SFI AutoShip Spring newsletter 2024

Spring greetings from the Centre Director

The first half of 2024 is now past us and the SFI AutoShip consortium has further increased its range of activities. Starting with our regular events, the researcher workshop on March 18 was marked by record attendance and included presentations by three of our partners. Moreover, in May and June two innovation workshops took place, in Ålesund and Trondheim, and our Board meeting was hosted by DNV in Høvik on June 6.

Three new researchers have arrived, whereas one postdoctoral and two PhD researchers have concluded their work in the Centre. Our graduates plan to continue their careers employed by partners of SFI AutoShip, where they can further build on their results.

Our focus on collaboration has been highlighted by 2 webinars and 1 seminar, as well as the initiation of the COLREGs working group, which is coordinated by DNV. In addition, we have been in close contact with several of our partners in order to plan testing campaigns, disseminate the Centre's activities to additional audiences of interest, and discuss topics like IP.

As the Centre's mid-term evaluation by the Research Council of Norway is approaching, I would like to thank all our researchers and partners for making SFI AutoShip an excellent platform for research-based innovation within autonomous ship technology.

With best wishes for the summer holiday,

Anastasios Lekkas

Contents

Completed projects during spring 2024:

Andreas Nygard Madsen

Melih Akdağ

Taufik Sitompul

Meet our newly hired researchers:

Giacomo Melloni

Manju James

Joel Jose

Centre events in spring 2024:

Researcher workshop

Webinars and seminars

Spring board meeting

Innovation workshops for PhDs and PDs

Partner meetings and Use Case activities

Completed projects during spring 2024

We are very proud to announce that three researchers have completed their projects in the SFI during the spring of 2024. Among them are the first two PhD graduates from the Centre, and our second completed postdoc project. They will all continue in either academia or industry going forward, building on their experiences in the SFI. We are very grateful for their excellent contributions!

Andreas Nygard Madsen

Andreas Nygard Madsen is the first PhD candidate in the SFI to submit his thesis, at the Department of Ocean Operations and Civil Engineering, NTNU in Ålesund. He is scheduled for PhD defence on 19 August.

What was your project about?

Imagine you are driving a car. It is an advanced vehicle with a high degree of automation. Suddenly it tells you to move into the opposite lane, and you don't understand why. Would you do it? Most people would not since we humans are reticent to apply and trust in decision support that we do not fully understand. My project was on Human-AI Compatibility to enhance decision transparency in autonomous collision avoidance systems, thereby improving navigators' situational awareness. Here, I advocate for a design philosophy that places human needs and capabilities at the forefront of technological innovation.

What have you achieved during your PhD?

During my PhD, I have achieved several milestones that contribute both to the academic community and the practical field of Human-AI interaction. I have authored four articles as the first author and contributed to four additional articles.

Being a part of the SFI has been incredibly beneficial, providing me with opportunities to network and collaborate with both industry- and research partners. These interactions have enriched my research, allowing me to integrate diverse perspectives into my work. Collaborating with other PhD candidates within the SFI has also fostered a supportive and intellectually stimulating environment.

What will you do next?

I have applied for a position as an associate professor at NTNU in Ålesund and will focus my energy on nautical education and research. My goal is to continue exploring and developing innovative solutions that enhance Human-AI interaction, particularly in the context of maritime navigation and safety. I am excited about the prospect of contributing to the academic community at NTNU and shaping the next generation of seafarers.

Melih Akdağ

The first PhD recruited to the SFI, Melih Akdağ, has submitted his thesis at the Department of Engineering Cybernetics, NTNU in Trondheim, and is scheduled to defend it in early September.

As my PhD journey reaches its conclusion, I feel mixed emotions. The past three years have been an intellectually rewarding adventure, filled with the satisfaction of exploring groundbreaking concepts in autonomous ship navigation. Yet, a sense of melancholy washes over me as I bid farewell to the supportive and vibrant environment that has nurtured my academic growth.

What was your PhD project about?

My research delved into collaborative collision avoidance strategies for autonomous ships. We identified four key maritime players - autonomous vessels, conventional ships, Vessel Traffic Service (VTS), and Remote Control Centers (RCC) - and their interactions in various scenarios. Our work focused on developing collaborative strategies that leverage active communication and information exchange among these actors to prevent collisions. This journey brought together the fields of cybernetics, computer science, and marine technology, as we implemented various control, optimization, and AI methods.

What have you achieved during your PhD?

The fruits of this labor are evident: six journal papers, two conference papers, and more than 25 presentations to industry partners, researchers, and the general public, all facilitated by SFI AutoShip. Beyond the research itself, I had the privilege of participating in workshops organized by Kjell Olav Skjølsvik, covering areas like Functional Analysis System Technique (FAST), Intellectual Property, and Research Innovation. These invaluable experiences honed my transferable skills, preparing me for the exciting career path ahead.

Looking back, I owe a debt of gratitude to NTNU and SFI AutoShip for providing an exceptional PhD experience. My academic knowledge, research skills, communication and dissemination abilities, and network have all flourished under their guidance.

Special thanks go to my supervisors, Prof. Tor Arne Johansen and Prof. Thor I. Fossen. Their invaluable guidance throughout my research journey was a perfect blend of freedom to explore my ideas with crucial support and insightful feedback. I also extend my gratitude to Tom Arne Pedersen, my co-supervisor and industry contact point from DNV. His industry perspective, gleaned from experience, insightful comments and discussions, significantly enhanced the real-world applicability and overall quality of my research.

Finally, immense appreciation goes to Anastasios Lekkas, Ingeborg Guldal, SFI AutoShip partners, and all PhD/PD colleagues for fostering an inclusive, supportive, and innovative research environment.

What will you do next?

As this chapter closes, a new one begins. I'm thrilled to announce my new role as AI Researcher at the DNV Group and Research Department in Trondheim. Here, I'll be joining the simulation technologies group, collaborating with a talented team of researchers and software developers. Building upon my PhD experiences, I'll be leveraging my knowledge to develop smart testing and assurance methods for cyber-physical systems, with a particular focus on autonomous ships.

Stay tuned for exciting developments in the world of safe and reliable autonomous navigation!

Fair winds and following seas!

Taufik Akbar Sitompul

Postdoctoral researcher Taufik Akbar Sitompul finished his project in January, as the second completed postdoc in the Centre.

What was your Postdoc project about?

My Postdoc project was about human-machine interfaces for remotely operated cranes. Cranes are traditionally operated by operators who are also present on-site, but nowadays there are also cranes that can be operated from remote control rooms. A shift from on-site to remote operation also introduces various issues that did not exist before, such as reduced sensorial

information, latency, and even boredom. My Postdoc project attempted to address some of these issues through graphical user interface (GUI) designs.

What have you achieved during your Postdoc fellowship?

In the past 2 years, I attempted to address some of the issues mentioned above. I proposed 2 GUIs that could be used for helping crane operators control their cranes in the presence of latency. Unfortunately, the results from my experiment showed that both GUIs for handling latency did not help the crane operators perform better and safer, compared to when they had no support. I also proposed 3 GUIs for improving depth perception in remote crane operation. This time, the results from my experiment showed that 2 out of 3 GUIs for improving depth perception helped the operators perform better and safer, than when they had no support.

The role of having good GUIs becomes more important in remote crane operation, since crane operators could not see their cranes and the surroundings directly. This concern led me to developing OpenCrane Design System, which aims to offer user GUI components for operating cranes that anyone can reuse, modify, and distributed at no cost. I also received NOK 200K from NTNU Discovery to develop OpenCrane Design System.

All in all, my Postdoc fellowship in SFI AutoShip produced 7 published papers, 3 accepted papers, and 1 Disclosure of Invention (DOFI) to NTNU Technology Transfer.

What will you do next?

I will still be working at Department of Design. Since February 2024, I have been working as a work package leader in the EU-funded SHEREC project. The project aims to improve safety to workers and reduce toxic waste to the environment in the ship-recycling process by deploying robots. The work package that I am leading investigates how such robots should be designed and measures the societal and environmental impacts of those robots in the ship-recycling process.

Newly hired researchers

We have entered the second phase of recruitment of PhDs and postdocs in the Centre and are pleased to share that three new PhD candidates began their work earlier this year. They are already important additions to our researcher community.

Giacomo Melloni

Giacomo Melloni is a PhD candidate in the Department of Electronic Systems at NTNU, contributing to Work Package 2 on **Channel Modeling and Measurements for Maritime Scenarios**. He is responsible for developing new channel models to gain a comprehensive understanding of the fading entities characterizing maritime communications. He will focus on analyzing use cases, in particular those involving challenging communication scenarios on which high reliability and capacity are required. To validate the theoretical models, he will conduct measurement campaigns in collaboration with SFI AutoShip partners.

During his master's degree, he earned a double degree in Telecommunication Engineering and Digital Infrastructure and Cyber Security from the University of Bologna and NTNU. He studied a wide range of topics related to radio communications, including mobile radio networks, satellite communications, and MIMO systems. For his master's project, he investigated channel entities related to LEO satellite communications in the UHF band.

Inspiration to research autonomous ships: "I have a special bond with the sea and sailing. I fondly remember family trips to Sardinia, where we would go fishing off the coast. Being part of SFI AutoShip is a unique and fulfilling opportunity, because it allows me to combine my passion for telecommunications with my love for the maritime world. I look forward to participating in new projects with SFI AutoShip and its partners."

Manju James

Manju James is a PhD candidate in the Department of Electronic Systems at NTNU. She will be working in Work Package 2 focusing on **Radio Twin: Digital twin for maritime communication system performance prediction**. She will use machine learning tools to model maritime communication channel to aid the performance prediction.

She has a master's degree in Electronics and Communication Engineering from Kerala University with specialization in Microwave and TV Engineering. She has been a faculty member at St. Joseph's College of Engineering and Technology, Kottayam, India after her education.

Inspiration to research autonomous ships: My interest in communication engineering prompted me to specialize in microwave engineering for masters. My passion for autonomous driving kept me technologically updated through my career. I am happy to be part of SFI AutoShip research project which gives me a platform to research on maritime communication combining my interest and passion.

Joel Jose

Joel Jose is a PhD candidate at the Department of ICT and Natural Sciences at NTNU (Ålesund Campus). He will be primarily associated with Work Package 1, researching on **Explainability-centered design of Collision Avoidance systems for MASS**. His aim is to use aspects and methods in Explainable AI to enhance the trustworthiness of AI-based solutions for collision avoidance. More specifically, he will identify and incorporate interpretable and explainable design approaches that helps developers and ship navigators to better understand the decisions of a reinforcement learning-based collision avoidance system.

Joel has a Master's degree in Robotics Engineering and Bachelor's in Naval Architecture and Ocean Engineering from Indian Institute of Technology, Madras. He was interested in combining his knowledge on ship manuevering and mobile robots, which led him to specialize in GNC systems for autonomous surface vessels. His master thesis is based on path following and collision avoidance solutions for underactuated surface vessels using Deep reinforcement learning.

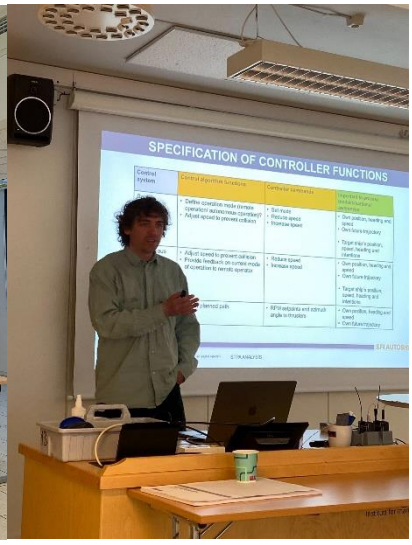
Inspiration to research autonomous ships: Much of the best memories I had during college was during the time I spent in my research group working on autonomous surface vessels. I had a strong liking towards robotics and programming since high school, and I got interested in learning about ship motions in college. Its an exciting opportunity to be able to combine both of my interests in research, and realized this was the way forward for me in my career. I am really lucky to be part of the SFI AutoShip project and eagerly look forward to exploring uncharted seas in the domain of autonomous ships.

Researcher workshop

The **Spring researcher workshop** was held on March 18, and included presentations on industry-related research challenges from industry partners DNV, Fugro and Kongsberg Maritime, as well as participation by Equinor, Gard, Idletechs, Maritime Robotics, Massterly, NCL, and Torghatten, and research partners NTNU, SINTEF, UiO and IFE. We had a record attendance of 60 participants, which contributed to excellent discussions. The day was as usual split in two parts:

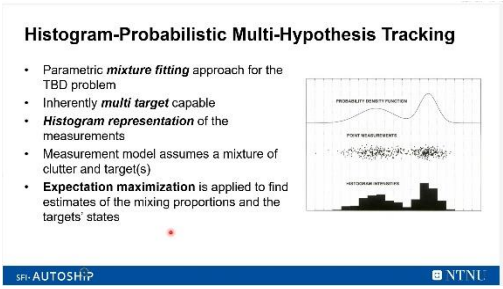
1. Plenary session covering general discussion issues and introducing new researchers (5 new PhDs since last researcher WS)
2. Parallel sessions (per or across work packages). Focused on the involvement of each PhD/postdoc with industry partners and improving cross-work package coordination.

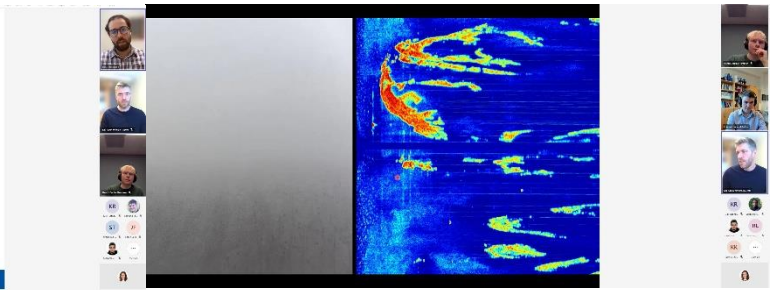
Webinars and seminars



We started arranging regular webinars last year 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 and seminars during spring 2024:

1. Radar in maritime situational awareness - Beyond point measurement (NTNU, Kongsberg Maritime)
2. Systems-Theoretic Process Analysis (STPA) tutorial (physical seminar at IMT, NTNU, well-attended by many of the partners)

Spring Board Meeting

DNV and Board Chair Øystein Engelhardtsen kindly hosted the Spring Board meeting at DNV headquarters in Høvik on 6 June. 17 partners were represented at the meeting. The Board discussed the status and progress of Centre activities including each of our 4 Use Cases, the Data Management Plan, and a Portfolio of innovation leads from ongoing PhD and PD projects. The upcoming mid-way evaluation by the Research Council was also a topic for discussion.

Innovation workshops for PhDs and PDs

Two innovation workshops were organized during the spring, focusing on a general introduction to innovation, and guiding our PhDs and postdocs towards investigating commercial potential from their research findings. The first workshop, in May, was arranged at NTNU in Ålesund, and included both PhDs and supervisors based there. In the second workshop most of the PhDs and PDs in the SFI gathered in Trondheim and participated in a dinner marking the end of the spring semester. The innovation workshops were led by SFI Innovation manager Kjell Olav Skjølsvik.

Partner meetings and Use Case activities

We had several partner meetings during the spring. To mention a few, the SFI was presented by the director and WP leaders to a large number of employees from Kongsberg Maritime in February, and representatives from Fugro visited Trondheim in April. They met with many of our researchers (NTNU & SINTEF) and WP1 and WP6 leaders to discuss participation in trial operations.

Our 4 Use Cases have progressed well during the spring, and in UC1 Bridge simulator studies were carried out in Ålesund in late April, with several consortium partners involved. The experiment was based on one of Grieg Star's ships, to test how periodically unmanned bridge will function, with reduced manning, number of shifts and types of tasks.

Contact us

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

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