SFI AutoShip Christmas newsletter 2023

Season's greetings from the Centre Director

The end of 2023 has arrived, and it has been yet another exciting year for SFI AutoShip! We held a number of events, with the main ones being the SFI days, two researcher workshops, and a parallel session on autonomous ships as part of Ocean Week. In all cases, events were improved by high attendance and excellent contributions by our partners, whose engagement in the Centre's research activities is steadily growing. The increased collaboration among our partners was also manifested through 7 webinars that were co-organized by more than 10 members of our consortium. One of the webinars resulted in the newly established working group on COLREGs, which will commence its activities in early 2024.

During 2023, our research capacity was increased to a total of 18 PhDs, 2 postdocs and one researcher. Our researchers published very interesting results on a wide range of topics, and our dissemination activities have continued, both nationally and abroad. In total, close to 150 results were registered by the Centre in 2023, including scientific publications, popular science publications, dissemination activities and graduated MSc theses. Even more importantly, following the adoption of our utilization plan by the Board, we put a lot of emphasis on training our researchers in pursuing innovation, starting with an innovation workshop in March, as well as several additional sessions on commercializing results, submitting DOFIs and collaborating with NTNU Technology Transfer.

SFI AutoShip has entered the phase where tight collaboration among the partners is actively taking place in pursuit of producing research-based innovations in the near future. In anticipation of many exciting joint results during 2024, I wish you all Happy Holidays and a Happy New Year!

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SFI Days

The annual **SFI AutoShip Days** on 16-17 October was attended by over 90 participants. Several consortium partners contributed to a strong programme, with many interesting presentations and discussions, including:

- Twelve **innovation leads**, presented by our PhDs and postdoctoral researchers
- **Torghatten**: Experiences from the world's first autonomous passenger ferry operation in Stockholm
- **Kongsberg Maritime**: Results from the Autoship H2020 project
- **DNV**: Testing collision and grounding avoidance systems
- **NTNU, IFE** and **Fugro**: Experiences within human factors and remote operations
- **NMA** and **NTNU**: Results of large-scale surveys including seafarers' views on autonomy at sea
- **Maritime Robotics**: an overview of their activities, including the upcoming first uncrewed freight route at sea
- **NTNU Technology Transfer**: tools for creating value from research, a main goal for our Centre
- **SINTEF**: an overview of automated mooring systems
- A presentation and posters by international guests from the MSCA ETN **AUTOBarge** project

Our **Scientific Advisory Committee**, with Nikolaos P. Ventikos, Thor I. Fossen and Paolo Braca, participated in the SFI Days and contributed with their feedback and a report assessing the Centre.

Ocean Week

SFI AutoShip and Ocean Autonomy Cluster (OAC) co-organized a joint session on Autonomous ships during **NTNU's Ocean Week** on 2 May, coordinated by our Innovation Manager Kjell Olav Skjølsvik and OAC's Frode Halvorsen. The session was well-attended by approx. 70-80 participants. In addition to introductions to SFI AutoShip and OAC projects, presentations focused on research infrastructure for autonomous ships (**NTNU** and **SINTEF**), efforts to increase autonomy in marine operations (**Equinor**), the short sea shipping use case in the H2020 Autoship project (**Kongsberg Maritime**), the framework around maritime autonomy (**DNV**), and preparations for the world's first commercial autonomous ferry operation in Stockholm (**Torghatten** together with **Zeabuz**). This was the first event in which four of our researchers held **innovation pitches** to a larger audience based on their innovation leads - these pitches were further developed before the SFI Days in which most of the Centre researchers presented.

2023 OCEAN WEEK

Autonomous ships – get insights and updates from leading researchers and industry

Reidun Svarva, Torghatten

Are Jørgensen, DNV

Anastasios Lekkas, NTNU and SFI Autoship

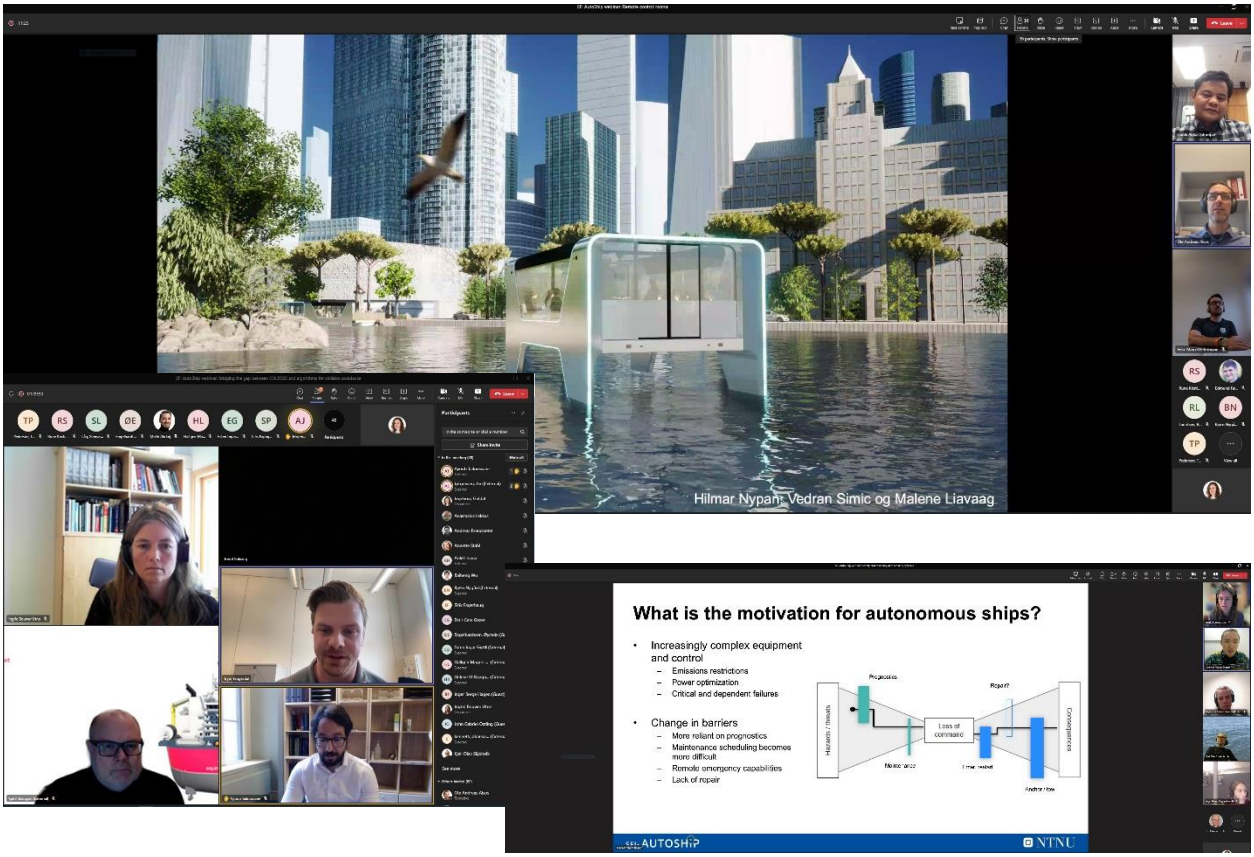
Meet them and many more at the parallel session «Autonomous ships»

Tuesday May 2nd, 12:30-16:30

NTNU OCEANS

NTNU

Webinars



We started arranging regular webinars during 2023 and will continue this going forward. They have been consistently well attended and have been a great way for researchers and industry/public sector partners to collaborate. Recordings of the webinars are available to the consortium in Teams: 3 Webinars

Overview of webinars in 2023:

1. Feasibility study of an unmanned cargo ship (**SINTEF**)
2. Bridging the gap between COLREGS and algorithms for collision avoidance (**NTNU, UiO, DNV**)
3. Automated docking for marine surface vessels (**NTNU, Kongsberg Maritime, DNV**)
4. Condition monitoring (**NTNU, DNV**)
5. Remote control rooms (**NTNU**)
6. AEGIS project (**NCL, MacGregor, Trondheim Havn, SINTEF**)
7. Safety and reliability of machinery systems (**NTNU, Torghatten**)

Board meetings

Telia kindly hosted the Spring Board meeting at their headquarters in Oslo in June. This was the first Board meeting at the premises of a partner. While there, Telia Board member Henning Huuse gave us an excellent guided tour of the 5G lab. The Board's Autumn meeting in November was held on Teams. **DNV** took over the Board chair from **Kongsberg Maritime** in 2023, first with Hans Anton Tvete and then with Øystein Engelhardtsen as Chairman.

Researcher workshops

The **Spring researcher workshop** was held on March 15, and included participation from industry partners **DNV, Gard** and **Maritime Robotics** in addition to research partners. The day was as usual split in two parts:

1. Plenary session covering general discussion issues and introducing new researchers (1 new PhD and 1 visiting PhD)
2. Parallel sessions (per or across work packages). Focused on the involvement of each PhD/postdoc with industry partners and improving cross-work package coordination.

Along with research partners there was increased industry participation in the **Autumn researcher workshop** on September 11, including representatives from **DNV, Kongsberg Maritime, Fugro** and **Torghatten**. The plenary session offered examples on submission of DOFIs and researcher mobility.

In the parallel sessions according to work packages the annual work plan for 2024 was discussed, and industry contact persons were assigned or planned for each PhD/PD.

Innovation workshops

Two innovation workshops were organized in 2023, focusing on guiding our PhDs and postdocs towards investigating commercial potential from their research findings. The first workshop, in March, was arranged in collaboration with **SFU Engage**, one of NTNUs Centres for Excellence in Higher Education. 17 innovation leads were developed, and researchers pitched their leads to a panel consisting of **Kongsberg Maritime** representing the SFI consortium, the Centre director

and Innovation manager representing the SFI management, as well as SFU Engage and **NTNU Technology Transfer**. Anders Aune from NTNU Technology Transfer also contributed in a follow-up workshop in December, discussing how to identify potential innovations, and developing DOFIs. Centre researchers have submitted three DOFIs so far, one of which is being evaluated by the Board. PhDs and postdocs were also encouraged to further develop dissemination in the form of "innovation stories" in the workshop. The innovation workshops were led by SFI Innovation manager Kjell Olav Skjølsvik.

Site visits

In February, WP leader for Use cases Trond Johnsen and PhD candidates Simon Lexau, Susanna Dybwad Kristensen and Raffael Wallner visited SFI partner **Reach Subsea** in Haugesund, as part of Use Case 4 Offshore support operations. Thorough introductions to ongoing offshore support operations and technology were given, followed by discussions around the use of unmanned surface vessels (USVs). Use case owner **Equinor** also participated in the workshop.

While in Haugesund, the **Norwegian Maritime Authority** (NMA) facilitated a workshop focusing on the risk-assessment of USVs and autonomous ships in general. **DNV** also contributed to this workshop with their insight from a classification perspective. Risk assessment will be an important focus area for Use Case 4.

A third Use Case 4 site visit was organized in February, as researchers and PhD students visited SFI partner **Fugro** in Nootdorp in the Netherlands. They received a guided tour around the Fugro TechCentre observing the technology development and prototyping. Fugro also provided a remote live tour of the Remote Operation Centre in Aberdeen. From this ROC, both ROVs and USVs are remotely operated.

Plans were made for future collaboration on research activities, specifically around the PhD projects. Use case owner **Equinor** also participated in the workshop.

Two WP3 researchers, Taufik Akbar Sitompul and Felix-Marcel Petermann, visited **Fugro**'s Remote Operation Centres (ROCs) in Aberdeen, Scotland in August. They observed the facilities of Fugro's ROCs, which included the ROCs for the unmanned surface vehicle (USV) Orca and the remote-operated vessel (ROV) Blue Essence.

The researchers also interviewed a superintendent and the global product manager of Fugro, who shared their insights into the transition from conventional vessel-based operations to ROC-based operations. The field trip was a valuable learning experience for the researchers, who hope to apply their findings to improve the design and evaluation of autonomous and remote-controlled vessels.

Newly hired researchers

Emir Cem Gezer

Emir Cem Gezer took up his position as a PhD candidate at NTNU's Department of Marine Technology in January. Holding a bachelor's degree in computer engineering and having completed his master's degree in ocean engineering with a specialization in underwater vehicles, Emir brings an interdisciplinary perspective to his research in autonomous mission management, guidance, and safeguarding control of autonomous ships.

Emir's research focuses on establishing a relationship between high-level vessel operations and supporting ship systems. With an emphasis on safe and intelligent coupling, he explores the topological abstraction of main functions within an autonomous ship control system. Emir aims to formulate nominal operating modes and design safeguarding control functions to ensure the seamless and secure operation of autonomous ships. Additionally, he delves into the development of algorithms for entering and maintaining Minimum Risk Conditions (MRCs) and works on creating a mode-based control architecture for efficient switching between control modes and MRCs.

In addition to those mentioned above, he is a musician who can solve a Rubik’s cube in a minute.

Welcome to the SFI, Emir!

Peter Morris

Peter Morris started as a PhD Candidate at NTNU's Department of Electronic Systems in October, and is tasked with "Data Fusion in Maritime IoT" as part of Work Package 2 Enabling Key Technologies. He aims to build systems that enable improved

cooperation and coordination between vessels perceiving and navigating the world around them.

He has two master's degrees from Uppsala University, in Engineering Physics and Computer Science, and has spent the last 7 years working as a researcher at Samsung Electronics in Seoul, South Korea. There he helped authored patents in the fields of IoT; High Performance Compute, and Machine Learning. He is excited to bring what he has learned to bear on this new maritime world.

Inspiration to research autonomous ships:

"I am interested in the fanciful idea of an autonomous sailboat, creating a craft that can indefinitely roam the seas through the power of wind and solar. While sailboats are not a primary target, I would be happy to contribute to such a thing in a small way. Also, my brother is a good sailor, I would love to build something to race him with."

Welcome to the SFI, Peter!

Sreekant Sreedharan

Sreekant Sreedharan is a PhD candidate at the Department of Engineering Cybernetics, NTNU, starting in December. He will be working on developing a comprehensive testing for the evaluation platform for evaluation of computer algorithms used in autonomous surface for compliance with COLREG (Collision Regulations) Concept of Operations (CONOPS), with specific focus on safety assessment and verification of collision and grounding avoidance algorithms. The platform is expected to explore a biomimetic design, wherein we may break up the COLREG specification into several faculties, with faculties interacting with each other synthesize a wide range of evaluation scenarios for COLREG compliance, for software operating in a simulated environment.

Sreekant has a Master's degree in Software Engineering from the University of Michigan and an MBA in IT & Strategy from the University of British Columbia, with over 25 years of professional experience the technology industry. More recently, and prior to joining the AutoShip project, Sreekant functioned as an Entrepreneur-in Residence, researcher at the Indian Institute of

Technology - Indian School of Mines (IIT-ISM), where he managed an R&D program developing digital-twin platforms, smart wearables and numerous sensors for the underground mining sector.

Inspiration to research autonomous ships:

"We are at an epoch in time where it is now certain that autonomous vehicles for all forms of transportation, across all modalities – air, sea and road – will become mainstream over the next two decades. However, given that international shipping is responsible for 90% of global trade, ($25 trillion worth of goods moved across the planet in 2022), the shipping sector is also certain to be a vanguard defining how autonomy will be delivered, controlled and regulated across all modalities in the future.

I see SFI AutoShip as a unique opportunity to partake in history as humanity collectively imagines the future of autonomous transportation."

Welcome to the SFI, Sreekant!

Miguel Hinostroza

Miguel Hinostroza is a Researcher at the Department of Engineering Cybernetics at NTNU, from August 2023. He will be working in Work Package 1 - AutoRemote, focusing on the development of perception and decision-making systems. In particular, he will perform system upgrades onboard the milliAmpere 1 ferry, including both software and hardware. Additionally, he will carry out experimental tests with the autonomous ferry at sea to validate the systems and algorithms developed within the work package.

He received his MSc and PhD degrees in Naval Architecture and Ocean Engineering from Instituto Superior Técnico, University of Lisbon, Portugal, in 2014 and 2021, respectively, in the field of motion planning, guidance, and control of autonomous surface vehicles. Additionally, he obtained his BSc degree in Mechatronics Engineering from the Universidad Nacional de Ingenieria, Lima, Peru, in 2012.

Inspiration to research autonomous ships:

"During the early stages of my academic career, I had the opportunity to meet researchers from NTNU who have made significant contributions to the field of autonomous ships. Their revolutionary ideas became a source of inspiration and motivation for me.

Therefore, this position offers me a unique opportunity to collaborate with a multidisciplinary and talented team and contribute to the development of new technologies in autonomous ships. I am highly looking forward to being part of the SFI AutoShip project."

Welcome to SFI AutoShip, Miguel!

Contact us

Don't hesitate to contact us if you have ideas for topics for the next newsletter or any other suggestions.

Ingeborg Guldal

Centre coordinator

ingeborg.guldal@ntnu.no

SFI AutoShip Website

SFI AutoShip LinkedIn