



# SFI Smart Ocean Annual Report 2025



# Partners

SFI Smart Ocean is a Centre for Research-based Innovation (SFI) funded by the Research Council of Norway (grant number 309612) and Centre partners. The consortium consists of 6 research partners, 10 user partners from industry, 3 industry clusters, and 2 national authority observers. Our goal is to enable sustainable ocean management through real-time measurements from autonomous and smart sensor networks.

## Research Partners



## User Partners / Industry Clusters



## User Partners / Industries



## National Authority Observers



COVER PHOTO: HÅKON SANDVEN

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## 01 Summary

Ingvar Henne, Centre Director

PHOTO: ROY BJØRGE / GCE OCEAN TECHNOLOGY



The Centre has successfully passed the mid-term evaluation, and we increase our focus on transforming research into innovations and establish spin-off projects to make a tangible impact.

### The mid-term evaluation

A significant milestone for the Centre was the mid-term evaluation, which commenced in the fall of 2024 and concluded in February, with a dialogue meeting involving an expert group, culminating in the Research Council's formal decision in March to continue supporting the Centre. We are now entering a phase where it is essential to maximize the realization of research outcomes into products and solutions alongside our industrial partners. To facilitate this process, we have established an innovation committee responsible for identifying opportunities where our ideas and results can drive innovations and enhance value creation in Norwegian businesses. The maturity level and potential of each result will guide our prioritization and inform the next steps for further development.

### Some results and highlights

NORCE has developed a highly flexible Software Defined Modem (SDM) platform that is used extensively in the Centre for testing transmission methods and network protocols. This platform has also been used in spin-off projects like SIMONE, contributing to the standardization of underwater communication in SWiG.

The PhD work at HVL and UiB has resulted in concrete methods and software related to data quality for ocean observations. The methods are also so generic that they have potential for exploitation beyond applications in SFI Smart Ocean. AdapAD (an AI-powered solution for Adaptive Anomaly Detection) has been implemented in the SFI Smart Ocean data platform. At Aanderaa, AdapAD is planned to be used for data quality monitoring in the



Roald Otnes (FFI), Varnan Jayasooriyana (HVL), Bård Henriksen and Anders Vahlin (NORCE) collaborated on field trials at Austevoll. PHOTO: INGVAR HENNE

01 Summary



Fibre optical sensing methods can protect the fibre network. Steinar Bjørnstad (Tampnet) presented the solutions at the Internet Governance Forum. PHOTO: DIGI.NO

smart sensors so that quality-assured data is transferred to the observation system. The solution offers the potential for more reliable measurements and a stronger market position.

Similarly, MuMSAD, an AutoML framework designed to detect multi-variate anomalies and identify their causes, has been introduced at Reach Subsea as a potential tool for automatic quality control of underwater sensors.

Dissemination

This year's spring conference was entitled "Creating Ocean Insights – Bridging Measurements and Data Management" and was held at UiB. In addition to established researchers and industry representatives, several of our PhD students contributed with good presentations here, and topics included measurement strategies and data quality. Sensor technology, antifouling technologies and underwater communication were also presented. The autumn meeting was at HVL in Kronstad. Here, the Centre's research results and innovation potential were discussed. As always, the autumn meeting focused on technical solutions for close integration across our research areas and coordination of work plans for the following year.

In addition to our own spring conference, the Centre's participants have presented results that are being noticed both nationally and internationally, for example Edmary Altamiranda at AkerBP who was named "Nordic Techwoman of the Year" in 2025 for her work with underwater technology.

Steinar Bjørnstad at Tampnet has published several articles on fibre measurements using submarine telecom cables - DAS (Distributed Acoustic Sensing) and SoP (State of Polarization), and especially SoP is a promising new technique with a relatively low cost-level for distributed measurements. Such solutions are very important for monitoring critical national and international



Camilla Sætre from UiB participated in a panel debate on 'Vestlandsbåten' at Arendalsuka, discussing the topic 'Safety in the Deep Sea: Solutions and Business Opportunities!' [VIDEOLINK \(AO STREAMING\)](#)



**Bård Henriksen (NORCE) and Steffen Troy (UiB) confirm the successful testing of the Software Defined Modem at Austevoll . PHOTO: ANDERS VAHLIN**

infrastructure for both communication, oil and gas, and power cables. Sensitivity and response for different fibre types, including a standard telecom cable, have been characterized by NORCE and UiB in the marine lab at HVL.

During One Ocean Week, we collaborated with NorEMSO on a work-shop where measurement methods, communication solutions and data quality were the topics. Real-time measurements from the ocean were the topic of a presentation at the Fjord Conference in Kristiansund, and bridging the gap between academia and industry has been a topic at a number of meetings and gatherings throughout the year.

Paul van Walree at FFI has published datasets for acoustic communication which are now part of IEEE DataPort. This is an important contribution to international research on underwater communication and already has over 5000 downloads, and we plan to publish more similar datasets.

We can also congratulate Julián Pelaez-Quiñones with the “EAA Best Student Paper Award at Forum Acusticum – Euronoise 2025”, and further dissemination activities can be found in the list of publications.

### Field trials in SFI Smart Ocean

The Norwegian Institute of Marine Research's research station at Austevoll remains very central to the Centre, and new trials and tests of equipment have been carried out in 2025. Measuring rigs with sensors are in continuous operation and deliver data to the SFI Smart Ocean data platform. The SDM (Software-Defined Modem) developed by NORCE was tested in the sea with an autonomous surface drone this spring. New protocols and modulation methods have been tested, and equipment from several partners has been connected. Preparations have also been made for the deployment of a 700m long fibre optic submarine cable donated by Tampnet for testing various methods for observing acoustic signals in the water.

This summer, a major expedition in the Arctic with KV Svalbard was carried out in collaboration with the HiAOOS project (led by NERSC). This was an international collaboration involving Master's students and postdoctoral fellow Håkon Sandven from UiB. The Centre's first long-range underwater communication was tested under the ice in the Arctic. Reliable communication under sea ice is crucial for autonomous observation systems. ●●●



### Ngoc Thanh Nguyen

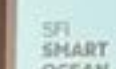
Doctoral Thesis Public Defense

#### Academic supervisors

Prof. Rogardt Heldal - Western Norway University of Applied Sciences (HVL), Norway  
 Prof. Patrizio Pelliccione - Gran Sasso Science Institute (GSSI), Italy  
 Prof. Lars Michael Kristensen - Western Norway University of Applied Sciences (HVL)



Keila Lima  
 Public Defence  
 27. August 2025



This work is part of the SFI Smart Ocean  
 (co-funded by the NFR - ref. 309813)

Two HVL Phd's in the making: Ngoc Thanh Nguyen (above) and Keila Lima at their respective defenses. PHOTO: TERJE RESTAD

### New project initiatives and international collaboration

Several of the Centre's partners are now collaborating on initiatives for new research projects building on SFI Smart Ocean results. Some of these are spin-off projects with the Centre's partners, and some are applications with international partners. Throughout the year, there has been extensive dialogue with both universities and industry in Europe, and researchers have had shorter and longer visits abroad, specifically **Amr Abboud** at the University in Bordeaux and **Lars Kristensen** at the University of Sorbonne.

### UiB/HVL Students

This year, two PhD candidates at HVL defended their dissertations. **Keila Lima** defended her thesis "IoT Data Integration and Quality in Marine Contexts" and **Ngoc-Thanh Nguyen** defended his thesis "Engineering of Software for Automatic Marine Data Quality Control". They have both left Norway, but we will have further

contact with Keila through the Gran Sasso Science Institute where we also have a professor employed in a part-time position. **Astrid Marie Skålvik** is in the final stages of her doctoral degree at UiB and is planning to defend her dissertation in 2026.

PhD student Amr Abboud had a very useful study stay at I2M laboratory in France where he worked with ultrasound for testing defects in materials. In addition, there were both bachelor's theses and many Master's theses that were directly or indirectly associated with topics in SFI Smart Ocean at both HVL and UiB. ●

## 02 Vision & Objectives

Our vision is the realization of a generic, autonomous and flexible wireless multi-parameter marine observation system for reliable management of a productive and healthy ocean.

SFI Smart Ocean is focusing on enabling real-time high-quality data for increased autonomy, and increased value of coastal and oceanic management models and systems. This will lead to sustainable and profitable ocean industry operations, and to fact-based ocean resource management. The observation system's key factors are highly cross-disciplinary:

- sensors research and development
- measurement strategy
- flexible and adaptive sampling in time and space
- point measurement vs. monitoring over large areas
- distributed measurements
- measurement uncertainty and reliability
- data quality classification and metadata definitions
- compression methods and embedded signal processing
- time series as input to big-data analysis
- cloud-based data and application services
- data format aggregation and safety
- low power consumption and embedded sensor intelligence

The organization of this Centre, which spans multiple scientific disciplines and sectors, ensures a vendor-neutral approach to the system, fostering a diverse range of applications.

By implementing standardized interfaces and data formats, we facilitate the integration of various sensor types, enhance communication interoperability, and promote effective data sharing both during and beyond the Centre's operational lifespan. SFI Smart Ocean deploys sensors specifically designed for monitoring environmental conditions, structural integrity, and marine life parameters.

These measurements provide critical data necessary for well-informed decision-making by industry and regulatory authorities. They play a vital role in optimizing operations, improving maintenance practices, and evaluating compliance with licensing requirements. Ultimately, these efforts serve as foundational elements for addressing knowledge gaps and tackling pressing societal challenges.

### Primary Objective

The Centre objective is to create a wireless observation system for multi-parameter monitoring of underwater environments and installations. The system based on autonomous smart sensors will serve as an enabling fundament in realizing flexible, distributed, robust, energy efficient, cost-effective, and safe marine measurements and big-data handling, to support the Centre's vision in respect to societal and industrial challenges. ●

Instruments are being deployed north of Svalbard in cooperation with the HiAOOS cruise. PHOTO: HÅKON SANDVEN





The observation buoy at Austevoll is prepared for redeployment after scheduled maintenance. PHOTO: HÅKON SANDVEN

### 03 Research Plan & Strategy

The primary objective of the research activities at the Centre is to ensure efficient and reliable data flow from underwater sensors to end-user applications. To maintain a strong emphasis on measurement methods, sensor design, underwater communications, and data management, SFI Smart Ocean organizes its efforts into three work packages (WPs) and two integrating functions (IFs).

The three WPs represent cutting-edge disciplinary activities that require substantial and effective collaboration among them. The IFs serve as cross-cutting interdisciplinary efforts, facilitating the integration of the three WPs to enhance overall research outcomes.

#### **WP1: Autonomous Sensors & Measurement Strategies**

This work package focuses on enabling and developing autonomous sensor technology for marine environmental and structural integrity measurements. The research and development are both on existing marine sensors and novel sensor technologies for real-time observations in an underwater wireless network.

Marine smart sensors will have embedded pre-processing of data in the sensor, compression of data and headers, acoustic modem compatibility, and smart operation for low energy use. Research and innovation on new sensor technology include guided ultrasonic wave sensors for integrity measurements, distributed fibre optic sensors with acoustic sensing of environmental noise and structural vibrations, nano technology for improved pH sensors, and new or improved optical measurements and research on light propagation in the ocean. Our research also includes nanostructured surfaces for anti-biofouling of sensor and modem surfaces,

to ensure higher data quality and longer deployment in the ocean. Research on measurement strategies aims to reduce measurement uncertainty and ensure trustworthy data. This includes self-validation and self-diagnostic capabilities of the smart marine sensors, and the uncertainty propagation from the marine sensors to the data presented to the end user.

Existing sensors, new sensor technologies, nanostructured self-cleaning surfaces, and the measurement strategies for trustworthy data are tested at pilot demonstrators in the Centre. Metadata definitions and standardization for data quality and measurement conditions are central to the measurement system design.

#### **WP2: Wireless Network Communications**

The realization of the SFI Smart Ocean observation system is heavily reliant on effective underwater communications. This work package is dedicated to developing wireless communication technology, focusing on a low-cost, miniaturized short-range acoustic underwater technology platform that will be integrated into an energy-efficient underwater wireless sensor network (UWSN). Both hardware and software will be optimized for long-term operations in challenging environments, placing a strong emphasis on energy efficiency and system reliability.

To accommodate a broader range of use cases, WP2 may also explore longer-range communication links and connections with moving platforms, such as autonomous underwater vehicles (AUVs). The acoustic modem and communication protocols ●●●

will leverage cutting-edge underwater acoustic communication technologies.

The system will interface with mobile networks (4G, 5G), satellite communications, fibre optic backbone networks, and unmanned surface vehicles. The communication requirements for SFI Smart Ocean are established in collaboration with other work packages, ensuring that communication solutions are aligned with application needs while taking into account the limitations and opportunities presented by the challenging underwater environment.

The testbed (Software Defined Modem) has been intensively used to investigate various modulation methods, coding techniques, and energy optimization strategies. This testbed has also facilitated the testing of compression methods and network layer functionality. Different protocols and network architectures, including multi-hop and mesh protocols, are being explored for their effectiveness in efficient data transfer while maintaining low energy requirements. Field trials are being conducted using the infrastructure provided by IF1.

Measurements of underwater communication channels utilizing the Austevoll infrastructure are contributing to international efforts aimed at standardizing underwater communication test channels. WP2 also performs analysis of acoustic measurements north of Svalbard in close cooperation with HiAOOS. Furthermore, innovative uses of fibre-optic cables (utilizing Distributed Acoustic

Sensing (DAS) and State of Polarization (SoP)) as subsea receivers for acoustic data transfer from other units are performed in conjunction with fibre optic sensing studies in WP1.

**WP3: Software Technology & Big-Data Middleware**

The work package focusing on software technology and big data middleware is dedicated to creating a digital ecosystem that provides cloud-based ocean data services. It aims to support the cost-effective development of software applications for both delivering and utilizing ocean data.

The SFI Smart Ocean cloud platform consists of a suite of software frameworks designed to facilitate the integration of both external and internal ocean data sources, data storage and processing, and application deployment. This platform enables the establishment of data spaces built on a standardized set of APIs, as well as uniform data and metadata formats. The software technology being developed within this work package is validated through the creation of application prototypes linked to consortium pilot demonstrators and the deployment of a reference implementation that integrates with external systems and data services.

Key topics addressed in this work package include the development and implementation of the smart ocean platform, system-of-systems software architecture, engineering technologies for smart software systems, middleware and protocols for sensor-cloud integration, edge computing, interoperability,



Ingvar Henne presents SFI Smart Ocean at EnergiRike, an executive roundtable gathering at UiB. PHOTO: UIB

data service APIs, data quality and integrity, software security and reliability, machine learning and analytics, and intelligent visualization of large datasets. The platform is available for use for all consortium partners.

The work package is organized into subprojects focusing on software system architecture, implementation, and deployment of the SFI Smart Ocean platform; research in software engineering technology, modelling, and validation; and the development of end-user applications and use cases.

**IF1: Test Arenas**

This overarching work package encompasses the sites where results from WPs 1, 2, and 3 are tested in diverse environments. The list of test sites is dynamic and will be expanded throughout the life-cycle of SFI Smart Ocean.

A local-scale environmental monitoring test site is currently operational at the IMR Research Station in Austevoll, near Bergen. This serves as our primary test arena, where the existing infrastructure facilitates the testing of components and systems developed within the SFI Smart Ocean project. Two modular test rigs equipped with various sensors are installed at this location, allowing for an extensive range of sensor and communication system evaluations and data collection.

The research station offers permanent infrastructure that undergoes continuous development, thereby simplifying modifications and maintenance of the rigs. Plans are underway to further enhance the Austevoll facilities by establishing a mesoscale test facility as an extension of the local-scale system. This advancement will support longer-range communication, geo-positioning, and mesoscale

environmental monitoring through the use of acoustic tomography and passive acoustics, thereby extending the capabilities of the already developed local-scale test system.

In addition, a large-scale environmental monitoring system was implemented in the Arctic Ocean north of Svalbard in 2025, with operations expected to last for two years in the Nansen and Amundsen Basins. Our partner, NERSC, along with collaborators including UiB, Kongsberg, and IMR, lead this EU initiative, known as HiAOOS (High Arctic Ocean Observation System). This system provides year-round acoustic and oceanographic observations and facilitates the testing of new technologies for data recovery and observations from underwater installations. The project will also enable trials of innovative technologies that utilize acoustic communication and the docking of remotely operated vehicles (ROVs).

Complementing HiAOOS, a mesoscale environmental monitoring system was set up north of Svalbard in 2025, with SFI Smart Ocean contributing equipment, planning, and analytical support. This collaboration facilitates testing of systems and equipment developed for SFI Smart Ocean in the challenging Arctic environment. HiAOOS also provides training events in oceanographic and acoustic methods and tools, offering a unique opportunity for collaboration with international institutions.

Additionally, a use case for an aquaculture observation system has been developed to ensure that the needs and requirements of fish



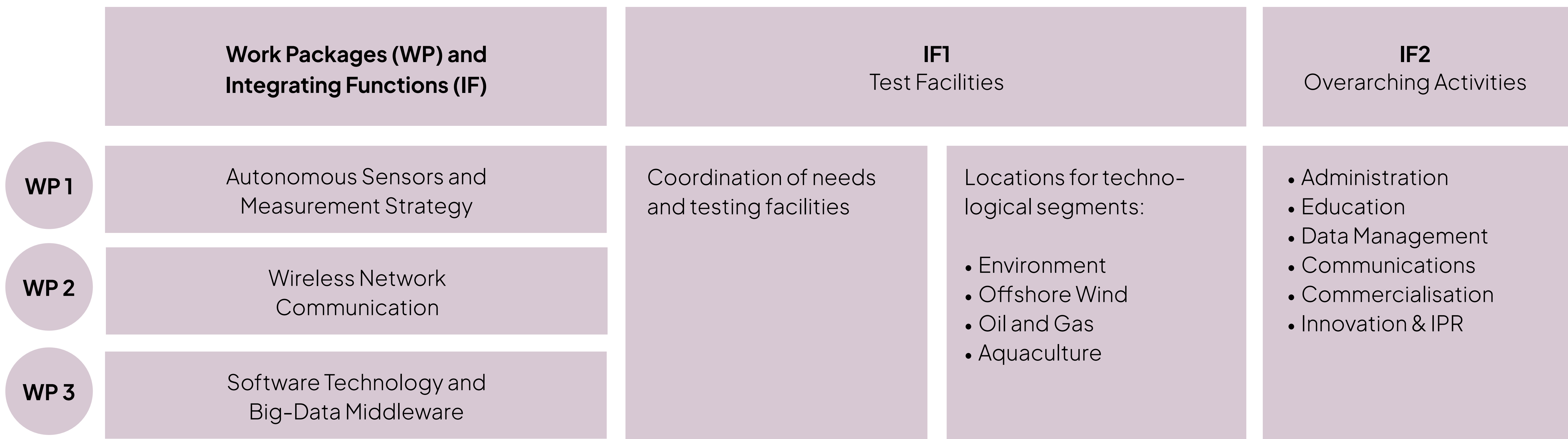
**Laboratory tests for DAS at HVL using a subsea telecom fibre cable (cable donated by Tampnet).** PHOTO: INGVAR HENNE

farmers are integrated into the development of SFI Smart Ocean technology. This use case will enable all scientific work packages to maximize their relevance and value for the aquaculture industry. A similar use case was prepared for the petroleum sector.

Furthermore, our activities include contributions to the Norwegian Ocean Observation Laboratory, where several partners of SFI Smart Ocean are working collaboratively. ●●●

**IF2: Overarching Activities**

Integrating Function 2 includes the administration of the Centre, and coordination of overarching activities such as commercialisation, innovation and IPR aspects, internal and external communication. ●



## 04 Organisation

SFI Smart Ocean is hosted by the University of Bergen (UiB), and the Centre is organised to ensure influence and contributions from all partners.

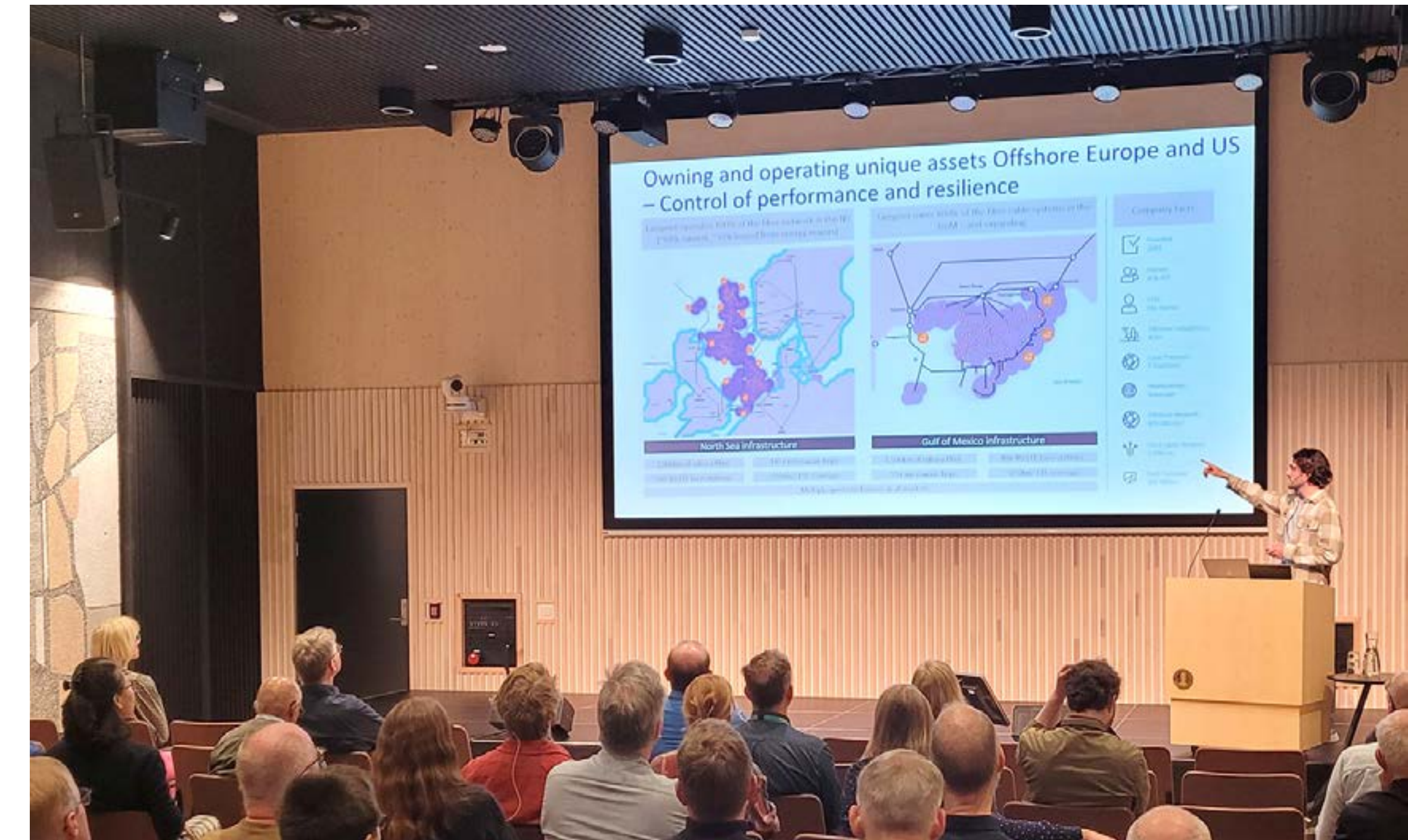
The General Assembly (GA) is the body responsible for major decisions regarding the Centre. All partners are represented in GA, and Vice Dean for research and innovation Øyvind Frette chairs the GA on behalf of UiB as host institution.

The Centre Board in 2025 consisted of Bjarte Fagerås (chair, Reach Subsea), Annette Fagerhaug Stephansen (NORCE), Gjermund Mathisen (Aker BP), Lise Doksæter Sivle (IMR), Steve Greenland (WSense), Jon O. Hellevang (CGE Ocean Technology) and Gunn Mangerud (UiB).

The members of the Scientific Advisory Committee (SAC) are Professor João Borges de Sousa (Porto University), Professor Leen Lambers (Brandenburg University of Technology) and Assistant Professor Paolo Casari (University of Trento). They give advice to the Centre Board on scientific issues and priorities, to ensure high-quality scientific impact.

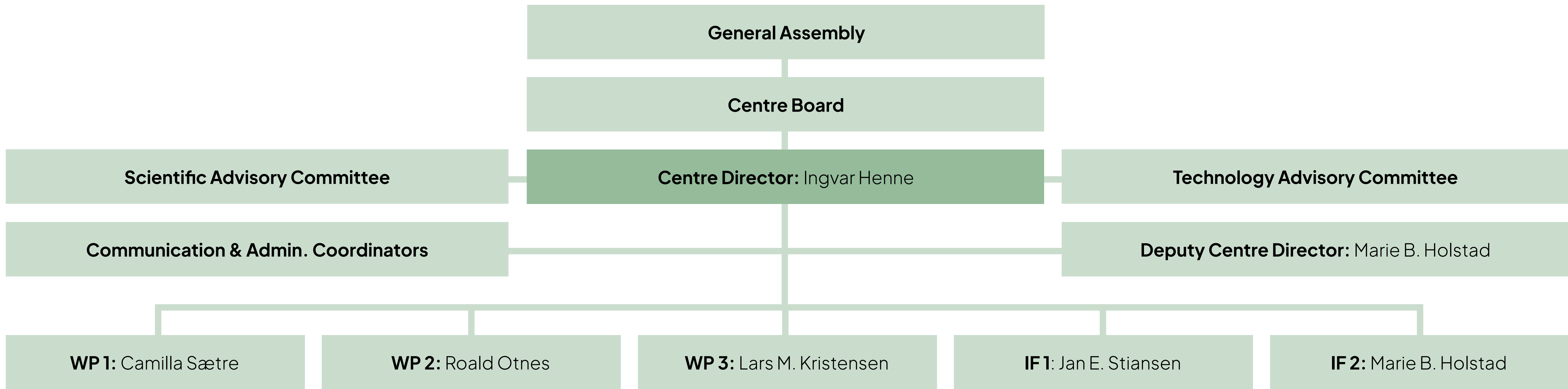
The Technology Advisory Committee (TAC) consists of one representative from each of the Consortium participants and advises the Centre Board via the Centre Director on technical issues and priorities, including IPR questions and possibilities for innovations, to ensure both industrial and scientific value creation. Camilla Sætre (UiB) is chair of TAC.

PhD student Keila Lima onboard the IMR research vessel "Hans Brattström". PHOTO: HÅKON SANDVEN



Presentation by Alvaro Doval of Tampnet at the SFI Smart Ocean spring gathering. PHOTO: TERJE RESTAD

Furthermore, an Innovation Committee, headed by Marie Bueie Holstad (NORCE), was established in 2025 to specifically identify opportunities where our ideas and results can drive innovations and enhance value creation in Norwegian businesses. ●



## 05 Cooperation between Centre Partners

**Constructive dialog between partners at the spring gathering. Patrizio Pelliccione of the Gran Sasso Science Institute (center) has a part-time position at SFI Smart Ocean.**

PHOTO: TERJE RESTAD



SFI Smart Ocean operates at the intersection of multiple scientific disciplines and spans various ocean industries and management sectors. Our initiative integrates a diverse range of technological components, presenting a complex set of challenges that necessitate close collaboration among our partners. Some partner contributes distinct yet complementary technologies and areas of expertise, while others serve as system integrators, providing a comprehensive perspective on complex systems and facilitating multidisciplinary integration.

Collaboration is fundamental to all activities within the Centre. The increasing engagement in testing various solutions in marine environments - particularly off the coast of Bergen and in the Arctic - has underscored the need for enhanced coordination across work packages. At our test site in Austevoll, industrial and research partners have worked together during field trials and preparatory phases, yielding valuable insights into both individual technology components and integrated systems. The data collected during these activities has proven instrumental for numerous scientists and PhD candidates focusing on measurement strategies and software architecture.

This year, a cruise north of Svalbard significantly strengthened our collaboration with the EU-funded HiAOOS project, which includes participation from several SFI partners. Over the course of six intensive weeks at sea, we undertook a range of demanding tasks that not only fostered teamwork among partners but also deepened our understanding of various challenges and the specific requirements involved in ocean observation and data collection in harsh environments.

The immersive nature of the operation allowed us to address real-world issues collaboratively, cultivating stronger relationships between scientific and industry partners. This collective effort has enhanced our ability to develop effective solutions tailored to the unique environmental conditions presented in the Arctic region.

We are actively developing a framework for student supervision through partnerships that leverage complementary competencies. This initiative seeks to enrich the learning experiences of Master's and PhD students, who serve as invaluable resources for the Centre. Their contributions significantly enhance various projects, meetings, and workshops, and they are increasingly recognized as integral members of the project teams.

Moreover, collaboration among partners broadens access to additional insights from industry, as both scientific and industrial associates maintain extensive networks of collaborators addressing related technological challenges. Industry clusters such as GCE Ocean Technology, GCE NODE, and NCE Seafood Innovation - each of which is a partner in SFI Smart Ocean - bolster our efforts by drawing on resources from a wider network of member companies. ●

## 06 Scientific Activities & Results



Sejal Pramlall, Phd student associated with Smart Ocean and participant in the One Ocean Cruise aboard "Statsraad Lehmkuhl", collects water samples. PHOTO: SEJAL PRAMLALL

### Autonomous sensors and measurement strategy

#### Sensor technology adaptation

The Smart Ocean network consists of significantly different modules with an underwater sensor network with an acoustic communication of selected and compressed data. Whereas above the sea there is a data and application service with the luxury of regular internet protocols. This year we have looked further into how these distinctively different layers can be linked together, in an internet of underwater things. Challenges are different or even lack of standardisation from underwater to air systems. The different modules and necessary integrations including metadata, data acquisition strategy and network implementation are mapped out, and the work will continue with a new dedicated task organized under the testing facilities of IF1.

#### Measurement strategy and anti-biofouling

For the physics-based real-time quality control, the focus has been on probabilistic analysis for self-diagnostics, also enabling an online evaluation of the measurement uncertainty over time for a limited set of correlated sensors. The methodology is to use Bayes' probabilistic theory on time series of data, where the observations update the probability of the correctness of the measurement. The method is verified using synthetic datasets with known errors, drift and random noise, and is tested on sensor data from Austevoll. PhD student **Astrid Marie Skålvik** submitted a paper on these results in November.

In addition, two Master's students at UiB have investigated self-diagnostics for pressure sensors from Reach Subsea (**Guro Kåshagen**) and on biofouling of oxygen sensors from Aanderaa in an onshore fish pen (**Ola Wiik**). Both Ola and Guro presented their work at the Centre's spring conference.

The work on nano technology for anti-biofouling and anti-corrosion has been carried out by associated UiB SEAS postdocs **Bichitra Nanda Sahoo** and **Paul Thomas** with their mentor **Martin Greve** in close collaboration with NORCE and Aanderaa. In the beginning of the year, a review paper was published on oceanographic sensors' response to fouling and state of the art for anti-biofouling methods. Initial laboratory experiments have been done for both transparent and metal samples. There are initiated field tests with transparent coating of turbidity and oxygen sensors.

#### Novel sensor technology

The work on Guided ultrasonic waves (GUW) for integrity measurements has been focused on the application of cement or grout integrity and on steel defects. PhD student **Amr Abboud** has successfully tested GUW for single-layer concrete with known faults during his research visit to Bordeaux. Amr has also collaborated closely with TSC Subsea.

Master's student at UiB, **Maja Villanger**, started her work on pulse compression methods for structural monitoring and defect detection in steel. ●●●

For distributed acoustic sensing (DAS) and state of polarization sensing (SOP) using fibre optical cables, PhD student **Julián Pelaez-Quiñones** has performed tests at MarinLab at HVL in close cooperation with Tampnet and Norce. Here he compared the acoustic response of different types of cables. Julián presented the work on storm detection in the North Sea by SOP sensing from a telecommunication cable at EGU in Vienna, and his work on sound detection in a fjord at Forum Acusticum Euronoise in Malaga.

The work on pH sensor technology has resulted in a research application for further innovation in collaboration between Aanderaa, UiB and NORCE.

### Marine optics

The research related to marine optics is linked to associated SEAS postdocs and Master's students at UiB. **Daniel Koestner** has published the results of long time series (2010–2022) of profiles of particulate organic carbon (POC) from optical measurements onboard the biogeochemical Argo floats in the Lofoten Basin. Håkon Sandven has worked with sensors for ambient light level measurements and how the interaction between light and the ecosystem is in the Arctic Ocean.

Two Master's students finished their thesis this spring. **Ole André Waldeland Høydal** on optical methods for particle size estimation in the Fram Strait, and **Simon Alvsaker** on experimental evaluation

of fiducial marker-based pose estimation for subsea operation. Simon's work was in close collaboration with Reach Subsea.

### Wireless network communication

The research in underwater wireless network communication encompasses development of software defined modems (SDM) where different modulation schemes and network protocols can run in real-time, and development of network protocols suitable for the specific challenges of underwater acoustics. The SDM hardware was the topic of Steffen Troy's Master's thesis, and he has now started a PhD on a new SDM generation. The network protocol development has initially been based on simulations, but now the work is coming together with an approach to run the developed network protocols on the processors used in the software defined modems. This is the topic of Varnan Jayasooriyan's Master's thesis which will be finalized in 2026..

Acoustic data was collected during NERSC's arctic cruise North of Svalbard in the late summer of 2025 and will be analysed in 2026. This data set is expected to be augmented in a new cruise in 2026.

There is also progress in the research towards reception of acoustic communication signals on underwater fibre cables using DAS (distributed acoustic sensing) and SOP (state of polarization). ●●●



Astrid Marie Skålvik presents her work on measurement uncertainty at a mini seminar. PHOTO: INGVAR HENNE



SDM hardware (Steffen Troy, Master's thesis, UiB 2025, design of MARLIN, a test platform for underwater communication) PHOTO: NORCE



Transmitter and receiver positions for the published SFI Smart Ocean Dataset, (van Walree et al, “Descriptor: The SFI Smart Ocean Dataset for Acoustic Communications (SODAC)”, IEEE Data Descriptions, 2025)

**Software technology and big-data middleware  
SFI Smart Ocean Cloud Platform**

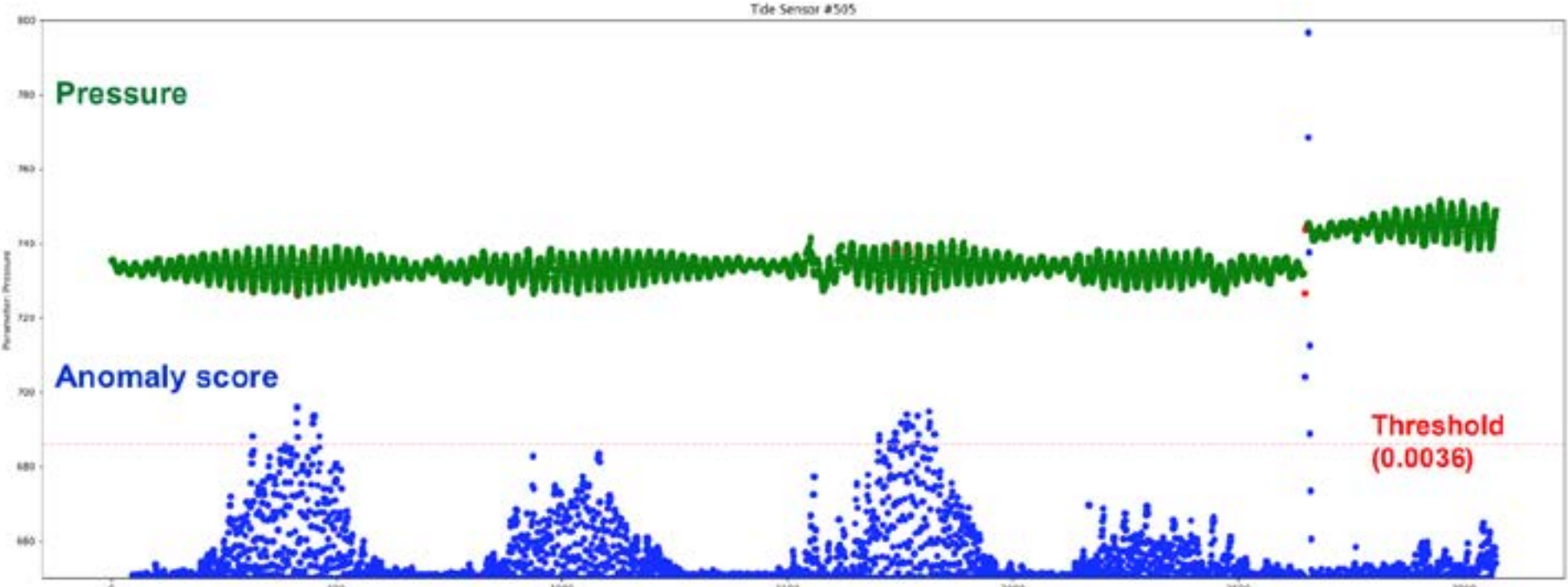
Development work has advanced on the SFI Smart Ocean Cloud platform, which has been continuously deployed in 2025 providing access to the real-time data flows and historical time series data from the Austevoll research station of IMR. This has included the first deployment of an implementation of the AdapAD algorithm for real-time data quality assessment developed as part of the PhD project of **Ngoc Thanh Nguyen** (see lower figure, at left). The NORCE Smart Ocean Data Explorer has been further developed and integrated as an end-user application using the provided software development kits. A prototype providing efficient handling of metadata and sensor configurations has been implemented and deployed as part of the cloud platform. Several conference and journal publications related to the platform were published in collaboration with international research partners in France, Italy, and Germany.

**Master's projects in software engineering and applied computer science**

There has been a substantial involvement of Master's students at HVL associated with the development of the SFI Smart Ocean platform as part of work package 3. The topics of the completed Master's projects in 2025 have included the development of software tool-assisted event detection for marine time series data, implementation and evaluation of unsupervised AI-based algorithms for sensor drift detection, cloud platform monitoring and telemetry data management, and the optimization of meta-data management for time series data. Several new Master's projects

have started up focusing on a data market places, middleware for underwater IoT, an improved API for retrieving historical time series and providing fine-grained authorization for data access, and a low-code approach for managing data flows in the real-time data service.

**At Aanderaa, we use a datalogger as a gateway for various connected sensors. These are typically systems with strict power constraints and limited data transmission bandwidth. In such systems, the algorithm developed in the Master's project of Pål Vindenes can be used either to trigger transmission of status data as an alarm event when something abnormal occurs or to avoid sending ordinary data that is not of interest. Pål has demonstrated that this can run locally on a resource-constrained embedded target.** - Jan Flatlandsmo (Aanderaa/Xylem)

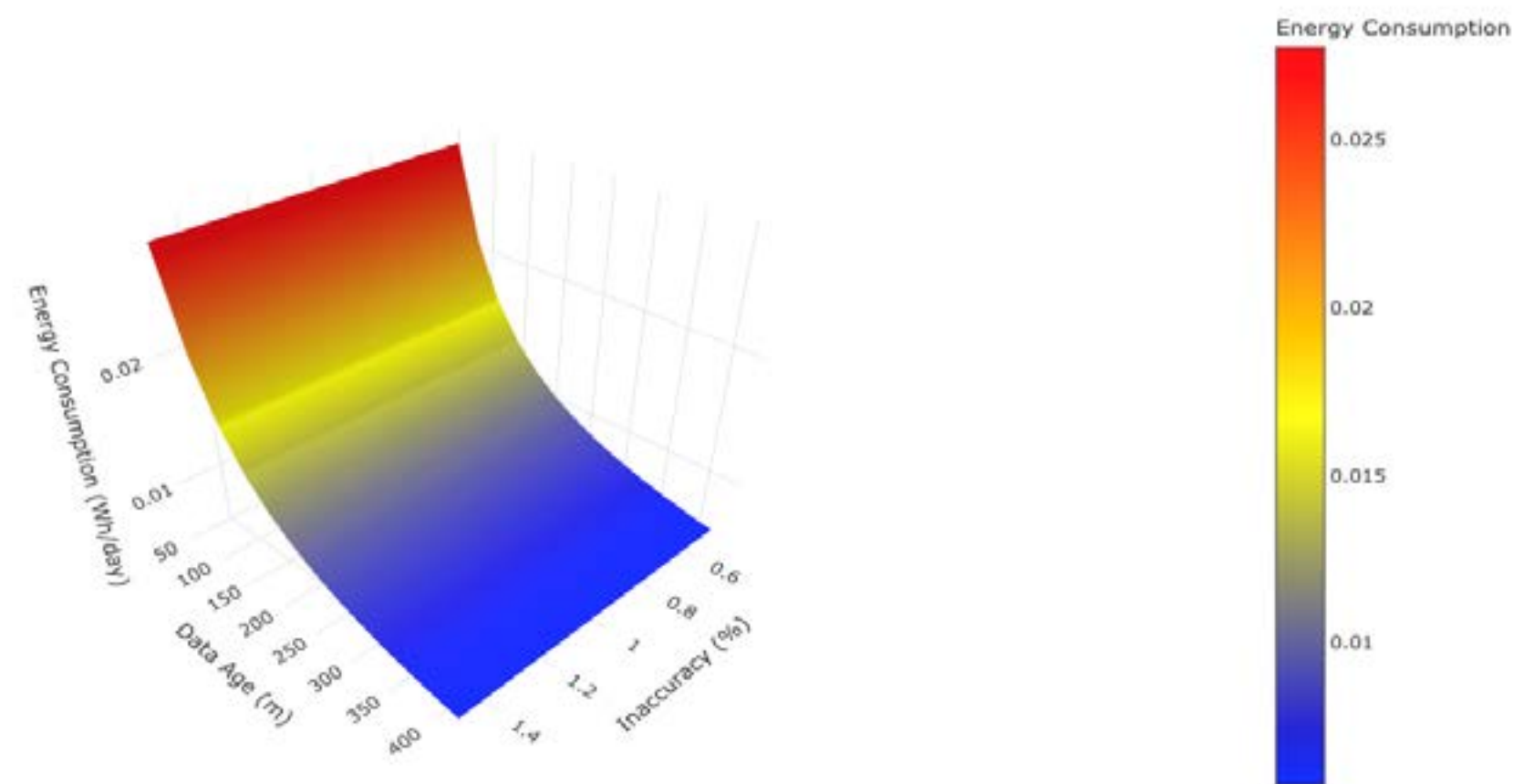


AdapAD calculates an anomaly score based on the real-time pressure measurements



**Jan Flatlandsmo**  
AANDERAA / XYLEM

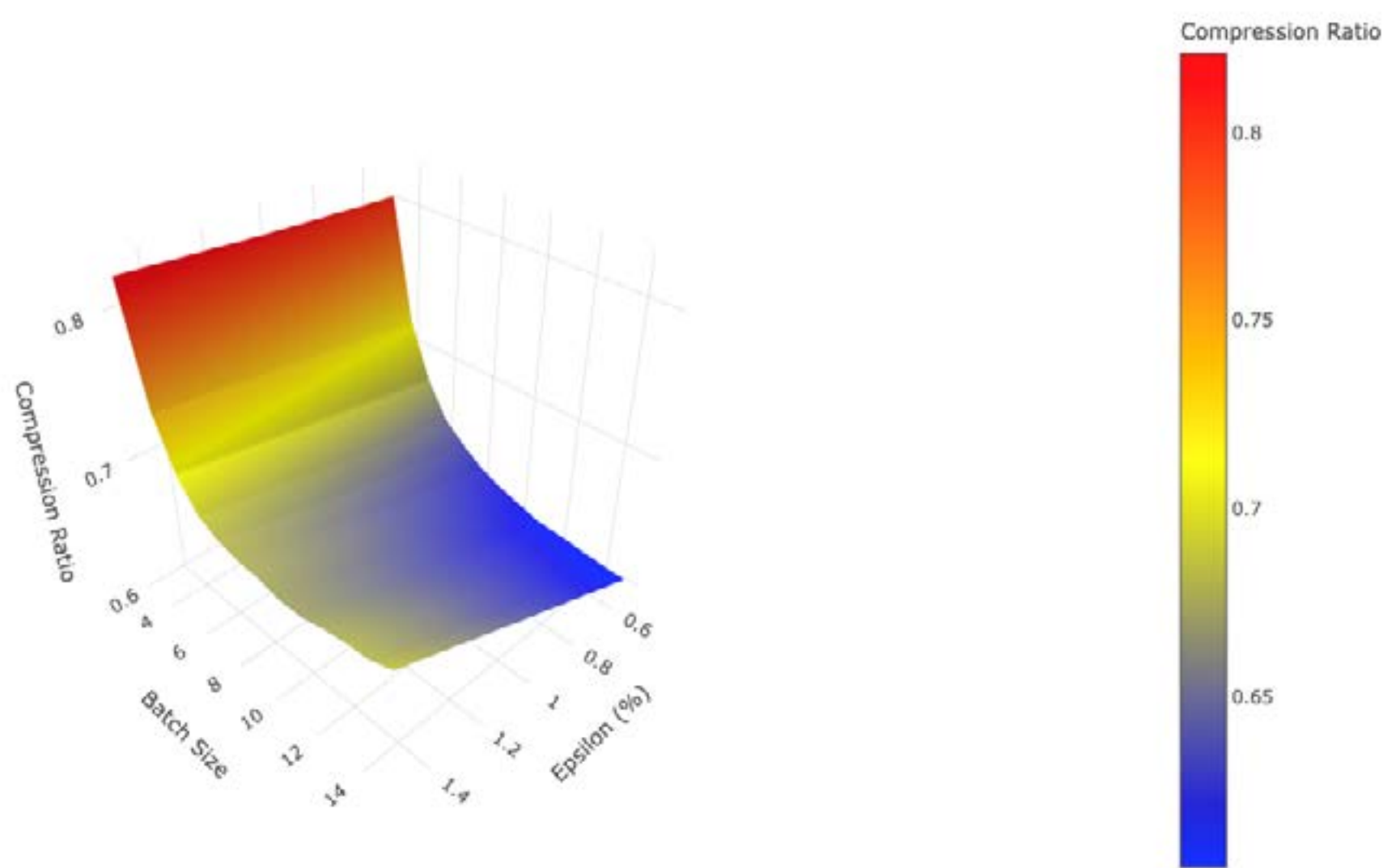
ENERGY CONSUMPTION



Edge computing and embedded data quality control

Master's student **Pål Hegrenes Vindenes** from HVL has been working in close collaboration with Aanderaa/Xylem on investigating the feasibility of performing data quality control directly on sensor hubs. This has resulted in a proof-of-concept prototype where data anomalies can be intelligently detected by the sensor itself. This may in turn may reduce the amount of data that needs to be transmitted across acoustics communication links. The approach relies on AI-based algorithms computing anomaly scores for data points in the time series. The results from the Master's project are currently being considered by Aanderaa/Xylem for further development of their sensor solutions, demonstrating the potential synergies between a Master's student project and industrial product development.

COMPRESSION RATIO



Digital Twin for Optimizing Acoustic Communication

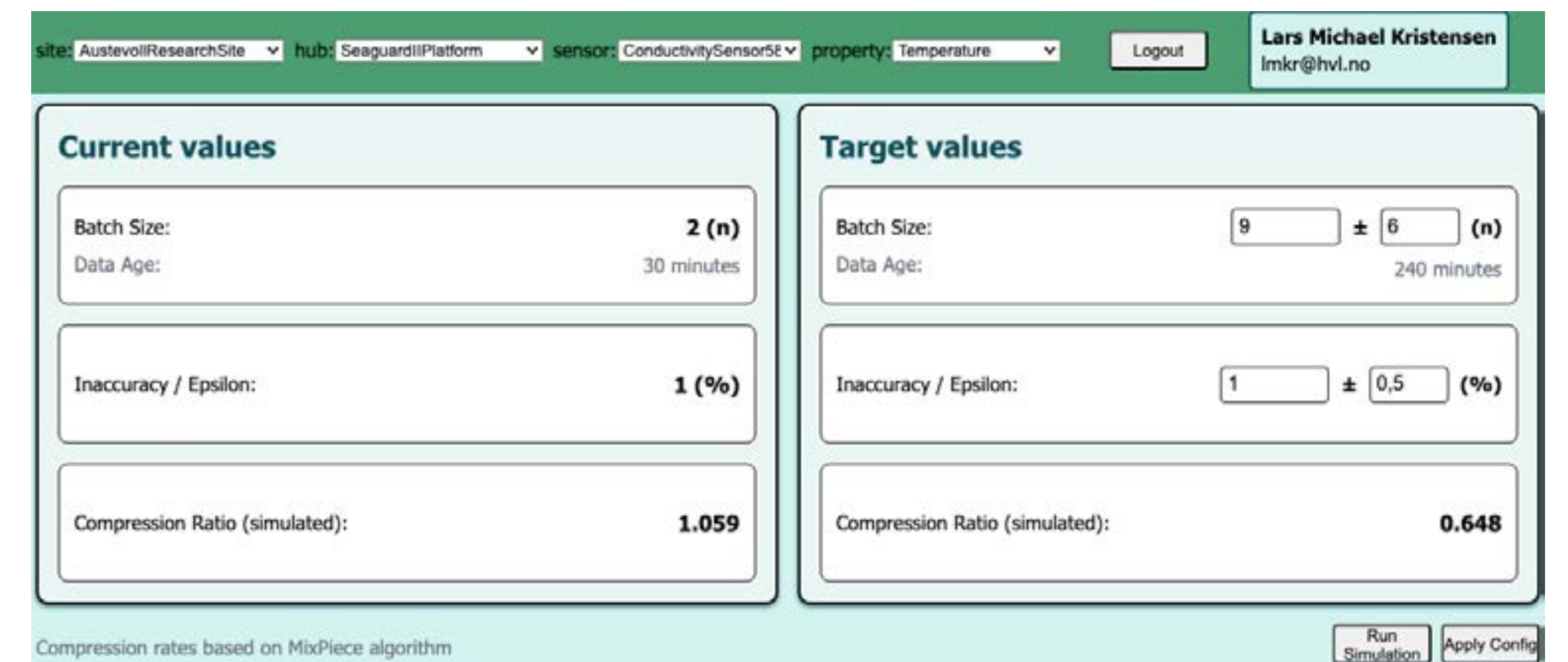
Bouvet and HVL has commenced their development of the digital twin solution initiated in 2024 as part of the PhD project of **Ivan Spajic** in work package 3. A digital twin has been developed targeting optimization of lossy compression algorithms for acoustic underwater communication. A web application dashboard (see figure at bottom right) makes it possible for the operator to set target values for data accuracy, and the embedded simulator will then determine optimal parameters focusing on data compression ratio and energy consumption of the resulting communication needs (see figures at left). The digital twin is based on a so-called mix-piece algorithm computing a linear approximation to time series

data. Further work includes the integration of the digital twin into the acoustic communication solutions being developed in work package 2.

Integrating functions

Field trials at Austevoll

Two major field trials were conducted on acoustic underwater communications this year, one in May for one route and the other involving two new routes in November. These trials were both based on the development of the Software Defined Modem (SDM) to verify modem performance on a new HW-platform. The test in May focused on network functionality to support multi-hop



The Bouvet application dashboard for the digital twin



Megan Thorsen  
Bouvet

Ivan Spajic  
PhD student, HVL

Industry and academia can often feel rather disconnected from one another, even when working within the same field. Our ongoing collaboration on the digital twin project provides a useful opportunity for learning on both sides, ultimately bridging the gap between the two. For the industry, it strengthens the scientific foundations behind the technical work, while for academia, it offers a real, societal purpose for the science conducted. More locally, the familiarity between Bouvet and HVL also creates internship and continuous learning opportunities for students and junior developers alike – Ivan Spajic (HVL) and Megan Thorsen (Bouvet)

and mesh architecture. In November, point-to-point communication performance was evaluated for several different distances and location of SDM nodes.

The NORCE Coastal Drone (ASV) was used to give a mobile communication node 15m below the surface as well as 4G connectivity for a control and monitoring channel. Students from both HVL and UiB were closely involved both in the preparations and completion of the trials. In addition to the SDM-tests, channel characterization was also performed, both by FFI and NORCE.

### HiAOOS 2025 Cruise: Expanding the Frontiers of Arctic Ocean Observation

SFI Smart Ocean has a close cooperation with the HiAOOS project, and hence we joined the summer cruise in August when scientists, engineers, and students embarked on the KV Svalbard in a collaborative effort to advance Arctic Ocean observation technologies. We conducted the first field tests of long-range underwater communication beneath Arctic sea ice. Results from these experiments will shape the design of future autonomous observing systems, where reliable under-ice communication is a gamechanger.

Researchers also measured light penetration and water properties under the sea ice. These observations, linked to student-led Master's projects, will help determine how changing ice and water conditions affect Arctic ecosystems and biological productivity.



Students at work on the sea ice, preparing optical instrumentation.

PHOTO: H. SAGEN, NERSC

Additional optical and CTD work in Svalbard fjords provided a valuable comparison between glacial meltwater environments and the central Arctic Ocean. More information about the cruise is available at the [HiAOOS website](#). ●

## 07 International Cooperation

All Centre partners engage in international collaborations and maintain offices abroad, making cooperation with their global networks—either directly or through affiliated activities—an integral aspect of our Centre's mission. As SFI Smart Ocean strives for a flexible, open, and vendor-neutral network technology, partnerships with end users and vendors worldwide are essential. Such collaborations will help maximize the impact of the technology solutions developed within the Centre and facilitate the implementation of standard technological solutions where applicable.

The Centre continues its engagement with the international industry standardization initiative, the Subsea Wireless Group (SWiG) where a number of our partners are active members. Particularly, spin-off projects from SFI Smart Ocean have contributed to the standardization work in SWiG by providing input to network protocols. The centre participants are also collaborating with institutions such as ISEN in France, and this partnership has expanded over the past year to include additional activities relevant to SFI Smart Ocean.

Moreover, the Centre maintains cooperation with the Helmholtz Institute for Environmental Research and the Max Planck Institute for Medical Research, focusing on anti-biofouling treatments for transparent substrates. This initiative is essential for enhancing the robustness of underwater sensors against biofouling. PhD students in software development, along with their supervisors, have established collaborations with the Gran Sasso Science Institute (GSSI) in Italy. Professor Patrizio Pelliccione at GSSI is also engaged in a

part-time position in SFI Smart Ocean, and PhD Keila Lima is now employed at this institute after her completion of her degree at HVL on IoT Data Integration and Quality in Marine Contexts as part of SFI Smart Ocean.

Additionally, the software engineering research group collaborates with Chalmers University of Technology in Sweden and the University Sorbonne Paris Nord in France. Two PhD students from HVL have undertaken several short international research visits, while one researcher spent a month at the University Sorbonne Paris Nord as a visiting professor. The Centre has been in further dialogue with both the University of Vaasa, Dinav Marine and European Maritime Safety Agency (EMSA) Subsea Services at the Techritory 2025 in Riga. ●●●

Students associated with SFI Smart Ocean participated in the One Ocean Cruise on "Statsraad Lehmkuhl". PHOTO: SEJAL PRAMLALL



## 07 International Cooperation

The University of Bergen participates in the SEAS program, a co-fund PostDoc mobility initiative. In this context, an American PostDoc is hired by UiB, whose activities are closely aligned with SFI Smart Ocean. Three additional PostDocs work in areas such as optics and nanotechnology. SFI Smart Ocean was also involved in the One Water application to the European Institute of Innovation and Technology (EIT).

The Centre will collaborate with OLAMUR, governed by IMR, for field trials of components from our observation system. SFI Smart Ocean also partners with The Nansen Environmental and Remote Sensing Centre (NERSC) on two international projects: the EU-funded HiAOOS – High Arctic Observation System, and the INTPART project UAK – Useful Arctic Knowledge. Both initiatives aim to strengthen education, research, and innovation in ocean observation technologies and include field trials in the Arctic Sea. These projects involve partners such as Scripps, the University of Rhode Island, and Laval University.

Imenco AS is collaborating with Brazilian partners on the project “Development of a Stand-Alone Subsea Instrumentation (SASI) Platform for Hydrocarbon Leakage Detection.” They are leveraging shared data needs and experiences from this project to inform SFI Smart Ocean’s efforts. SFI Smart Ocean was also presented at the November Conference in Rio last November.

Furthermore, funding applications have been submitted to Horizon Europe and the Research Council of Norway, in partnership with an extensive list of international collaborators. Both project development and future potential cooperation initiatives enhance our international cooperation and extend our global impact. ●



SFI Smart Ocean supported the One Water application to EIT. From left, Kathrin Jakobsen (Vestland County), Ingvar Henne, Andrea Magugliani, Jane Cathrine Særsten Jünger, and Charlotte Eide (UiB) PHOTO: ANDREA MAGUGLIANI

## 08 Communication & Dissemination

Our website, [www.sfismartocean.no](http://www.sfismartocean.no), contains public information, along with news about the Centre. Our [LinkedIn profile](#) is used for publication of recent, important happenings and upcoming events. We also have a [YouTube channel](#) with informative videos.

The open seminar series has been continued also in 2025. Topics from the seminars cover results from the Centre activities and other associated activities, and both industry and academia are represented. The seminars serve as a channel for information both internally in the Centre and externally.

We have been very visible in both the scientific communities, industry and in the educational system, particularly at HVL and UiB. A range of publications, presentations and other contributions have been prepared:

- **19** scientific papers published in journals or conference proceedings
- **33** scientific presentations, posters or guest lectures at industrial and scientific conferences, workshops and seminars
- **7** overall presentations of SFI Smart Ocean and activities in the Centre to industry and other users
- **7** contributions to external papers, web pages and exhibitions
- **16** Master's students working on topics related to SFI Smart Ocean completed their studies

Some of our Centre participants have also won international awards in 2025. **Edmary Altamiranda Maldonado** (AkerBP) won the Nordic

Woman in Tech Award NWITA, Category Digital Transformation Leader of the Year 2025. Edmary is recognized for her groundbreaking contributions in control systems, digitalization, and subsea technology. Earlier this year, she was named one of Norway's 50 Leading Women in Tech and was a [finalist for Petrolady of the Year](#).

PhD candidate **Sejal Pramlall** is one of five young ocean researchers to be given the [French Institute Nordic Award \(FINA\)](#). The award funded her participation at the third UN Ocean Conference in Nice in France in June.

PhD candidate **Julián Pelaez-Quinones** won the EAA Best Student Paper Award at [Forum Acusticum – Euronoise 2025](#) in Málaga, Spain. ●●●



**Kjell Eivind Frøysa (HVL) poses a question during the spring meeting.**

PHOTO: TERJE RESTAD / INSET: HVL



**Sejal Pramlall**  
PHD STUDENT / UIB

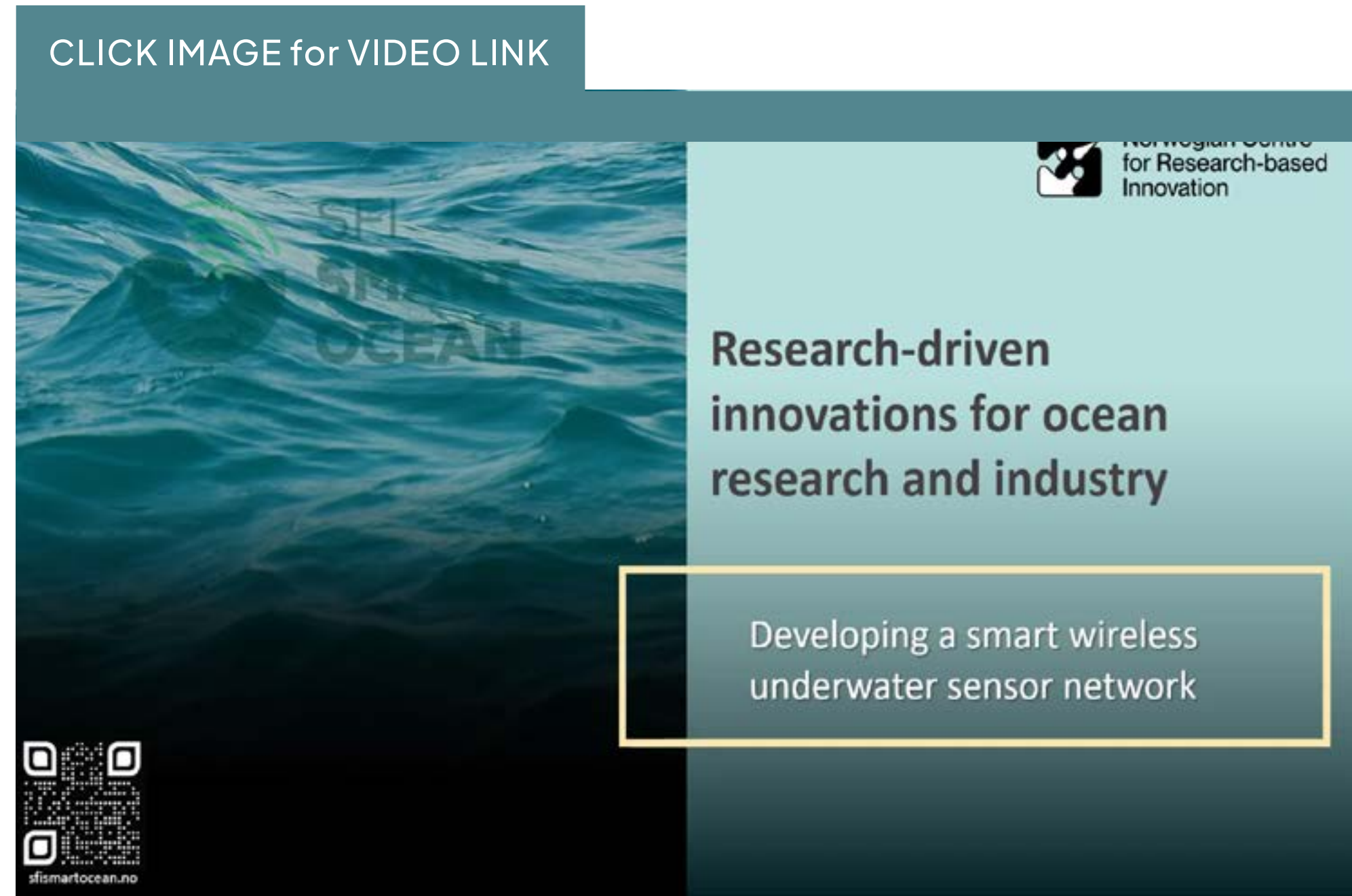


**Julián Pelaez-Quinones**  
PHD STUDENT / UIB



**Edmary A. Maldonado**  
AKERBP

## 08 Communication & Dissemination



A video (see left) introducing SFI Smart Ocean was presented at the November conference in Rio, and the Centre was also presented at the One Ocean Week arrangement in Seattle when Statsraad Lehmkuhl arrived in October. Students associated with SFI Smart Ocean also participated in the One Ocean Expedition.

The 4 postdocs from the SEAS program that are linked to SFI Smart Ocean (**Daniel Koestner** and **Håkon Sandven** in optics, and **Bichitra Nanda Sahoo** and **Paul Thomas** in nanophysics) presented their work at UiB's MSCA COFUND Annual Meeting in November.

SFI Smart Ocean invited to the conference “Creating Ocean Insights – Bridging Measurements and Data Management” in June. During this event, Centre participants showcased the research innovations and results stemming from the past year’s activities, highlighting the significant advancements made in ocean observation and data management. Internally in the Centre, communication was significantly strengthened by the two physical meetings held over two days each, one in June and one in October. The combination of external engagement at the conference and internal collaboration through meetings reflects SFI Smart Ocean's commitment to advancing ocean science and technology through effective communication and teamwork. ●

## 09 Recruitment

In 2025, SFI Smart Ocean recruited two new PhDs, both of whose projects relate to smart sensing and acoustic underwater communications. **Steffen Troy** started at UiB in August and is working on compact and energy-efficient smart sensors for wireless communications. **Yash Sanjay More** started at HVL in May 2025 and is developing a framework for Continuous and Automated Threat Modeling using Large Language Models (LLMs). ●



**Steffen Troy**  
PHD STUDENT / UIB



**Yash Sanjay More**  
PHD STUDENT / HVL

## 10 Annual Accounts 2025

### Funding

	Amount (1000 NOK)
The Research Council	10 777
The Host Institution (UoB)	16 136
Research Partners*	7 931
Enterprise Partners**	5 317
Public Partners***	71
<b>TOTAL</b>	<b>40 232</b>

### Costs

	Amount (1000 NOK)
The Host Institution (UoB)	18 225
Research Partners	17 669
Enterprise Partners	4 267
Public Partners	71
<b>TOTAL</b>	<b>40 232</b>

\* NORCE, HVL, NERSC, IMR, FFI

\*\* Aanderaa Data Instruments AS, Reach Subsea AS, TSC Subsea AS, IMENCO Future Technologies AS, Kongsberg Discovery AS, Tampnet AS, Bouvet Norge AS, Odfjell Technology AS, Aker BP AS, WSENSE AS, GCE NODE Service AS, GCE Ocean Technology, NCE Seafood Innovation

\*\*\* Directorate of Fisheries, Norwegian Ocean Industry Authority

## 11 Personnel SFI Smart Ocean 2024

### Centre Administration

Henne, Ingvar	UiB	Centre Director
Holstad, Marie Bueie	NORCE	Deputy Centre Director
Terje Restad	UiB	Administrative Manager
Kavitha Østgaard	UiB	Communication Manager

### Key Researchers

Key Researchers	Institution	Main Contributions
Henne, Ingvar	UiB	Centre Director
Greve, Martin M.	UiB	Novel sensor technology & anti-biofouling: pH sensor
Lunde, Per	UiB	Guided Ultrasonic Waves (GUW)/Distributed Acoustic Sensing (DAS)
Sætre, Camilla	UiB	Measurement strategy and uncertainty/Marine optics
Pedersen, Audun O.	UiB	Guided Ultrasonic Waves (GUW)/Distributed Acoustic Sensing (DAS)
Hamre, Børge	UiB	Marine Optics Polarization (PoS)
Kristensen, Lars M.	HVL	Adaptive Data Retrieval Methods and Visualisation
Heldal, Rogart	HVL	Software Engineering: Software Quality, Modelling and Validation
Frøysa, Kjell-Eivind	HVL	Measurement Strategy and Uncertainty
Oyetoyan, Tosin Daniel	HVL	Software Engineering: Software Quality, Modelling and Validation
Kampen, Anne Lena	HVL	Communication Protocols and Network Architecture
Holstad, Marie Bueie	NORCE	Deputy Centre Director
Cook, Jeremy	NORCE	Adaptive Data Retrieval Methods and Visualisation
Henriksen, Bård	NORCE	Underwater communications: Requirements, limitations, and possibilities
Vahlin, Anders	NORCE	Software modems – modulation, protocol implementation and experiments
Langeland, Tor	NORCE	Adaptive Data Retrieval Methods and Visualisation
Thomas, Peter James	NORCE	Distributed Acoustic Sensing (DAS)
Tomasi, Beatrice	NORCE	Software modems – modulation, protocol implementation and experiments
Bergh, Øivind	IMR	Coordinate activities in IFI
Sagen, Hanne	NERSC	Geographical testing location Svalbard Nord
Storheim, Espen	NERSC	Geographical testing location Svalbard Nord
Otnes, Roald	FFI	Underwater communications: Requirements, limitations, and possibilities
van Walree, Paul	FFI	Underwater communications: Requirements, limitations, and possibilities

## 11 Personnel SFI Smart Ocean 2025

### Postdoctoral researchers working on projects in the Centre with financial support from other sources

Name	Funding	Nationality	Period	Sex	Topic
Koestner, Daniel	EU/UiB	USA	06.22 – 05.26	M	Improving the capabilities of autonomous platforms in marine science with optical sensors
Sandven, Håkon J.	EU/UiB	Norway	06.23 – 11.26	M	Development and use of instrumentation for monitoring of light scattering and absorption by marine particles
Sahoo, Bichitra N.	EU/UiB	India	10.23 – 9.26	M	Reinventing anti-biofouling coatings for combating biofouling of marine sensors
Thomas, Paul	EU/UiB	India	11.23 – 10.26	M	Study on bifunctional nanozyme activities of layered double hydroxide derived Zn-Mo films for anti-biofouling and anti-corrosion applications in the subsea environment

### PhD students with financial support from the Centre budget

Name	Nationality	Period	Sex	Topic
Skålvik, Astrid M.	Norway	1.22 – 12.25	F	Self-diagnostics and self-calibration methodologies for underwater sensors
Lima, Keila	Cape Verde	1.22 – 31.24	F	Software Engineering Methodology: Software Quality, Modelling and Validation
Ngoc-Thanh Nguyen	Vietnam	04.21 – 04.25	M	A framework for real-time marine data quality control
Abboud, Amr	Syria	9.22 – 8.26	M	Guided ultrasonic waves (GUW)
Al Shayokh, Md.	Bangladesh	6.23 – 5.27	M	Communication protocols
Pelaez Quiñones, J. D.	Colombia	12.23 – 11.27	M	Distributed acoustic sensing
Steffen Troy	Norway	09.25 – 09.29	M	Software modems - Embedded signal processing for wireless underwater sensors

### PhD students working on projects in the Centre with financial support from other sources

Name	Funding	Nationality	Period	Sex	Topic
Cheatham, Shea	UiB	USA	12.22 – 11.26	F	Modeling and measuring light in changing polar waters
Spajic, Ivan	HVL	Croatia	10.22 – 09.27	M	Digital twins in the maritime domain
Pramlall, Sejal	UiB	S.Africa	08.24 – 07.28	F	Improving the utility of ocean colour remote sensing for monitoring water quality using hyperspectral data
Lie, Espen Oen	HVL	Norway	10.24 – 09.29	M	Heterogeneous real-time data sources
More, Yash Sanjay	HVL	India	05.25 – 04.29	M	Continuous and automated threat modelling

### Master's Degrees

Name	Sex	Topic
Sjursen, Hanne	F	Design og optimalisering av et ROV-operert UXO-sensorsystem
Larsen, Kristine Ø.	F	A combined experimental and numerical study of nylon moorings for the INO WIND-MOOR floating wind turbine
Gravdal, Viktor Karl & Wergeland, Andreas F.	M	Unsupervised drift detection for quality control of long-term oceanographic data
Troy, Steffen	M	Design of MARLIN a test platform for underwater communications
Svendsen, Erica I.	F	Numerical mooring analysis and accidental limit state assessment of a floating closed aquaculture cage
Kristoffersen, Hanne J.	F	Eksperimentell responsanalyse av en lukket sjømerd med rammefortøyning
Falk, Hedde W.	F	Comparison of analytical models for wind farm flows
Dybevik, Vilde S.	F	Transmit-receive switching for ultrasound pulse-echo measurements
Hübschle, Mats N.	M	Nonlinear a propagation in fisheries acoustics: comparison between numerical solutions
Wiik, Ola	M	Spektralanalyse og maskinlæring for automatisk deteksjon av biofilm på optiske oksygensensorar
Alvsaker, Simon	M	A spectral matching approach to identify and investigate bio-optical anomalies in coastal waters and fjords
Kåshagen, Guro G.	F	Self-diagnosis for three redundant underwater pressure sensors
Waldeland, Ole A.	M	Examining optical methods for particle size estimation in the fram strait
Drivenes, Mikal	M	Optimizing storage of metadata in time-series sensor networks
Heggedal, Sigve B.	M	A software tool-assisted approach to event detection & annotation in marine time series

## 12 Publications 2025

**B. Tomasi et al.**, Operational Results from UNDINA Project for the Characterization of Underwater Communication Performance, OCEANS 2025 Brest, Brest, France, 2025, pp. 1–7

**A. Kaszubowska-Anandarajah et al.**, Intent and Context-Aware Optical Networks, 2025 25th Anniversary International Conference on Transparent Optical Networks (ICTON), Barcelona, Spain, 2025, pp. 1–2

**K. S. Vaskinn, D. J. Elson, S. Beppu, D. Soma, S. Bjørnstad, D. R. Hjelme, and Y. Wakayama**, Localising State-of-Polarisation Perturbation on a Repeated Link Using Wavelength Dispersion Delay Walk-Off, in Optical Fiber Communication Conference (OFC) 2025, Technical Digest Series (Optica Publishing Group, 2025), paper Th2A.39

**A. F. Baird, J.P. Morten, V. Oye, S. Bjørnstad**; Ocean Space Surveillance and Real-Time Event Characterization Using Distributed Acoustic Sensing on Submarine Networks, *Seism. Res. Ltrs.* 2025; 96 (2A): 691–705

**S. Bjørnstad, J. Gjesdal, A. Tysdal**, State of Polarization Sensing– Correlating Across Cable Sections, *SubOptic2025*, 2025

**S. Bjørnstad, J. Gjesdal, Ø. Blaauw, A. Tysdal**, A Scaleble Fibre Sensing Architecture for Telecom Operators, *SubOptic2025*, 2025

**E. Altamiranda, N. Judell, C. Baldone, G. E. Galioto, D. Spaccini and C. Petrioli**, Experimental Trials for the Dual Channel Acoustic Communication Protocol, in *IEEE Internet of Things Journal*, vol. 12, no. 20, pp. 42769–42789, 15 Oct.15, 2025

**P. Van Walree et al.**, Descriptor: The SFI Smart Ocean Dataset for Acoustic Communications (SODAC), in *IEEE Data Descriptions*, vol. 2, pp. 218–223, 2025

**Evangelista, S., Kristensen, L.M. & Petrucci, L.** Evaluation of a distributed explicit state space exploration algorithm with state reconstruction for RDMA networks. *Int J Softw Tools Tech Transfer* 27, 149–168 (2025)

**Aziz, N.A.A.A., Kong, E.D.H., Lai, C.W. et al.** Synthesis of d-glucose modified graphene oxide with epoxy composite coating as an anticorrosion protective approach. *Int. J. Environ. Sci. Technol.* 22, 10783–10794 (2025)

**Lunde, P.; Pedersen, A.O.** Criteria for Consistent Broadband Pulse Compression and Narrowband Echo Integration Operation in Fisheries Echosounder Backscattering Measurements. *Fishes* 2025, 10, 389

**E.N. Mosland, P. Lunde, J. Kocbach**; Comparison of measured and finite element-based diffraction correction (FEDC) for ultrasonic measurement systems in a gaseous medium. *J. Acoust. Soc. Am.* 1 June 2025; 157 (6): 4273–4284

**Koestner, D., Clayton, S., Lerner, P., Jones-Kellett, A. E., & Walker, S. L. (2025).** Biogeochemical-Argo floats reveal seasonality of the biological carbon pump influenced by the Lofoten Basin Eddy. *Geophys Res Ltrs*, 52, e2024GL111937

**Sandven, H., Granskog, M. A., Opdal, A. F., Connan-McGinty, S., Hamre, B., & McKee, D. (2025).** Increased light availability in the northern Barents Sea driven by sea ice loss. *J of Geophys Res: Oceans*, 130, e2025JC022370

**K. Lima, T. D. Oyetoyan, R. Heldal and W. Hasselbring**, Evaluation of MQTT Bridge Architectures in a Cross-Organizational Context, 2025, IEEE 22nd International Conference on Software Architecture (ICSA) (2025): 243–254

**Md Al Shayokh, A.-L. Kampen, K.E. Frøysa, L. M. Kristensen**, Performance Impact of Wind Speed on MAC Protocols for Underwater Wireless Sensor Networks, *Procedia Computer Science*, Volume 257, 2025, Pages 190–197

**I. Spajić, L.M. Kristensen, V. Stolz**, Toward Digital-Twin-Assisted Data Acquisition in Underwater Acoustic Sensor Networks, *Procedia Computer Science*, Volume 257, 2025, Pages 241–248

**Sahoo, B.N., Thomas, P.J., Thomas, P., Greve M.M.** Antibiofouling Coatings For Marine Sensors: Progress and Perspectives on Materials, Methods, Impacts, and Field Trial Studies, *ACS sensors*, 2025

**Nguyen, N.-T., Skålvik, A.M., Sylligardos, E., Heldal, R., Pelliccione, P., Boniol, P.** Interpretable Multivariate Anomaly Detector Selection for Automatic Marine Data Quality Control, 2025 IEEE International Conference on Big Data (Big Data), Macau, China, pp. 1494–1499

## 13 Presentations & Posters 2025

**Øivind Bergh:** Marine Multi-Use as a Means to Achieve 30x30, Arctic Frontiers 2025, January 29, 2025

**Ingvar Henne:** A wonderful world of wireless communication, Bergen School of Architecture, January 15, 2025

**Ingvar Henne:** Autonomous systems for digitalization of the food industry, BI Norwegian Business School, January 20, 2025

**Paul van Walree:** The Smart Ocean dataset for acoustic communications, Seminar series – SFI Smart Ocean, February 28, 2025

**Ilker Fer:** NorEMSO, ocean observation infrastructure in the Nordic Seas, Seminar series – SFI Smart Ocean, March 28, 2025

**Bichitra Nanda Sahoo:** Transparent anti-biofouling coating, Seminar series – SFI Smart Ocean, April 24, 2025

**Julián Pelaez-Quiñones:** Storm detection in the North sea with a subsea telecommunication cable and State of Polarization sensing, EGU 2025, April 30, 2025

**Julián Pelaez-Quiñones:** Underwater sound detection with a taut, vertically suspended fibre-optic cable and distributed acoustic sensing, Forum Acusticum Euronoise 2025, June 24, 2025

**Ingvar Henne:** Fra toktbasert datainnsamling til sanntidsmålinger tilgjengelig i skyen, Fjordkonferansen 2025, June 17, 2025

**Keila Lima:** Evaluation of MQTT Bridge Architectures in a Cross-Organizational Context, 22nd International Conference on Software Architecture, April 3, 2025

**Marie Bueie Holstad:** From Ocean to User: ensuring data quality, DigiPro Centre medlemsamling, April 23, 2025

**Paul van Walree:** An explanation of the empirical range-rate relationship in underwater acoustic communications, 38th Symposium on Hydroacoustics 2025, May 7, 2025

**Sejal Pramlall:** How can society benefit from courses such as the ones on board the tall ship? One Sustainable and Equitable Ocean, Statsraad Lehmkuhl, Quai Riboty, Port of Nice, June 7, 2025

**Steinar Bjørnstad:** State of polarization sensing – correlating across cable sections, SubOptic 2025, June 4, 2025

**Steinar Bjørnstad:** A scalable fibre sensing architecture for telecom operators, SubOptic 2025, June 4, 2025

**SFI Smart Ocean spring conference 2025: Creating Ocean Insights – Bridging Measurements and Data Management, June 3, 2025**

**Ingvar Henne:** From Cruise-based observations to real-time online monitoring

**Kjell Eivind Frøysa:** Measurement strategy for ocean monitoring

**Keila Lima:** Marine data systems monitoring

**Ivan Spajic:** Toward Digital-Twin-Assisted Data Acquisition in Underwater Acoustic Sensor Networks

**Håkon Sandven:** Light and life: Remote sensing and in situ optical measurements

**Alvaro Doval:** Novel fiberoptical sensing technologies

**Anders Tengberg:** Getting more out of your deployments by combining auxiliary sensor data

**Astrid Marie Skålvik:** Data quality assessment based on physical models

## 13 Presentations & Posters 2025

**Petter Kvadsheim:** The impact of acoustic signals on life in the ocean

**Paul van Walree:** The Smart Ocean dataset for acoustic communications

**Gjermund Mathiesen:** Dual-frequency protocol for acoustic communications

**Beatrice Tomasi:** Multi-modal underwater communication for AUVs

**Md al Shayokh:** Acoustic underwater network architecture

**Ola Wiik:** Spectral Analysis for Marine Biofouling Monitoring on Oxygen Optodes

**Guro Fosshagen:** Self-diagnosis for three redundant pressure sensors

**Steffen Troy:** MARLIN - a test platform for underwater communications

**Pål Hegrenes Vindenes:** Embedded AI-based anomaly detection for marine sensor systems

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**Steinar Bjørnstad:** Protecting Internet subsea infrastructure transforming optical communication cables into sensors, IGF 2025, June 26, 2025

**Hanne Sagen:** HiAOOS 2025 arctic research cruise, Seminar series – SFI Smart Ocean, September 26, 2025

**Paul van Walree:** A journey from underwater acoustics to underwater communications, University of Alabama, October 3, 2025

**Camilla Sætre et al:** Statistical methods for autonomous data quality control and self-diagnostics in underwater sensor networks, MathMet 2025, October 7, 2025

**Lars Michael Kristensen:** The Smart Ocean Platform. Providing underwater sensor network data in cloud computing services, AI Talks Seminar Series UiS, April 10, 2025

**Lars Michael Kristensen:** KI og smarte software systemer: Who rules the waves?, Maritim Uke Haugesund, September 3, 2025

**Lars Michael Kristensen:** Coloured Petri Nets for modeling and validation of concurrent systems, Petri Nets PhD School, Paris, France, June 21, 2025

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**NorEMSO workshop, One Ocean Week, April 11, 2025**

**Ingvar Henne:** A sensor- and communication system for real-time ocean monitoring

**Lars M. Kristensen:** The SFI Smart Ocean Platform: Software Architecture for Real-time and Historical Data Services

**Astrid Marie Skålvik:** Bayesian Networks for sensor data quality diagnostics

**Håkon Sandven:** From optical measurements to underwater light models in the Barents Sea: Further potential for biogeochemical sensors

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**Ingvar Henne:** The path from research towards innovations and industrial impacts, FoU-forum Vestland, September 10, 2025

**Ingvar Henne:** Forskning til industriell nytte, Energiomstilling Vest, September 22, 2025

**Ingvar Henne:** Innovasjoner for havforskning og havindustri, Erfaringsutveksling HI / SINTEF, September 24, 2025

**Ingvar Henne:** Research-based innovations and industrial impacts, EnergiRike Toppledersamling, November 19, 2025