NTNU – Trondheim
Norwegian University of
Science and Technology

Waterborne Transport in NTNU Oceans

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NTNU Oceans

Oceans at NTNU

Maritime	Underwater science and technology	**Polar research**	Marine bioresources	Marine minerals and oil&gas	Enabling technology	Marine infrastructure	Marine environment, society and coastal development

Autonomous Shuttle Ferry

Ferry in Trondheim

Associate Professor Egil Eide,
Department of Electronics Systems, NTNU

NTNU
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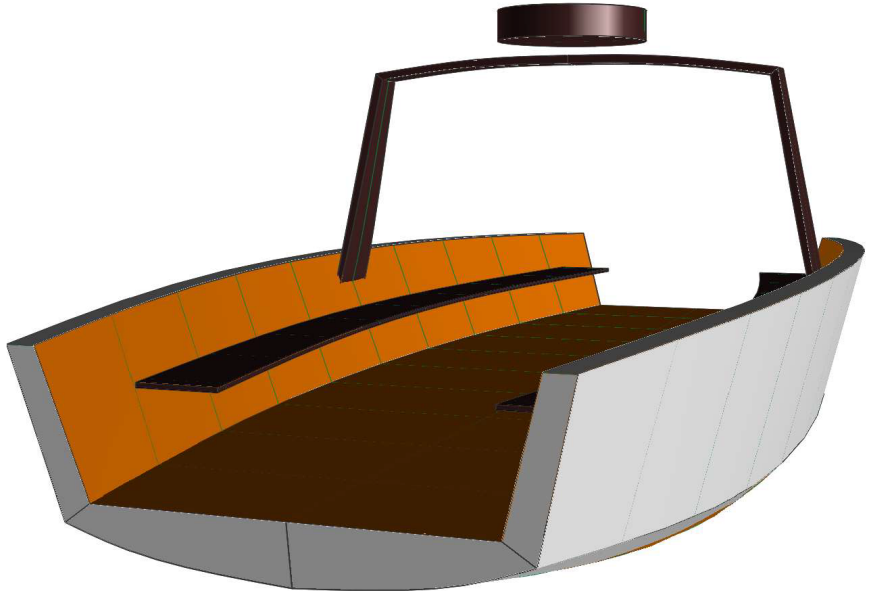
- **Technologically feasible**
- **Scalable and reconfigurable system**
- **Low environmental footprint and cheaper than bridge**
- **A new tourist attraction for Trondheim City**

NTNU
Kunnskap for en bedre verden

Department of Electronics Systems
Department of Engineering Cybernetics
Department of Marine Technology

NTNU AMOS
Centre for Autonomous Marine Operations and Systems



Concept

- **”On-demand ferry”** - push the button for the ferry to come
- Traveling time: **1 minute** → low latency
- Passengers: **12 persons**
- **Electrical propulsion**, **Automatic charging** of batteries
- Navigation: **High-precision GNSS (cm accuracy)** plus backup system
- **Anti-collision system**

Time schedule

Phase 1 (2016): Concept study, student projects. **Webcamera and radar** to register boat traffic i the harbour. Dynamic Position system to be tested onboard **ReVolt** from DNV-GL in Trondheim Harbour.

Phase 2 (2017): Autonomous **pilot ferry** for concept testing and to study behaviour of the other boat traffic.

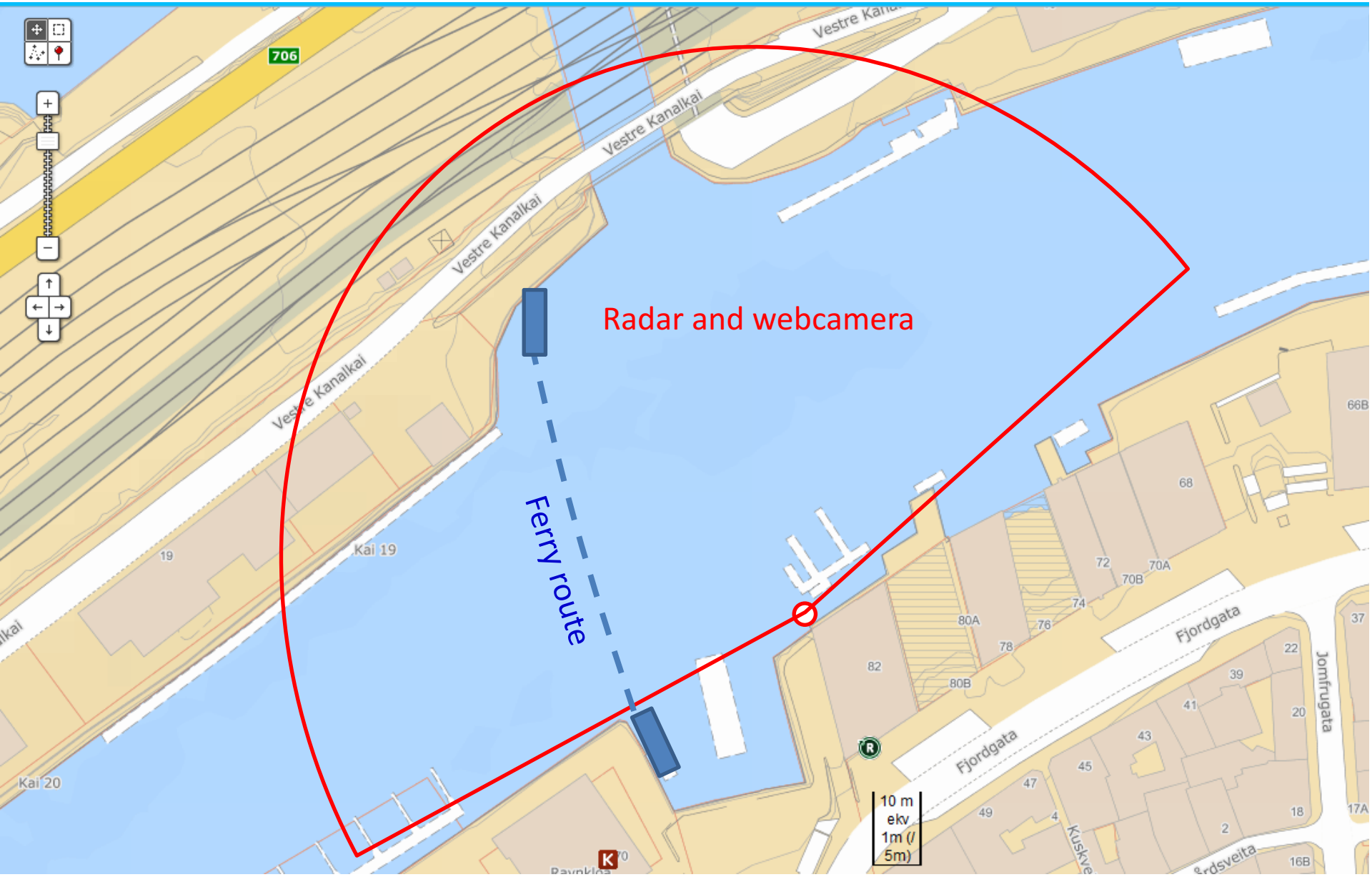
Phase 3 (2018/2019): Full scale ferry certified for passengers.

Phase 1: Test area Trondheim Harbour

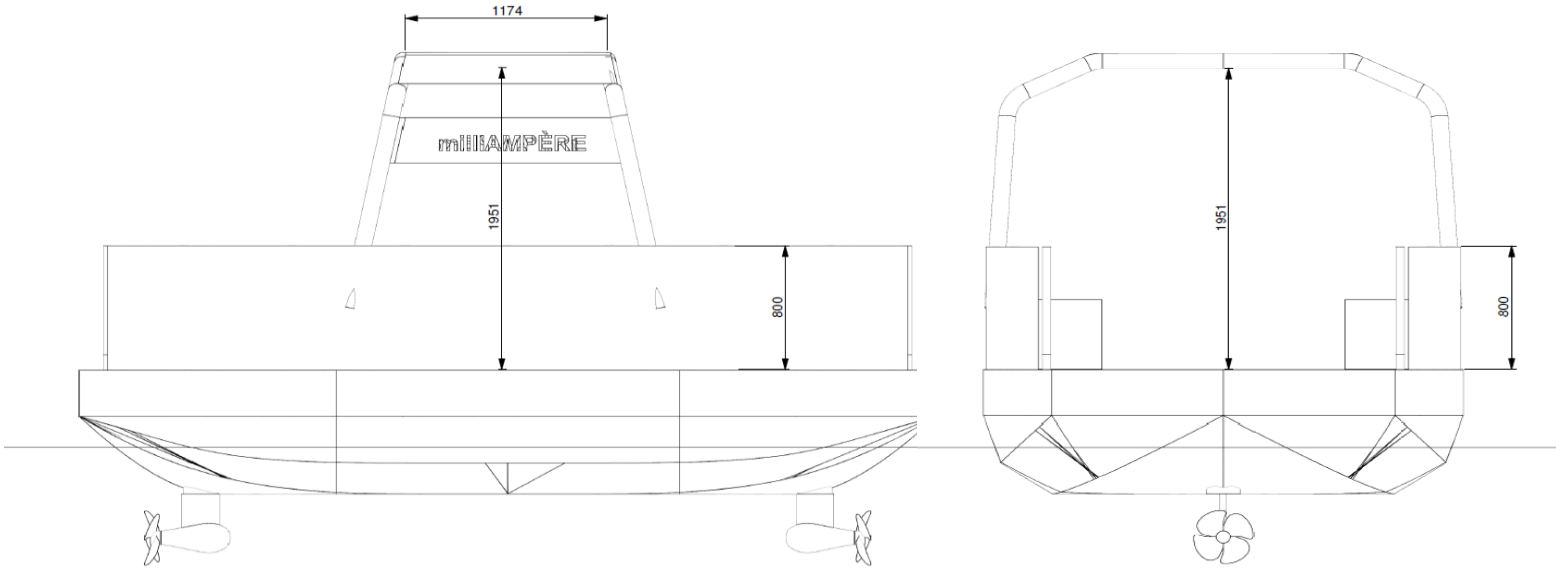

Fosenkaia
←New pedestrian bridge
Vestre Kanalkai
Ravnkloa
706
Vestre Kanalkai
Kai 19
Kai 20
Kai 21
Frostakaia
Fjordgata
Munkegata
Jomfrugata
Taraldsgårdsveita
Credoveita
Ørjave
Olav Tryggvasons gate
E 6

Phase 1: Boat traffic monitoring in the Harbour

(Collaboration Maritime Robotics)

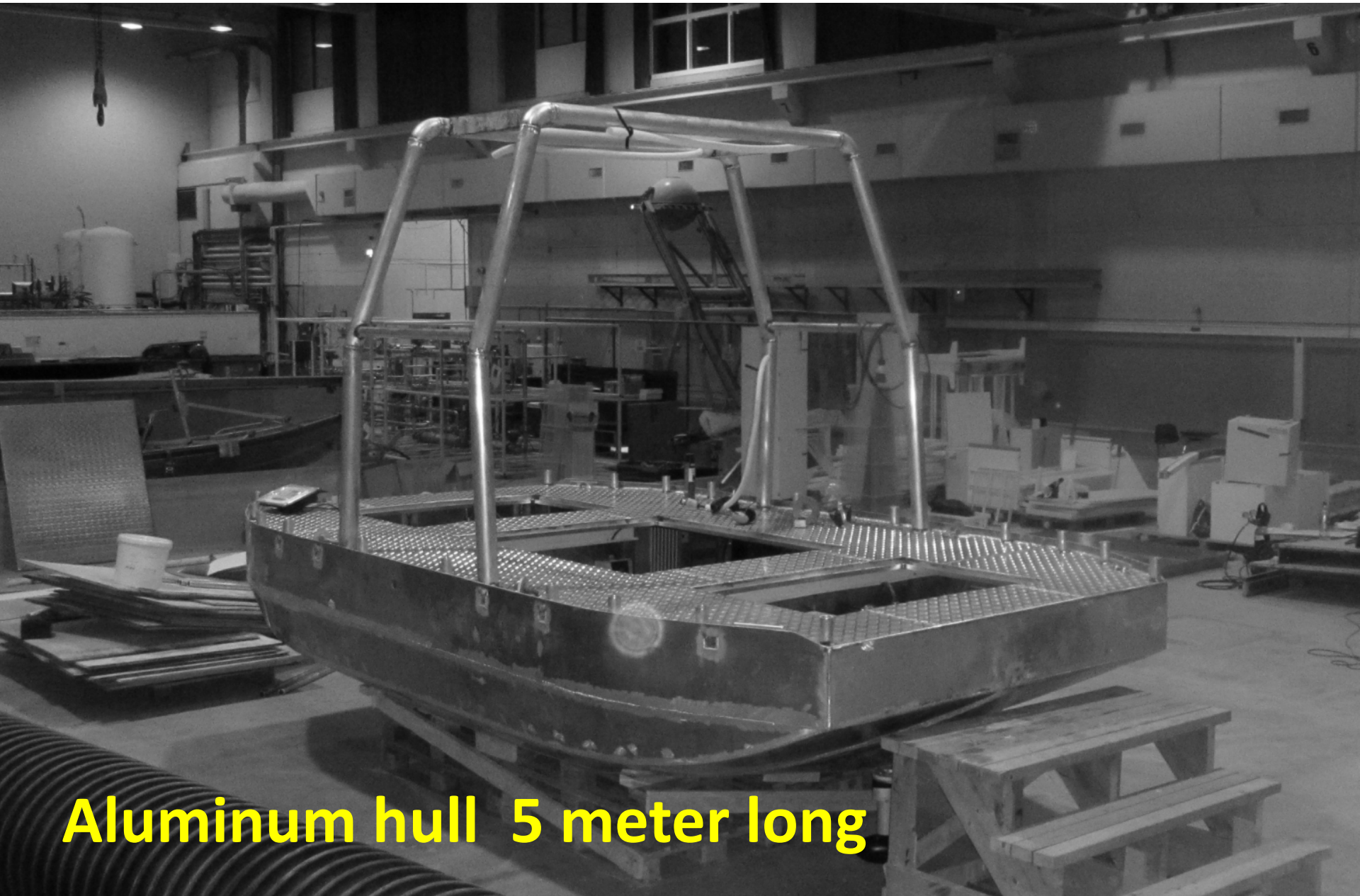


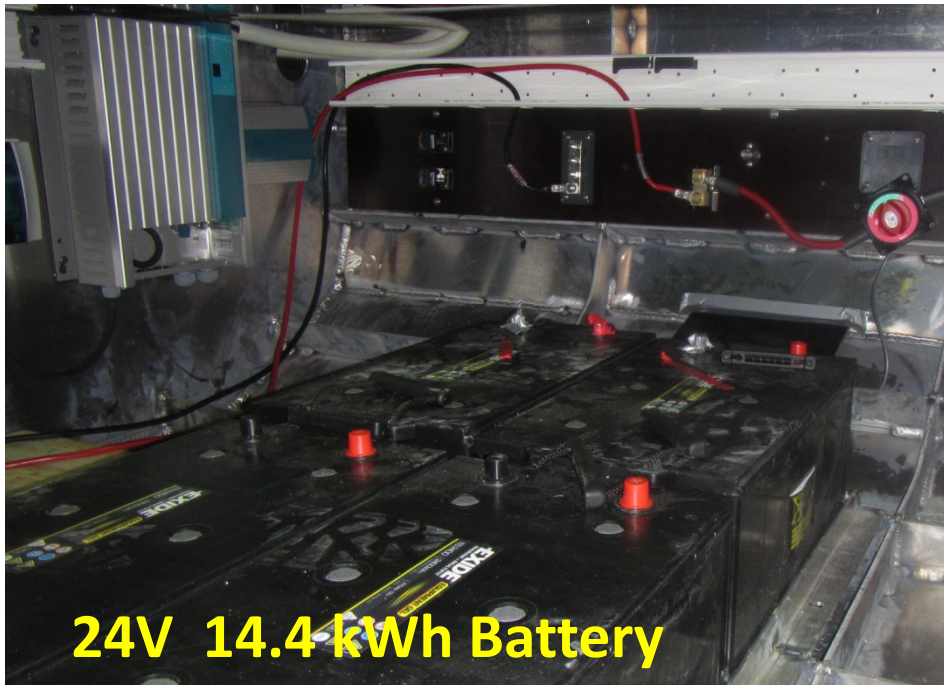
Phase 2: Pilot Ferry (development platfrm)



- Funded by NTNU and Amos
- Aluminum hull with scale 1:2 (5 meter long)
- Testing of propulsion system, batteries, and charging system
- Development of navigation system and automatic docking
- Testing of anti-collision sensors

Phase 2: Pilot Ferry (development platfrm)





- Batteries, thrusters, OBC and Remote control installed and tested
- Navigation sensors (RTK GNSS and IMU) to be installed
- Dynamic Position software to be installed and tested
- Preparation for sea testing (painting, finish)
- Testing in Trondheim harbour fall 2017

Phase 3: Full Scale Ferry

- Size: L: 8–10m x W: 3.5–4m
- 12 passengers
- Automatic battery charging (induction or plug connector)
- Propulsion: 2 x 10kW azimuth thrusters
- RTK GNSS-compass + LIDAR system
- AIS and 2-way wireless communication including video

The Autosea project

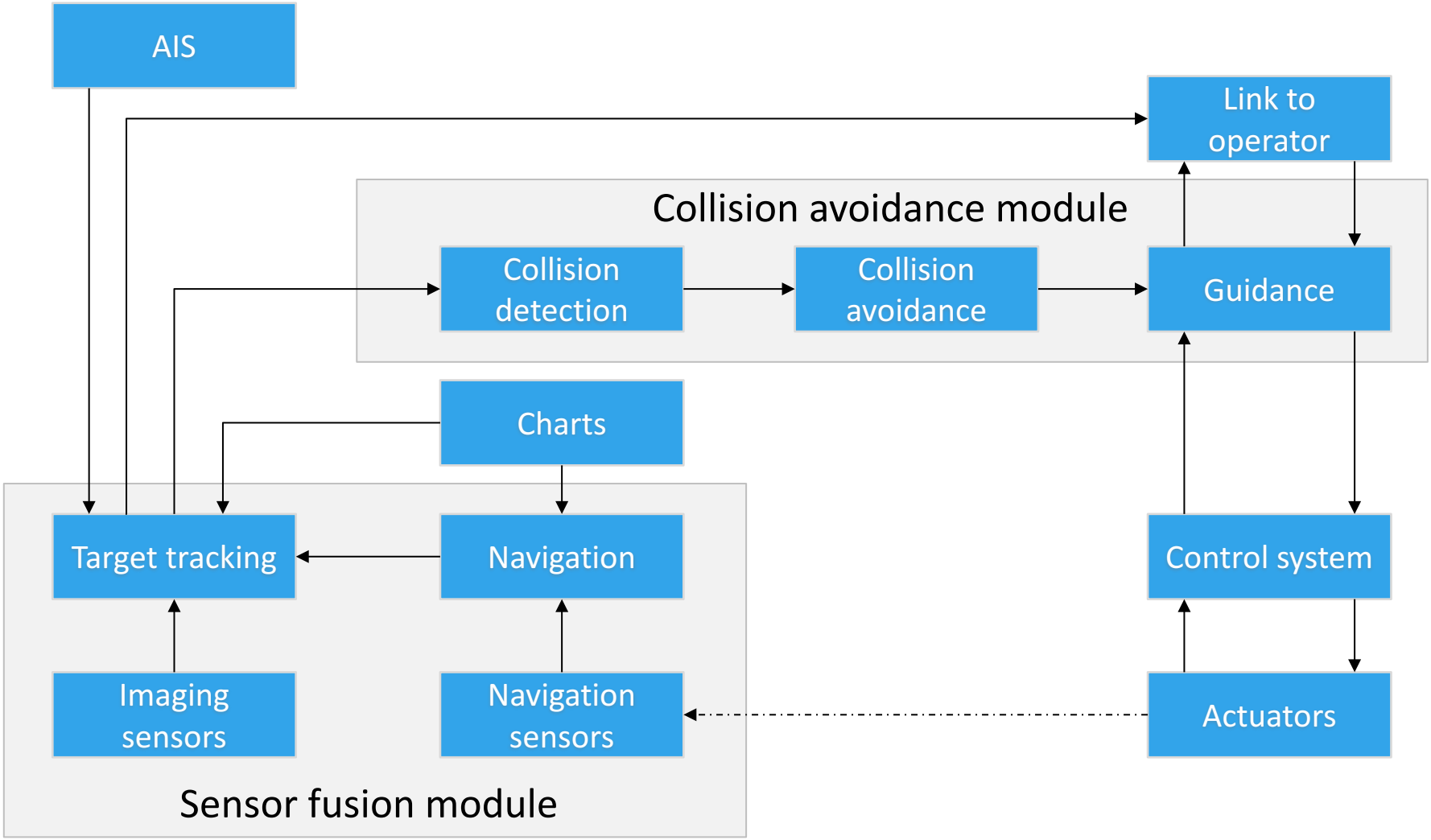
Edmund Førland Brekke, Associate Professor, NTNU

NTNU DNV·GL KONGSBERG MARITIME ROBOTICS

The AUTOSEA project

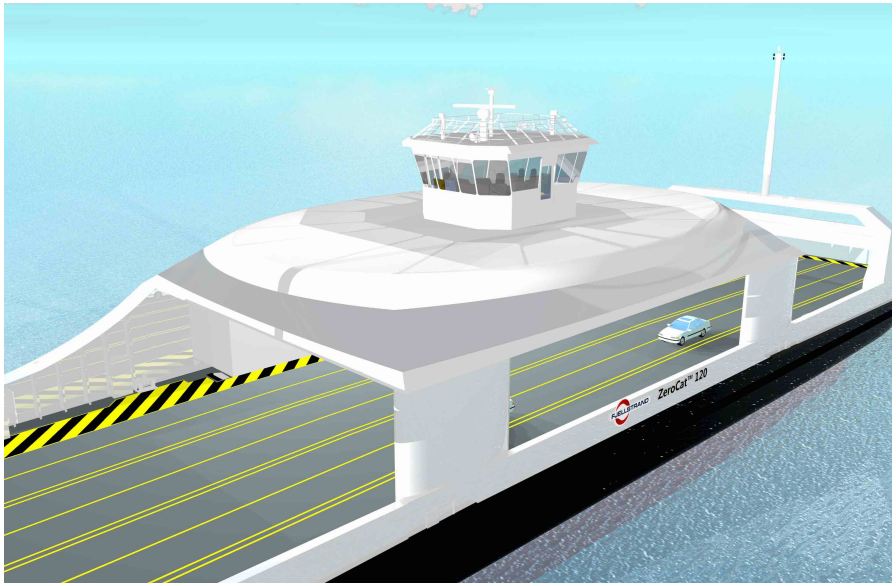
- Funded under the MAROFF programme of the Research Council of Norway.
- Budget 11MNOK, with contributions from DNV GL, Kongsberg Maritime and Maritime Robotics.
- Duration: August 2015-Spring 2019.
- Competence building project: The aim is to educate PhDs with expertise on maritime collision avoidance.
- The project funds 2 PhD candidates and one postdoctoral fellow. In addition, 2 PhD candidates and several MSc candidates are affiliated with the project.
- Project is owned by the Department of Engineering Cybernetics at NTNU.

Focus areas of the AUTOSEA project



New Pilot-E Project

- **Prosjekttittel:** Energioptimalisert konsept for hel-elektriske, utslippsfrie og autonome ferje i integrerte transport og energisystemer
- Søker: **Kongsberg Maritime** (+ Grenland Energi, Fjellstrand, Grønn kontakt)
- NTNU the only academic partner. Participation in WP4 (Autonomi og optimalisering)
- Main goals for NTNU:
  - Minimum-energy path planning
  - Autonomous docking



Other

- MarTERA applications (with industry participation) on autonomous ships, decision support for aquaculture, arctic technology, and so on.
- High interest for a number of calls within the Transport Work Programme.