.93	tracers, salts
207	SCSE-11	9/4/24 20:40	60.3062	5.5933	60	18.37	5	35.6	
208	SCSE-12	9/4/24 21:44	60.3455	5.6398	60	20.73	5	38.39	
209	SCSE-13	9/4/24 22:42	60.3842	5.6855	60	23.05	5	41.13	tracers, salts
210	SCSE-14	9/4/24 23:49	60.423	5.7303	60	25.38	5	43.82	
211	SCSE-15	9/5/24 0:49	60.4618	5.7755	60	27.71	5	46.53	tracers
212	SCSE-16	9/5/24 1:54	60.501	5.822	60	30.06	5	49.32	
213	SCSE-17	9/5/24 2:48	60.5407	5.8677	60	32.44	5	52.06	tracers
214	SCSE-18	9/5/24 3:47	60.5795	5.9123	60	34.77	5	54.74	
215	SCSE-19	9/5/24 4:39	60.6185	5.9583	60	37.11	5	57.5	
216	SCSE-20	9/5/24 5:44	60.6962	6.0487	60	41.77	6	2.92	tracers
217	SCSE-21	9/5/24 7:10	60.7743	6.1433	60	46.46	6	8.6	
Section NFS									
218	NFS-1	9/6/24 4:58	62.2945	-2.486	62	-17.67	-3	30.84	tracers
219	NFS-2	9/6/24 6:13	62.357	-2.348	62	-21.42	-3	39.12	
220	NFS-3	9/6/24 7:25	62.4187	-2.2093	62	-25.12	-3	47.44	
221	NFS-4	9/6/24 8:27	62.481	-2.0675	62	-28.86	-3	55.95	tracers
222	NFS-5	9/6/24 9:36	62.5432	-1.9275	62	-32.59	-2	4.35	
223	NFS-6	9/6/24 10:40	62.6058	-1.7855	62	-36.35	-2	12.87	tracers
224	NFS-7	9/6/24 12:01	62.668	-1.645	62	-40.08	-2	21.3	
225	NFS-8	9/6/24 13:16	62.7305	-1.5037	62	-43.83	-2	29.78	tracers, salts
226	NFS-9	9/6/24 14:44	62.793	-1.3603	62	-47.58	-2	38.38	
227	NFS-10	9/6/24 16:13	62.8542	-1.2172	62	-51.25	-2	46.97	tracers
228	NFS-11	9/6/24 17:48	62.9172	-1.0788	62	-55.03	-2	55.27	
229	NFS-12	9/6/24 19:22	62.9797	-0.93533	62	-58.78	-1	3.88	tracers, salts
230	NFS-13	9/6/24 21:15	63.0417	-0.7915	63	-2.5	-1	12.51	
231	NFS-14	9/6/24 22:44	63.1048	-0.64683	63	-6.29	-1	21.19	
232	NFS-15	9/7/24 0:23	63.1662	-0.50417	63	-9.97	-1	29.75	tracers
233	NFS-16	9/7/24 2:47	63.2908	-0.2165	63	-17.45	-1	47.01	
234	NFS-17	9/7/24 5:07	63.4147	0.071667	63	24.88	0	4.3	
235	NFS-18	9/7/24 7:45	63.5388	0.3655	63	32.33	0	21.93	tracers, salts
236	NFS-19	9/7/24 10:40	63.664	0.6555	63	39.84	0	39.33	
237	NFS-20	9/7/24 13:14	63.7888	0.95	63	47.33	0	57	tracers
238	NFS-21	9/7/24 16:19	63.913	1.2452	63	54.78	1	14.71	
239	NFS-22	9/7/24 19:32	64.1007	1.6875	64	6.04	1	41.25	tracers, nucleic acids

240	NFS-23	9/7/24 23:21	64.2877	2.136	64	17.26	2	8.16	
241	NFS-24	9/8/24 3:14	64.4738	2.5863	64	28.43	2	35.18	tracers, DIC/TA, 14C, U236/I129, [DOC], DO14C, salts, nutrients, SVD14C, LVE
Section SV									
242	SV-1	9/8/24 18:00	64.2307	-1.56	64	-13.84	-2	26.4	tracers, salts
243	SV-2	9/8/24 21:15	64.0955	-1.8325	64	-5.73	-2	10.05	
244	SV-3	9/8/24 23:57	63.9605	-2.104	63	-57.63	-3	53.76	tracers
245	SV-4	9/9/24 3:00	63.8252	-2.373	63	-49.51	-3	37.62	
246	SV-5	9/9/24 5:18	63.69	-2.6418	63	-41.4	-3	21.49	tracers
247	SV-6	9/9/24 7:47	63.5552	-2.9093	63	-33.31	-3	5.44	
248	SV-7	9/9/24 9:45	63.4195	-3.1745	63	-25.17	-4	49.53	tracers, salts
249	SV-8	9/9/24 12:05	63.2848	-3.4398	63	-17.09	-4	33.61	
250	SV-9	9/9/24 13:38	63.2175	-3.571	63	-13.05	-4	25.74	tracers
251	SV-10	9/9/24 15:21	63.1498	-3.7045	63	-8.99	-4	17.73	
252	SV-11	9/9/24 16:52	63.0825	-3.8343	63	-4.95	-4	9.94	tracers
253	SV-12	9/9/24 18:12	63.0485	-3.9	63	-2.91	-4	6	
254	SV-13	9/9/24 19:26	63.0152	-3.9662	63	-0.91	-4	2.03	
255	SV-14	9/9/24 20:29	62.9805	-4.0328	62	-58.83	-5	58.03	tracers, 14C, U236/I129,nutriets, [DOC], SVDI14C, DOC14C, salts, XLVE
256	SV-15	9/9/24 21:53	62.9468	-4.0975	62	-56.81	-5	54.15	
257	SV-16	9/9/24 22:55	62.9132	-4.1623	62	-54.79	-5	50.26	
258	SV-17	9/9/24 23:55	62.8795	-4.228	62	-52.77	-5	46.32	tracers, U236/I129
259	SV-18	9/10/24 1:04	62.8457	-4.2927	62	-50.74	-5	42.44	
260	SV-19	9/10/24 2:02	62.8122	-4.3577	62	-48.73	-5	38.54	tracers, DIC/TA, U236/I129
261	SV-20	9/10/24 3:04	62.7783	-4.4225	62	-46.7	-5	34.65	
262	SV-21	9/10/24 4:05	62.7103	-4.5528	62	-42.62	-5	26.83	tracers, U236/I129
263	SV-22	9/10/24 5:05	62.6433	-4.6807	62	-38.6	-5	19.16	tracers, U236/I129
264	SV-23	9/10/24 6:05	62.5745	-4.8107	62	-34.47	-5	11.36	
265	SV-24	9/10/24 7:06	62.507	-4.9412	62	-30.42	-5	3.53	tracers, U236/I129
266	SV-25	9/10/24 8:09	62.4408	-5.0675	62	-26.45	-6	55.95	U236/I129
267	SV-26	9/10/24 9:09	62.3735	-5.1965	62	-22.41	-6	48.21	tracers, U236/I129
Section SVN									
269	SVN-1	9/10/24 13:23	63.097	-5.1842	63	-5.82	-6	48.95	
268	SVN-2	9/10/24 14:16	63.0615	-5.2455	63	-3.69	-6	45.27	
270	SVN-3	9/10/24 15:10	63.1345	-5.1268	63	-8.07	-6	52.39	tracers
271	SVN-4	9/10/24 16:20	63.1717	-5.0723	63	-10.3	-6	55.66	
272	SVN-5	9/10/24 17:19	63.2083	-5.0143	63	-12.5	-6	59.14	tracers
273	SVN-6	9/10/24 18:34	63.2448	-4.9575	63	-14.69	-5	2.55	
274	SVN-7	9/10/24 19:48	63.2825	-4.9007	63	-16.95	-5	5.96	tracers
275	SVN-8	9/10/24 21:09	63.3183	-4.8428	63	-19.1	-5	9.43	
276	SVN-9	9/10/24 22:31	63.3927	-4.7288	63	-23.56	-5	16.27	tracers, salts
277	SVN-10	9/11/24 0:09	63.4663	-4.6138	63	-27.98	-5	23.17	
278	SVN-11	9/11/24 1:42	63.54	-4.4975	63	-32.4	-5	30.15	tracers, salts
279	SVN-12	9/11/24 3:28	63.6138	-4.3827	63	-36.83	-5	37.04	
280	SVN-13	9/11/24 5:01	63.6882	-4.2668	63	-41.29	-5	43.99	tracers, salts
281	SVN-14	9/11/24 7:00	63.7623	-4.1495	63	-45.74	-5	51.03	
282	SVN-15	9/11/24 8:35	63.836	-4.0353	63	-50.16	-5	57.88	tracers, salts
Section MSO									
283	MSO-1	9/11/24 23:37	61.9157	-0.34933	61	-54.94	-1	39.04	
284	MSO-2	9/12/24 0:38	61.9725	-0.20283	61	-58.35	-1	47.83	
285	MSO-3	9/12/24 1:39	62.0302	-0.0545	62	-1.81	-1	56.73	
286	MSO-4	9/12/24 2:43	62.0873	0.0925	62	5.24	0	5.55	
287	MSO-5	9/12/24 3:54	62.1447	0.24083	62	8.68	0	14.45	
288	MSO-6	9/12/24 5:05	62.2017	0.3895	62	12.1	0	23.37	tracers
289	MSO-7	9/12/24 6:45	62.2593	0.53783	62	15.56	0	32.27	
290	MSO-8	9/12/24 8:21	62.3165	0.688	62	18.99	0	41.28	tracers

291	MSO-9	9/13/24 0:38	62.374	0.83817	62	22.44	0	50.29	tracers
292	MSO-10	9/13/24 2:53	62.4307	0.98767	62	25.84	0	59.26	
293	MSO-11	9/13/24 4:52	62.4878	1.137	62	29.27	1	8.22	tracers
294	MSO-12	9/13/24 7:17	62.5453	1.2862	62	32.72	1	17.17	
295	MSO-13	9/13/24 9:00	62.6023	1.438	62	36.14	1	26.28	
296	MSO-14	9/13/24 10:48	62.6593	1.5893	62	39.56	1	35.36	tracers, salts
297	MSO-15	9/13/24 12:48	62.7172	1.742	62	43.03	1	44.52	
298	MSO-16	9/13/24 14:42	62.6873	1.9243	62	41.24	1	55.46	
299	MSO-17	9/13/24 16:30	62.6577	2.1098	62	39.46	2	6.59	tracers, salts
300	MSO-18	9/13/24 18:14	62.6287	2.295	62	37.72	2	17.7	
301	MSO-19	9/13/24 19:41	62.5993	2.4802	62	35.96	2	28.81	tracers
302	MSO-20	9/13/24 21:05	62.5693	2.6638	62	34.16	2	39.83	
303	MSO-21	9/13/24 22:15	62.5398	2.8477	62	32.39	2	50.86	tracers, salts
304	MSO-22	9/13/24 23:36	62.5098	3.0318	62	30.59	3	1.91	
305	MSO-23	9/14/24 0:51	62.4803	3.2163	62	28.82	3	12.98	
306	MSO-24	9/14/24 2:02	62.4507	3.4005	62	27.04	3	24.03	tracers
307	MSO-25	9/14/24 3:25	62.4212	3.584	62	25.27	3	35.04	
308	MSO-26	9/14/24 4:34	62.3913	3.766	62	23.48	3	45.96	
309	MSO-27	9/14/24 5:44	62.3618	3.9498	62	21.71	3	56.99	tracers
310	MSO-28	9/14/24 7:09	62.3315	4.1337	62	19.89	4	8.02	
311	MSO-29	9/14/24 8:12	62.302	4.3182	62	18.12	4	19.09	tracers
Section NW									
312	NW-1	9/14/24 18:04	63.706	6.45	63	42.36	6	27	tracers, salts
313	NW-2	9/14/24 20:24	63.5947	6.6217	63	35.68	6	37.3	
314	NW-3	9/14/24 22:21	63.4832	6.7945	63	28.99	6	47.67	tracers, nutrients, [DOC], SVDI14C, DO14C, salts, XLVE
315	NW-4	9/15/24 0:36	63.373	6.967	63	22.38	6	58.02	
316	NW-5	9/15/24 2:26	63.2583	7.1397	63	15.5	7	8.38	
317	NW-6	9/15/24 3:56	63.1845	7.2447	63	11.07	7	14.68	tracers
318	NW-7	9/15/24 5:38	63.1395	7.2662	63	8.37	7	15.97	
319	NW-8	9/15/24 6:58	63.0962	7.2835	63	5.77	7	17.01	tracers
320	NW-9	9/15/24 8:14	63.0515	7.302	63	3.09	7	18.12	
321	NW-10	9/15/24 9:16	63.0078	7.3213	63	0.47	7	19.28	tracers, salts
322	NW-11	9/15/24 10:28	62.9635	7.3402	62	57.81	7	20.41	
323	NW-12	9/15/24 11:32	62.9193	7.3588	62	55.16	7	21.53	tracers, salts
324	NW-13	9/15/24 12:39	62.876	7.378	62	52.56	7	22.68	
325	NW-14	9/15/24 13:37	62.832	7.3963	62	49.92	7	23.78	tracers
326	NW-15	9/15/24 14:42	62.7878	7.4158	62	47.27	7	24.95	
327	NW-16	9/15/24 15:43	62.7433	7.432	62	44.6	7	25.92	tracers
328	NW-17	9/15/24 16:37	62.6998	7.4525	62	41.99	7	27.15	
329	NW-18	9/15/24 17:27	62.655	7.4708	62	39.3	7	28.25	
Section SE									
330	SE-1	9/16/24 3:24	61.4812	5.5357	61	28.87	5	32.14	
331	SE-2	9/16/24 4:24	61.4232	5.3922	61	25.39	5	23.53	
332	SE-3	9/16/24 5:23	61.3637	5.2502	61	21.82	5	15.01	
333	SE-4	9/16/24 6:28	61.3073	5.11	61	18.44	5	6.6	
334	SE-5	9/16/24 7:29	61.2495	4.964	61	14.97	4	57.84	tracers
335	SE-6	9/16/24 8:46	61.191	4.82	61	11.46	4	49.2	tracers
336	SE-7	9/16/24 10:07	61.1332	4.6795	61	7.99	4	40.77	tracers, salts
337	SE-8	9/16/24 11:49	61.0753	4.5345	61	4.52	4	32.07	
338	SE-9	9/16/24 13:20	61.0175	4.394	61	1.05	4	23.64	tracers, salts
339	SE-10	9/16/24 15:18	60.96	4.2512	60	57.6	4	15.07	
340	SE-11	9/16/24 16:52	60.9017	4.1087	60	54.1	4	6.52	tracers
341	SE-12	9/16/24 18:42	60.8432	3.9683	60	50.59	3	58.1	
342	SE-13	9/16/24 20:08	60.7862	3.8285	60	47.17	3	49.71	tracers
343	SE-14	9/16/24 21:42	60.727	3.6875	60	43.62	3	41.25	tracers

344	SE-15	9/16/24 23:06	60.6688	3.5482	60	40.13	3	32.89	
345	SE-16	9/17/24 0:15	60.6112	3.4073	60	36.67	3	24.44	
346	SE-17	9/17/24 1:19	60.5532	3.2673	60	33.19	3	16.04	
347	SE-18	9/17/24 2:19	60.495	3.1275	60	29.7	3	7.65	
348	SE-19	9/17/24 3:15	60.437	2.9882	60	26.22	2	59.29	

Appendix B: Mooring Diagrams



Note A
Profile Depth Interval = 108 m to 602 m

Hardware Required (per mooring without spares)	
(16)	1/2" Anchor Shackle (SH)
(8)	5/8" Anchor Shackle (SH)
(3)	3/4" Anchor Shackle (SH)
(2)	7/8" Anchor Shackle
(15)	5/8" Sling Link (SL)
1	1-1/4" Master Link
1	3-ton Swivel

Hardware Designation	
Ⓐ	(2) 1/2" SH, (1) 5/8" SL
Ⓑ	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
Ⓒ	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓗ	(2) 5/8" SH, (1) 5/8" SL
Ⓙ	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
Ⓚ	(1) 5/8" SH, (2) 5/8" SL, (1) 7/8" SH
Ⓜ	(1) 1 1/4" Masterlink
Ⓢ	Swivel

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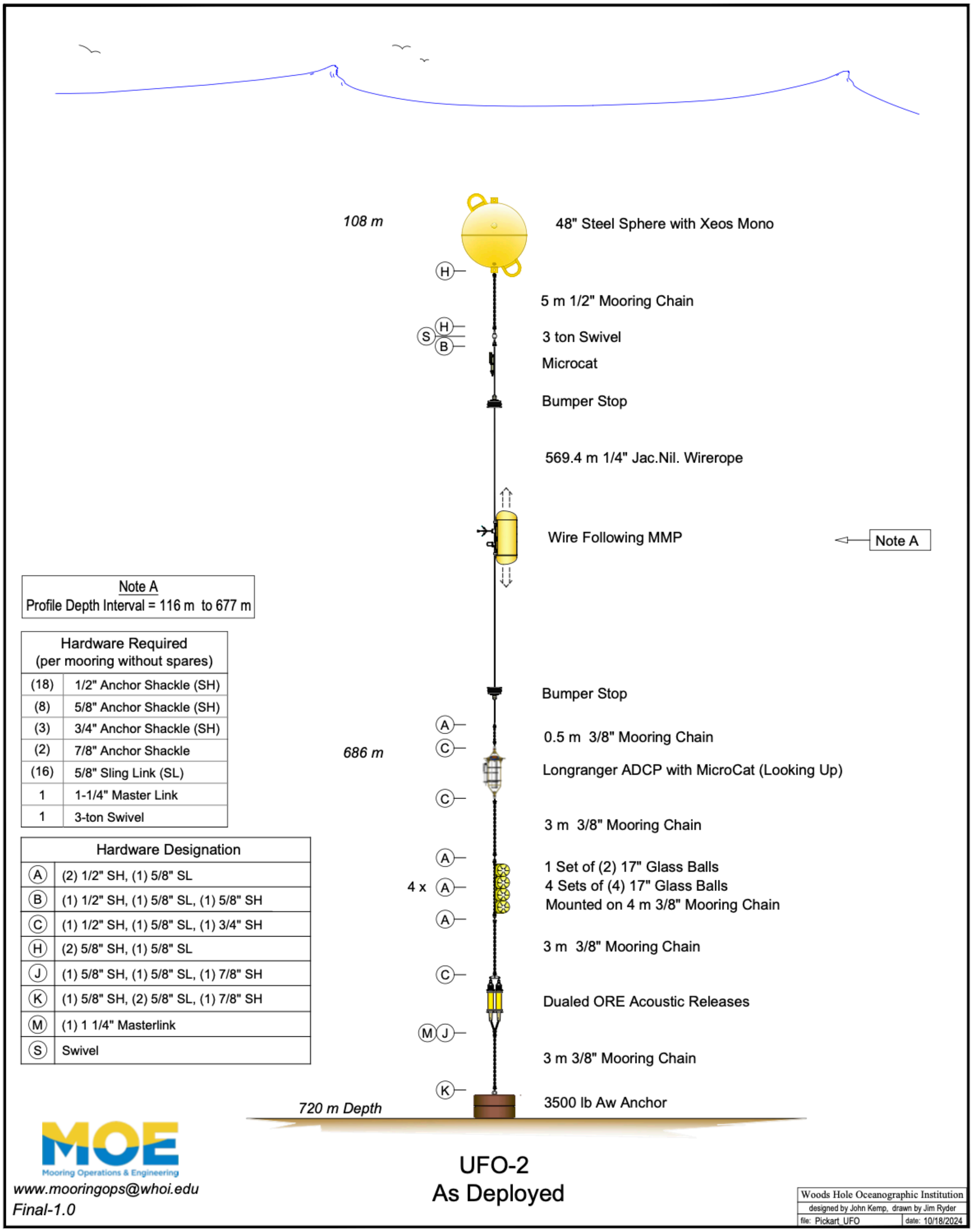
UFO-1
As Deployed

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Jim Ryder
file: Pickart_UFO date: 10/18/2024



Note A
Profile Depth Interval = 116 m to 677 m

Hardware Required (per mooring without spares)	
(18)	1/2" Anchor Shackle (SH)
(8)	5/8" Anchor Shackle (SH)
(3)	3/4" Anchor Shackle (SH)
(2)	7/8" Anchor Shackle
(16)	5/8" Sling Link (SL)
1	1-1/4" Master Link
1	3-ton Swivel

Hardware Designation	
Ⓐ	(2) 1/2" SH, (1) 5/8" SL
Ⓑ	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
Ⓒ	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓗ	(2) 5/8" SH, (1) 5/8" SL
Ⓙ	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
Ⓚ	(1) 5/8" SH, (2) 5/8" SL, (1) 7/8" SH
Ⓜ	(1) 1 1/4" Masterlink
Ⓢ	Swivel

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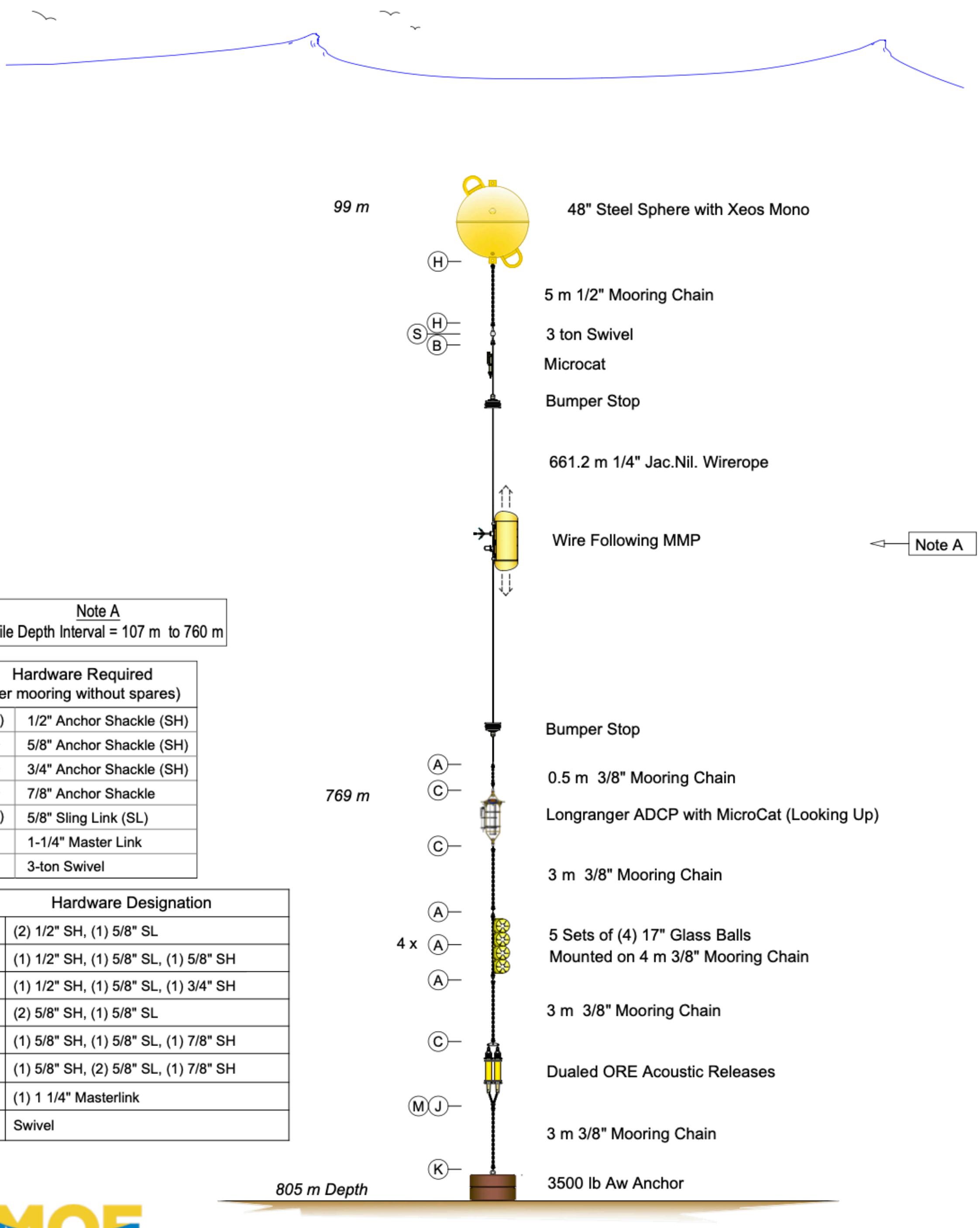
UFO-2
As Deployed

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Jim Ryder	
file: Pickart_UFO	date: 10/18/2024



Note A
Profile Depth Interval = 107 m to 760 m

Hardware Required (per mooring without spares)	
(18)	1/2" Anchor Shackle (SH)
(8)	5/8" Anchor Shackle (SH)
(3)	3/4" Anchor Shackle (SH)
(2)	7/8" Anchor Shackle
(16)	5/8" Sling Link (SL)
1	1-1/4" Master Link
1	3-ton Swivel

Hardware Designation	
Ⓐ	(2) 1/2" SH, (1) 5/8" SL
Ⓑ	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
Ⓒ	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓗ	(2) 5/8" SH, (1) 5/8" SL
Ⓙ	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
Ⓚ	(1) 5/8" SH, (2) 5/8" SL, (1) 7/8" SH
Ⓜ	(1) 1 1/4" Masterlink
Ⓢ	Swivel

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UFO-3
As Deployed

Woods Hole Oceanographic Institution
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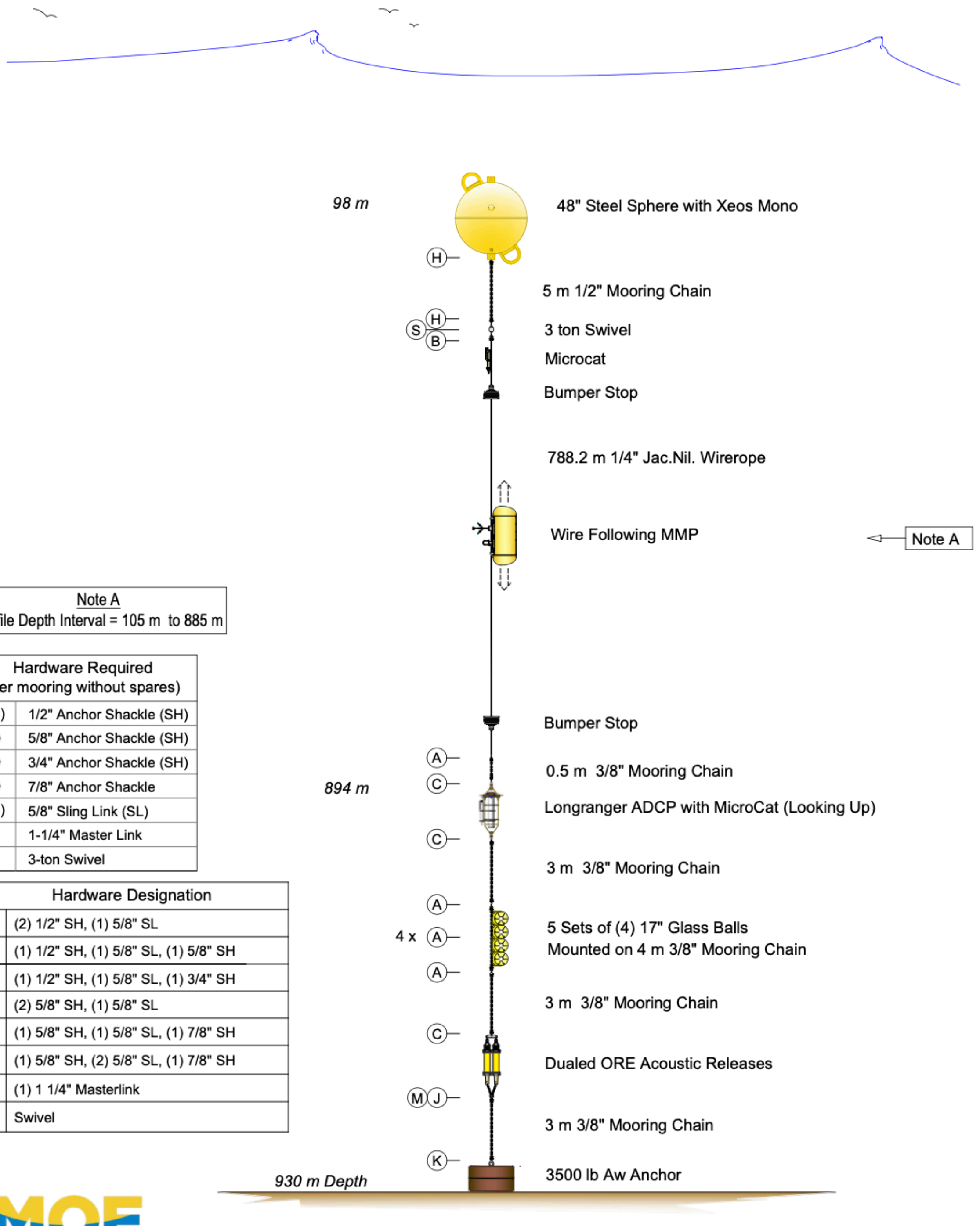
file: Pickart_UFO
date: 10/18/2024



Note A
Profile Depth Interval = 105 m to 885 m

Hardware Required (per mooring without spares)	
(18)	1/2" Anchor Shackle (SH)
(8)	5/8" Anchor Shackle (SH)
(3)	3/4" Anchor Shackle (SH)
(2)	7/8" Anchor Shackle
(16)	5/8" Sling Link (SL)
1	1-1/4" Master Link
1	3-ton Swivel

Hardware Designation	
Ⓐ	(2) 1/2" SH, (1) 5/8" SL
Ⓑ	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
Ⓒ	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓗ	(2) 5/8" SH, (1) 5/8" SL
Ⓙ	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
Ⓚ	(1) 5/8" SH, (2) 5/8" SL, (1) 7/8" SH
Ⓜ	(1) 1 1/4" Masterlink
Ⓢ	Swivel

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UFO-4
As Deployed

Woods Hole Oceanographic Institution
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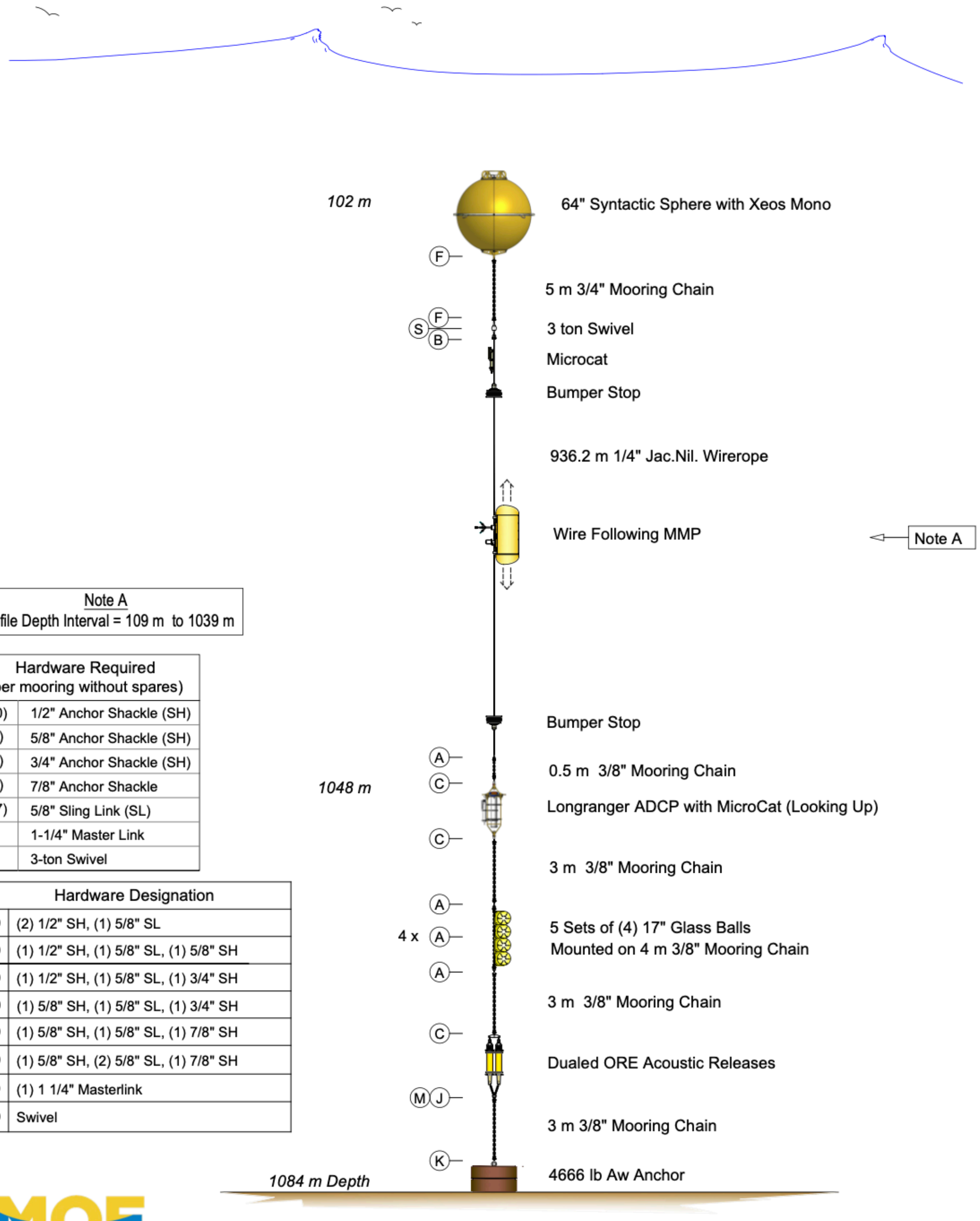
file: Pickart_UFO
date: 10/18/2024



Note A
Profile Depth Interval = 109 m to 1039 m

Hardware Required (per mooring without spares)	
(20)	1/2" Anchor Shackle (SH)
(6)	5/8" Anchor Shackle (SH)
(5)	3/4" Anchor Shackle (SH)
(2)	7/8" Anchor Shackle
(17)	5/8" Sling Link (SL)
1	1-1/4" Master Link
1	3-ton Swivel

Hardware Designation	
Ⓐ	(2) 1/2" SH, (1) 5/8" SL
Ⓑ	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
Ⓒ	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓕ	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓙ	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
Ⓚ	(1) 5/8" SH, (2) 5/8" SL, (1) 7/8" SH
Ⓜ	(1) 1 1/4" Masterlink
Ⓢ	Swivel

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UFO-5
As Deployed

Woods Hole Oceanographic Institution
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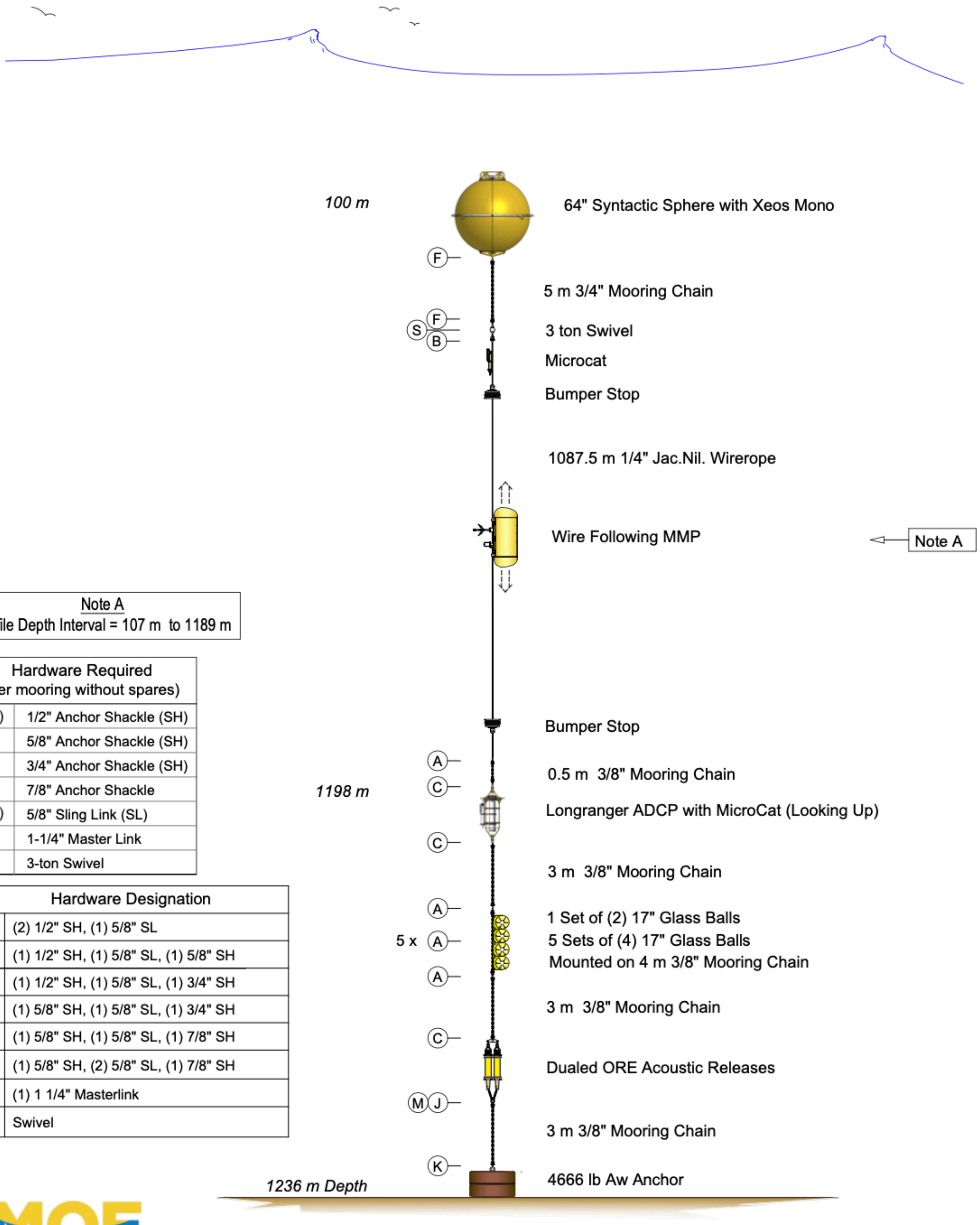
file: Pickart_UFO date: 10/18/2024



Note A
Profile Depth Interval = 107 m to 1189 m

Hardware Required (per mooring without spares)	
(20)	1/2" Anchor Shackle (SH)
(6)	5/8" Anchor Shackle (SH)
(5)	3/4" Anchor Shackle (SH)
(2)	7/8" Anchor Shackle
(17)	5/8" Sling Link (SL)
1	1-1/4" Master Link
1	3-ton Swivel

Hardware Designation	
Ⓐ	(2) 1/2" SH, (1) 5/8" SL
Ⓑ	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
Ⓒ	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓕ	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓙ	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
Ⓚ	(1) 5/8" SH, (2) 5/8" SL, (1) 7/8" SH
Ⓜ	(1) 1 1/4" Masterlink
Ⓢ	Swivel

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UFO-6
As Deployed

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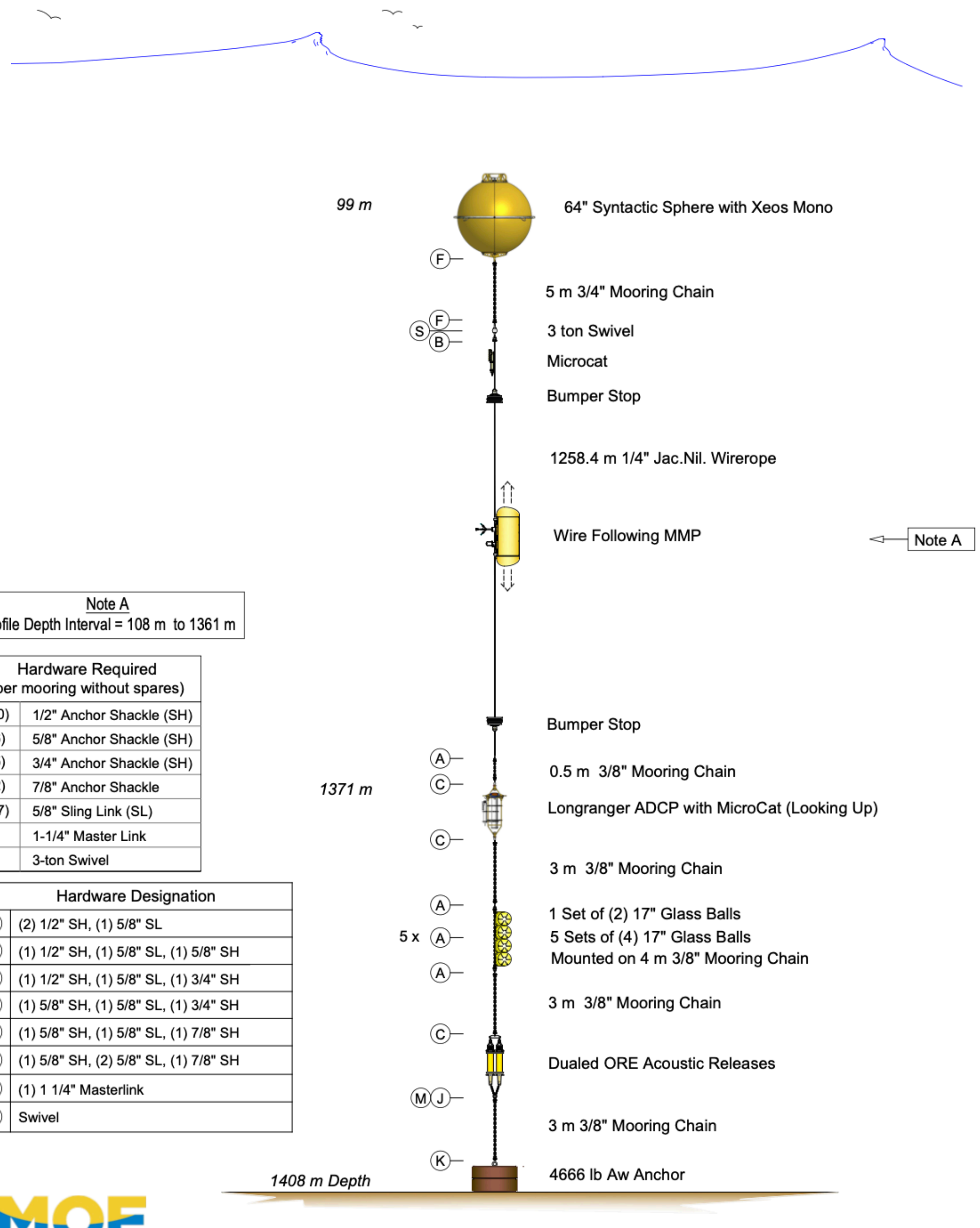
file: Pickart_UFO
date: 10/18/2024



Note A
Profile Depth Interval = 108 m to 1361 m

Hardware Required (per mooring without spares)	
(20)	1/2" Anchor Shackle (SH)
(6)	5/8" Anchor Shackle (SH)
(5)	3/4" Anchor Shackle (SH)
(2)	7/8" Anchor Shackle
(17)	5/8" Sling Link (SL)
1	1-1/4" Master Link
1	3-ton Swivel

Hardware Designation	
Ⓐ	(2) 1/2" SH, (1) 5/8" SL
Ⓑ	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
Ⓒ	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓕ	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓙ	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
Ⓚ	(1) 5/8" SH, (2) 5/8" SL, (1) 7/8" SH
Ⓜ	(1) 1 1/4" Masterlink
Ⓢ	Swivel

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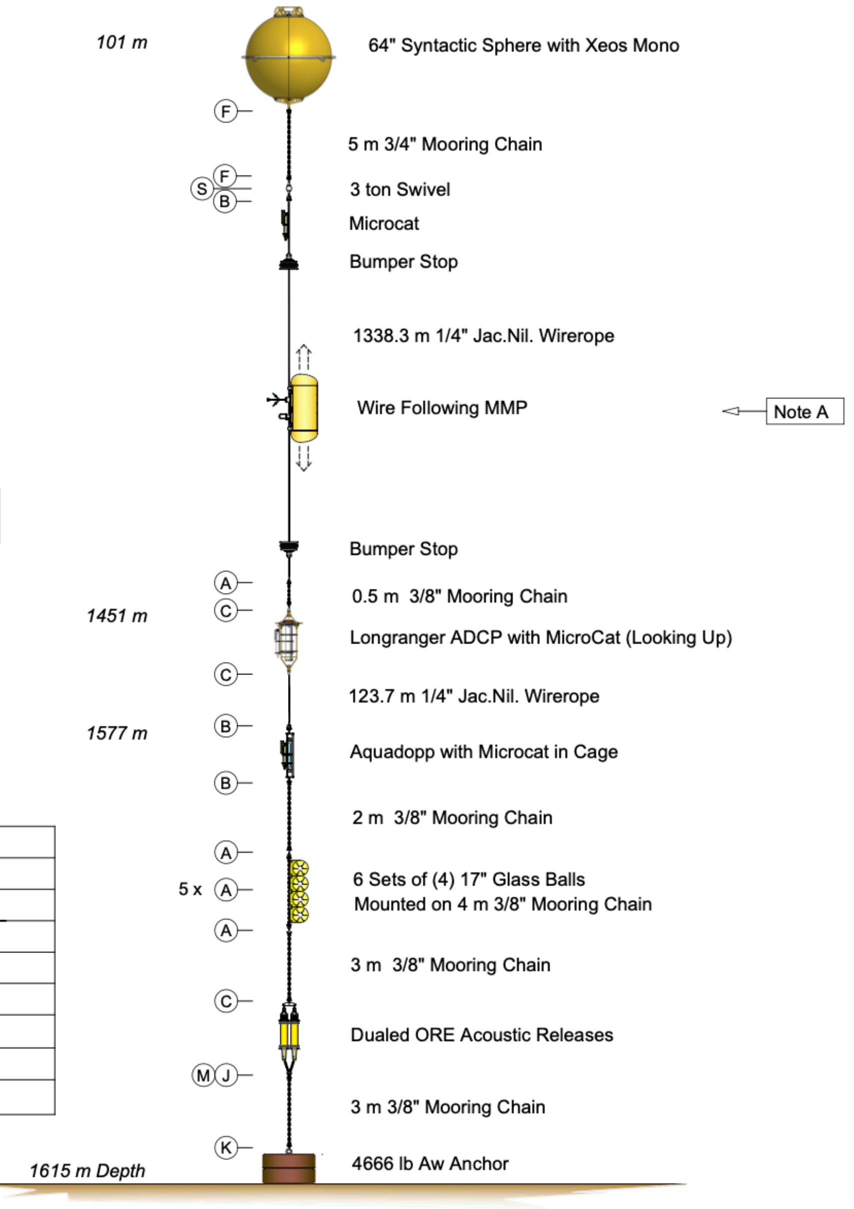
UFO-7
As Deployed

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Jim Ryder
file: Pickart_UFO date: 10/18/2024



Note A
Profile Depth Interval = 108 m to 1363 m

Hardware Required (per mooring without spares)	
(22)	1/2" Anchor Shackle (SH)
(8)	5/8" Anchor Shackle (SH)
(5)	3/4" Anchor Shackle (SH)
(2)	7/8" Anchor Shackle
(19)	5/8" Sling Link (SL)
1	1-1/4" Master Link
1	3-ton Swivel

Hardware Designation	
Ⓐ	(2) 1/2" SH, (1) 5/8" SL
Ⓑ	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
Ⓒ	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓕ	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
Ⓙ	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
Ⓚ	(1) 5/8" SH, (2) 5/8" SL, (1) 7/8" SH
Ⓜ	(1) 1 1/4" Masterlink
Ⓢ	Swivel

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UFO-8
As Deployed

Woods Hole Oceanographic Institution
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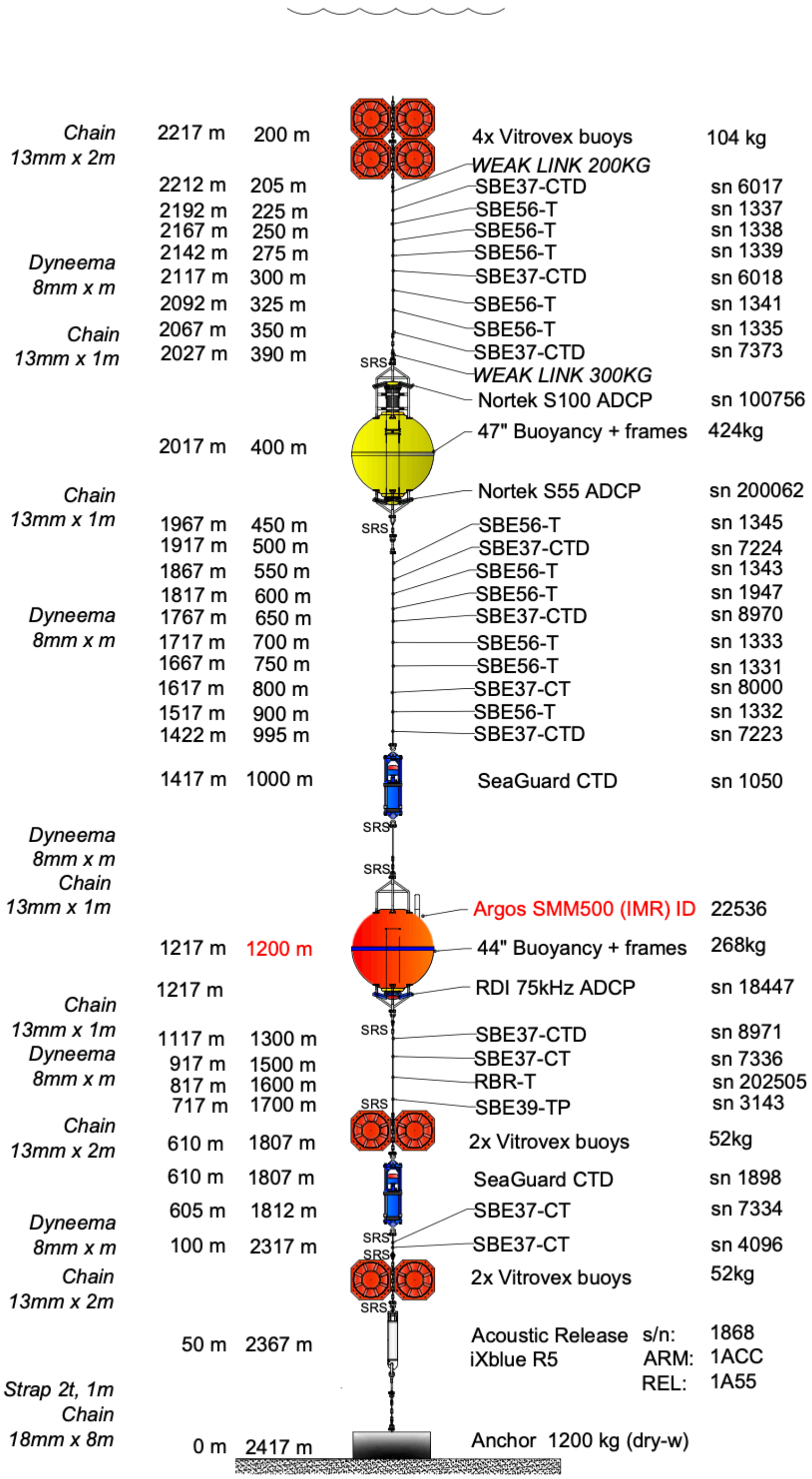
file: Pickart_UFO
date: 10/18/2024



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Geofysisk Institutt

Mooring name: **UFO-9 UIB**

Project: UFO-UIB mooring
Location: Faroe N-W
Position: Lat 64N3.85'
Lon 7W5.65'
Depth: 2417 m
Deployed:
Recovered:
Notes:

SRS = Shackle-Ring-Shackle 2T SWL
Mooring wire Dyneema SK78 8mm
Observe:
1:SMM500 exceed rating!! Need to attach to yellow buoy or above
2: Lots of flotation! Consider to reduce to increase stable weight!

Latest update: 14/08/2024

UFO_10
2024

Planned Position
64°07,000 N
006°35,000 V
Echo Depth:2809 m

Positión:
Lat: 64°07,210 N
Lon:006°34,984 V
Depth: 2790m Echo sound
Date: 30/8 - 2024
Time: 03:34 (UTC)
Observer: HH/EM
Recovered: xx/xx-xxxx