CHRISTMAS NEWSLETTER 2025

Anastasios M. Lekkas presenting at the SFI Days.
Photo: Kai Dragland/NTNU

Christmas greetings from the Centre Director

SFI AutoShip is approaching the end of another productive year, with continued progress across research, innovation, and collaboration. Our two final PhD candidates, Johannes and Mikkel, started their positions in August and will continue their work with the Centre until its completion in 2028. This autumn we saw the completion of two PhD theses, by Luka in September and Lukas in December, and several researchers are now close to submitting their theses as well. We have also strengthened our international collaboration through new activities with UC Berkeley and the University of Genoa, and the Centre has now reached a total of 26 innovation leads. Our autonomous passenger ferry milliAmpere1 has received further hardware and software updates and remains at the centre of our sea-trial activities. Looking ahead to 2026, we are planning additional joint activities with our partners, including increased researcher mobility. I would like to thank everyone involved for their strong engagement and contributions throughout the year, and wish you a very nice Christmas and a great start to the New Year!

Anastasios M. Lekkas

Publications registered in 2025
- Journal papers: 21
  - (5 co-written with industry partners)
- Conference papers: 16
  - (2 co-written with industry partners)

News and partner collaboration

- The COLREG working group has been meeting regularly, and has recently focused on legal and computer engineering aspects of COLREG compliance, emphasizing situational awareness and the limits of autonomous systems, to be developed in a paper.
- This year's Board meetings were held at the offices of Equinor in Rotvoll, Trondheim (June) and on Teams (November). The Innovation and Commercialization Committee and the Board have discussed and approved the updated portfolio of innovation leads, which was also presented at the SFI Days.

PhD and PD status

PhDs and PDs have participated in regular meetings to follow up innovation training and integration with Use Cases, and we recently held a gathering with the whole group marking the end of the year.

3 PhDs were completed during 2025:
- Daniel Menges (WP1) defended his PhD "Digital Twin for Situational Awareness and Optimal Control of Autonomous Surface Vessels" in May.
- Luka Grgičević (WP3) defended his PhD "Game-Theoretical Maritime Guidance Algorithms" in September.
- Lukas Herrmann (WP2) is due to defend his PhD "Maritime Radar Detection and Tracking of Low-Observable Targets" on December 19.
- In addition, two PhD theses have been submitted, and several more are due to be submitted soon.

Luka Grgičević's PhD defence. Left-right in front: Supervisor Erlend Magnus Lervik Coates, Luka Grgičević, and Head of Department Rune Volden. Assessment committee left-right behind: Dr. Bjørn-Olav Holtung Eriksen, Professor Damiano Varagnolo and Professor Maria Prandini.
Photo: Eli Anne Tvergrov/NTNU

Marthe Kristine Sand (Kongsberg Maritime) presenting at the SFI Days.
Photo: Ingeborg Guldal/NTNU

SFI AutoShip Days

Our main annual event, the SFI AutoShip Days, was arranged on October 14-15, with 90 participants. The programme included ongoing developments by both industry and public sector partners, and guest presenters from the Norwegian Mapping Authority and the international student competition Njord. Presentations also reflected industry collaborations, theoretical research as well as field results by several of our recent graduates and current researchers from NTNU and SINTEF.

Researcher workshops

On March 17, 60 researchers and industry partners attended our researcher workshop. The aim of the event was to update and develop the innovation leads of each of the SFI researchers.

The Autumn researcher workshop was arranged on September 15, with 50 participants from research and industry partners. Discussions focused on the annual work plan for 2026, the status of research activities and collaborations, and input for the upcoming SFI Days.

International collaboration

- SFI personnel have visited and presented the Centre at IMO in London, Ecole Centrale and INSA in Lyon, and UC Berkeley and UC Santa Cruz. We received delegations from Nordic 5 Tech, the University of Singapore, INSA/Lyon, Riga Technical University and University of Loyola at NTNU in Trondheim and Ålesund.
- Continued collaboration and visits from PhD researchers Camilla Fruzzetti (University of Genoa) and Liz Dietrich (UC Berkeley).

Webinars in 2025

- Open Crane Design System (WP3, NTNU)
- Results from sea trials with milliAmpere1 (WP1, NTNU)
- Simulating Situational Awareness for Performance Requirements and testing Collision Avoidance Systems using Signal Temporal Logic (WP2, NTNU and DNV)
- **Upcoming webinars:** "Mission planning for ASVs - Main concepts and preliminary results with milliAmpere1" and "Comparative study of COLREGS-compliant COLAV: Theory and Sea Trials " (WP1. NTNU).

PhD and PD Innovation/use case workshop in December.
Photo: Ingeborg Guldal/NTNU
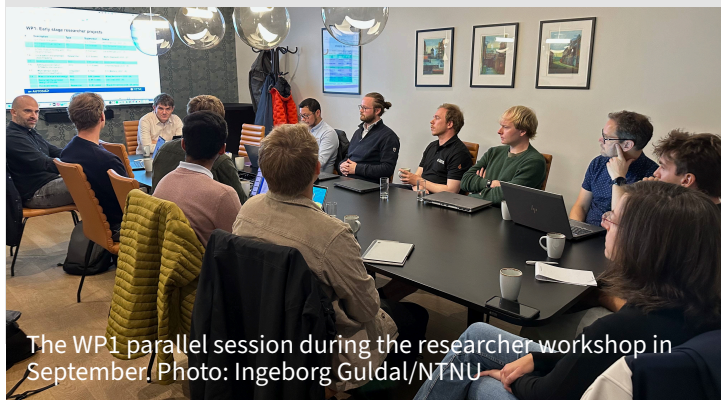
The WP1 parallel session during the researcher workshop in September. Photo: Ingeborg Guldal/NTNU

Lukas Herrmann
Thesis title: "Maritime Radar Detection and Tracking of Low-Observable Targets"

What was your project about?

Autonomous vessel operations heavily depend on environment perception and situational awareness. One of the enabling factors and main drivers is the use of radar sensors due to their long-range capability and proven robustness in the maritime domain. However, in autonomous scenarios, challenges arise from detecting low-observable targets, such as small vessels like kayaks or ASVs, targets at long ranges, or targets made of less-reflective materials, combined with unwanted reflections from the sea surface that collectively complicate the tracking process. In my research, I addressed these challenges by developing algorithms based on the track-before-detect (TkBD) paradigm, which integrates target detection and tracking into a unified process. In contrast to the traditional detect-then-track principle, where a detection is first declared and then tracked, TkBD processes raw, unthresholded sensor data across multiple frames to detect weak targets while simultaneously estimating their kinematic state, thereby contributing to situational awareness in autonomous maritime environments.

Main take-aways from SFI AutoShip

For me, being part of SFI AutoShip was a valuable experience. It gave my research a clearer purpose by connecting it directly to real challenges in autonomous maritime operations. The centre provided a stimulating environment that combined academic rigor with practical industrial challenges, real-world implementation aspects, and meaningful applications. In addition to the technical knowledge I gained during my PhD, I benefited from participating in interdisciplinary meetings that strengthened my communication skills, broadened my perspective, and encouraged networking.

What have you achieved during your PhD?

As part of my PhD project, we established a radar network consisting of four radar systems at two different sites to observe the Trondheim Fjord. This not only formed the foundation of my research but has also expanded the available radar infrastructure for future studies. The main findings of the research have been published in three conference proceedings and three journal articles, and were presented at the conferences as well as numerous workshops, seminars, and webinars. Generally, throughout my PhD, I continuously grew both personally and as a researcher, and the collaboration during my stay at the University of Liverpool further supported this development and expanded my national and international network. Since TkBD had largely been restricted to simple, theoretical examples, one personal highlight was the final paper, in which we combined, analysed and verified our previously developed methods in a full-scale implementation using experimental radar data from the Trondheim Fjord, and demonstrated the applicability and performance.

What will you do next?

I'm happy to announce that I have started a position in R&D at Kongsberg Discovery, Seatex, where I will continue to work on the development of radar-based target detection and tracking methods.

Lukas will defend his PhD on December 19. **Follow online**

PhD and PD status

- We congratulate **Daniel Menges, Luka Grgičević and Lukas Herrmann** on completing their PhDs this year.
- Several PhD candidates have already submitted or are expected to submit their thesis soon.

Tentative dates for next year's events:

- Spring researcher workshop: March 16
- Spring board meeting: June 3
- Autumn researcher workshop: September 14
- SFI AutoShip Days: October 13-14