NTNU | Kunnskap for en bedre verden

MENNESKET I FREMTIDENS HAVROMSOPERASJONER

Ole Andreas Alsos
Førsteamanuensis ved Institutt for design
Leder NTNU Shore Control Lab
Prodekan for Innovasjon ved Fakultet for Arkitektur og Design

Fløttmannen
Foto: Trondheim byarkiv


milliAmpere2

Ole Andreas Alsos

Associate Professor in Interaction Design
Head of NTNU Shore Control Lab
Vice Dean for Innovation at Faculty of Architecture and Design
Department of Design
Norvegian University of Science and Technology
ole.alsos@ntnu.no
915 44 825

Previously
Head of Department, NTNU
Founder of two companies
Interaction designer and IT advisor
PhD in interaction design
Master in Computer Science
Officer in the Norwegian Navy

NTNU Shore Control Lab
https://www.ntnu.edu/shorecontrol

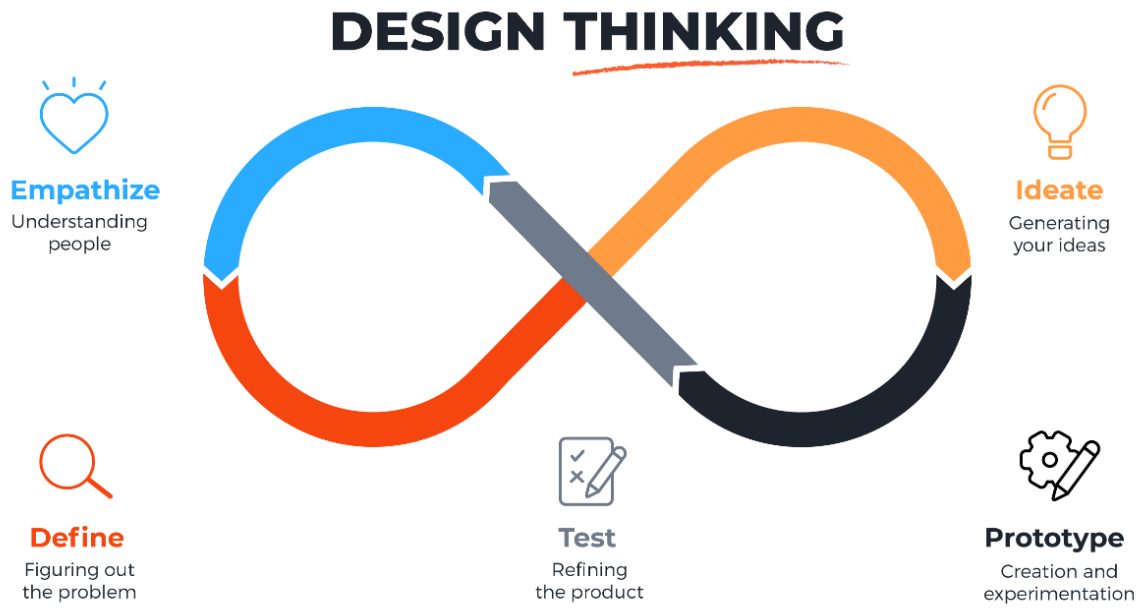
NTNU Shore Control Lab on YouTube
https://www.youtube.com/channel/UCvIJvommzc5kFg08MA0dRaA


Institutt for design
Photo: Kjell Are Refsvik

Pilot: Designtenkning for teknologer

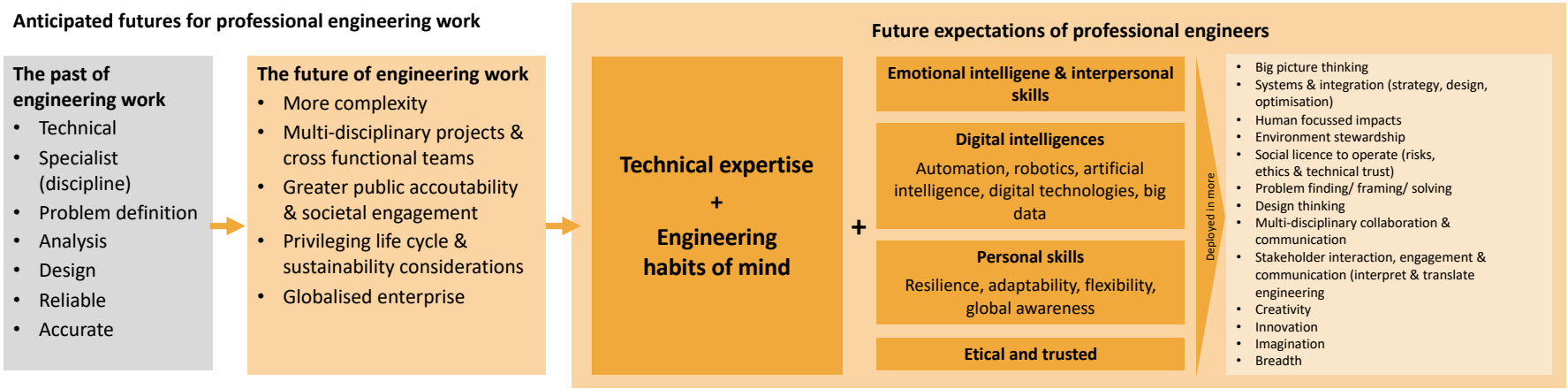
En iterativ, ikke-linjær arbeidsmetodikk som går ut på forstå brukere og løse problemer.

Metodikken gjør teknologer istand til å utforme *gode og brukervennlige* teknologier, systemer, produkter som løser *brukernes* problemer (ikke utvikle teknologi for teknologiens skyld)



Centre for Human-Centred Engineering Education

Enabling responsible engineering for a sustainable future



Maritime Robotics

Slangerobot, NTNU

Yara Birkeland


FAST
FLEKSIBEL AUTONOM SMART TRANSPORT
Moen Marin
SINTEF
MARITIME ROBOTICS
OCEAN AUTONOMY CLUSTER
SINTEF
MARITIME ROBOTICS
Moen Marin
Innovasjon Norge


milliAmpere2

SFI AutoShip

Aim and scope: Contribute to Norwegian players taking a leading role in the development of both technology and business models for autonomous ships, where emphasis is placed on safe, secure, environmentally friendly and cost-effective solutions.

Centre for Research-Based Innovation for the development of autonomous ships for safe and sustainable operations (8 years, 240 MNOK)

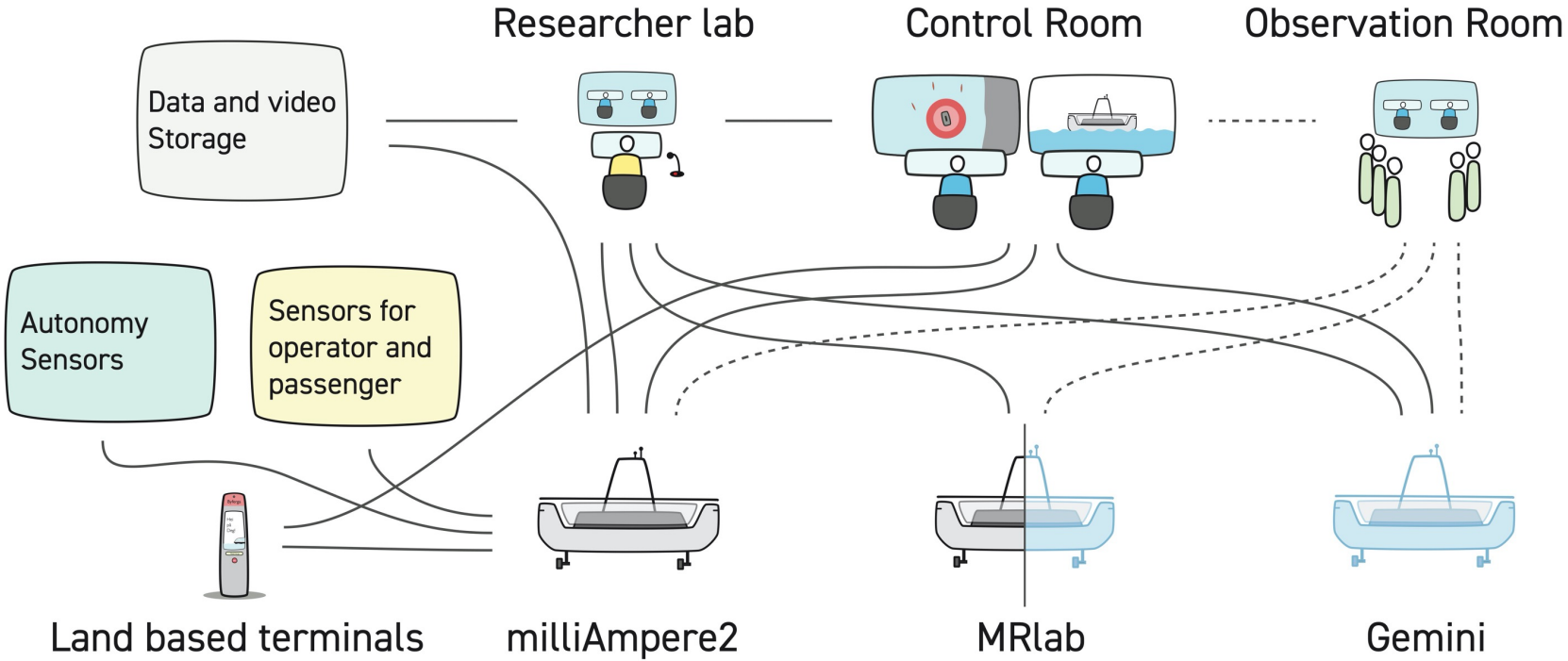
From the bridge to the shore

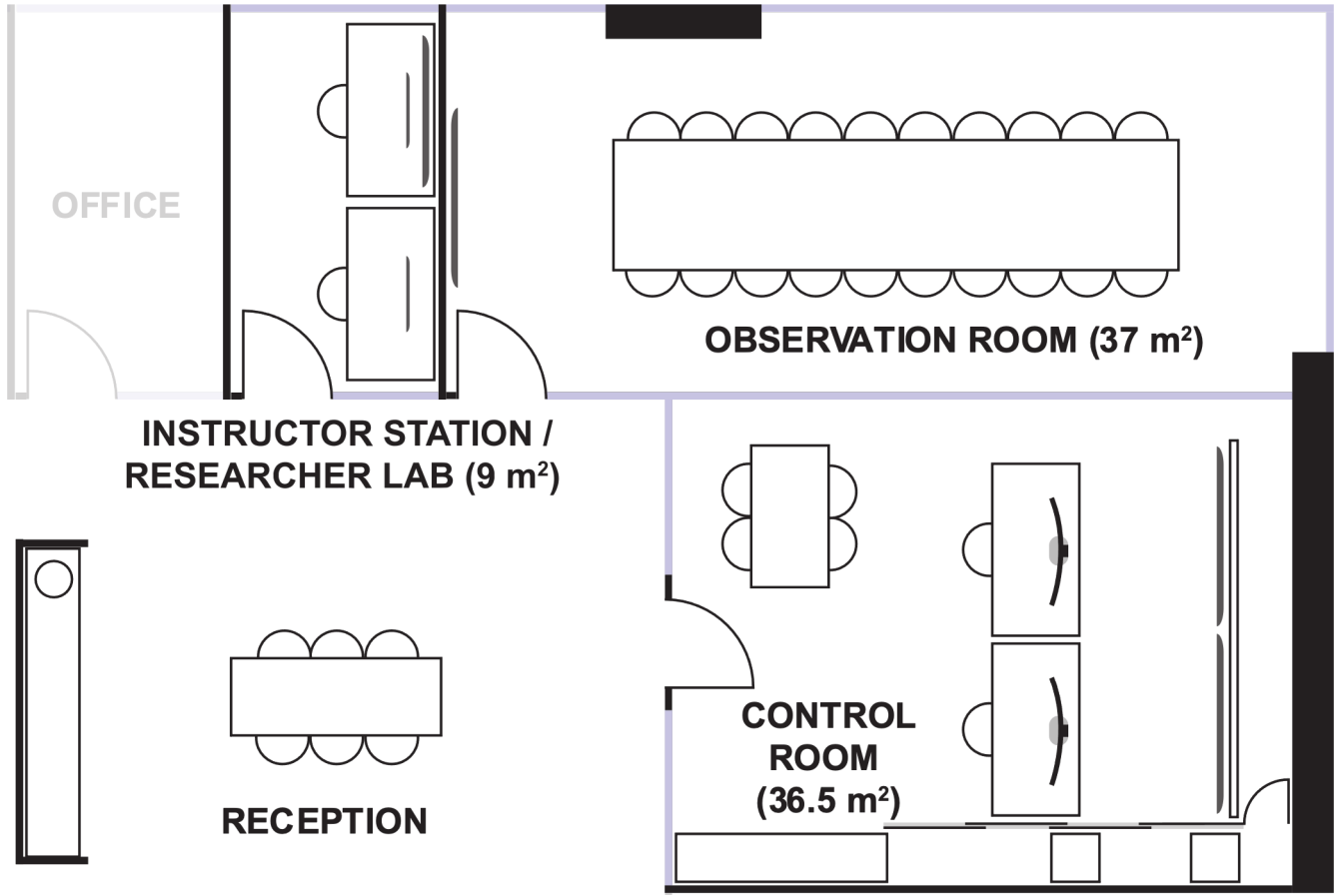
Ship brigdes

Shore-based control centers

Photo: NorthBySouthBaranof and Erik Veitch

Shore Control Lab Infrastructure

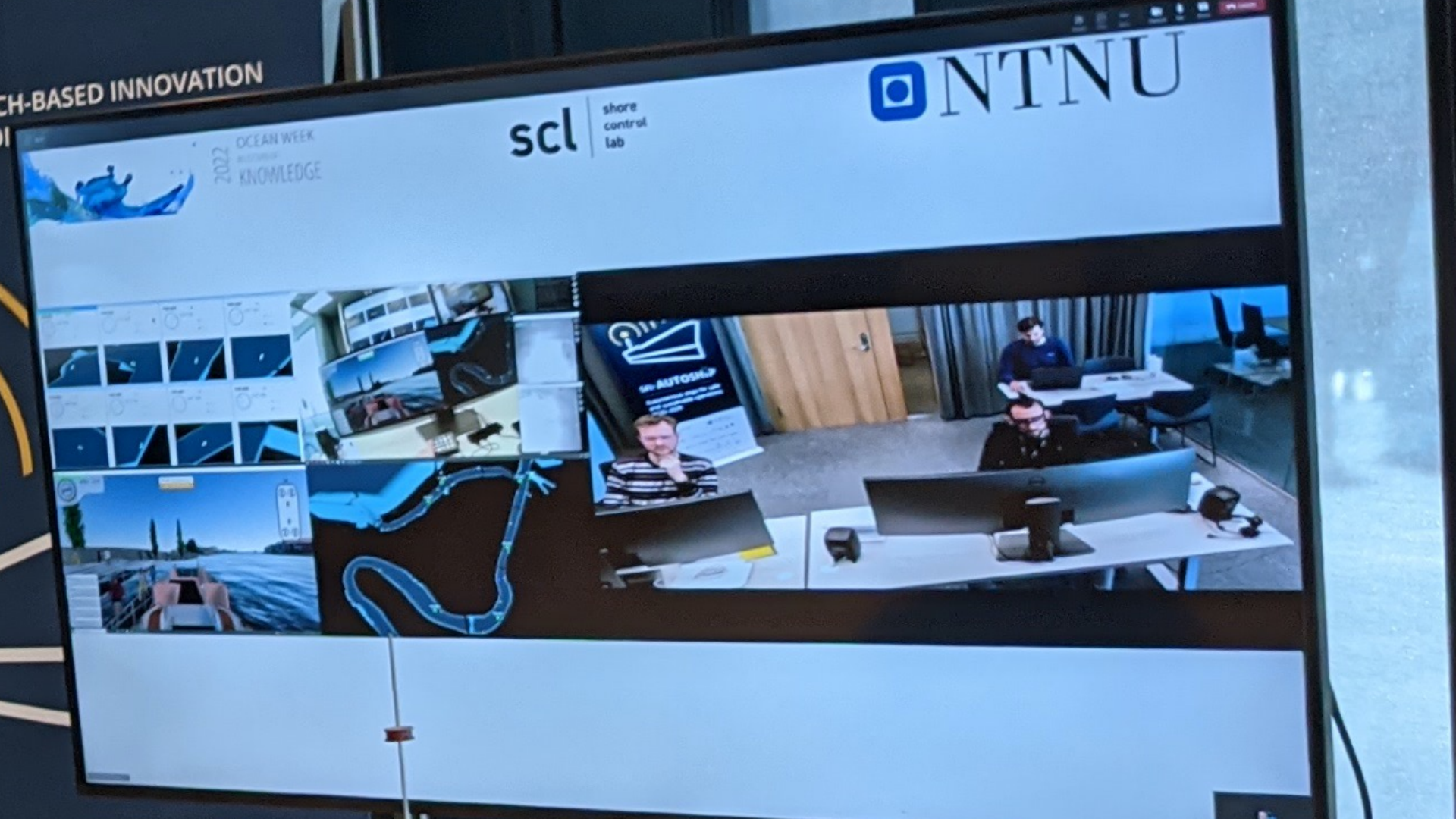



OFFICE
OBSERVATION ROOM (37 m²)
INSTRUCTOR STATION /
RESEARCHER LAB (9 m²)
RECEPTION
CONTROL
ROOM
(36.5 m²)

Control room

For two operators, flexible setup


NTNU
scl
PX-31
UNMANNED
AIRCRAFT SYSTEMS (UAS)
SFI · AUTOSHIP
Autonomous ships for safe
and sustainable operations
2020–2028


CH-BASED INNOVATION
scl
shore
control
lab
NTNU
2022 OCEAN WEEK
KNOWLEDGE

Researcher lab

For monitoring operators


Acquisition in progress...
EDA 1.69 µS
1.80
1.74
1.68
1.62
1.56
1.50
02:52:57
02:52:59
02:53:01
02:53:03
02:53:05
HR 61 bpm
60
40
20
0
-20
-40
-60
02:52:57
02:52:59
02:53:01
02:53:03
02:53:05

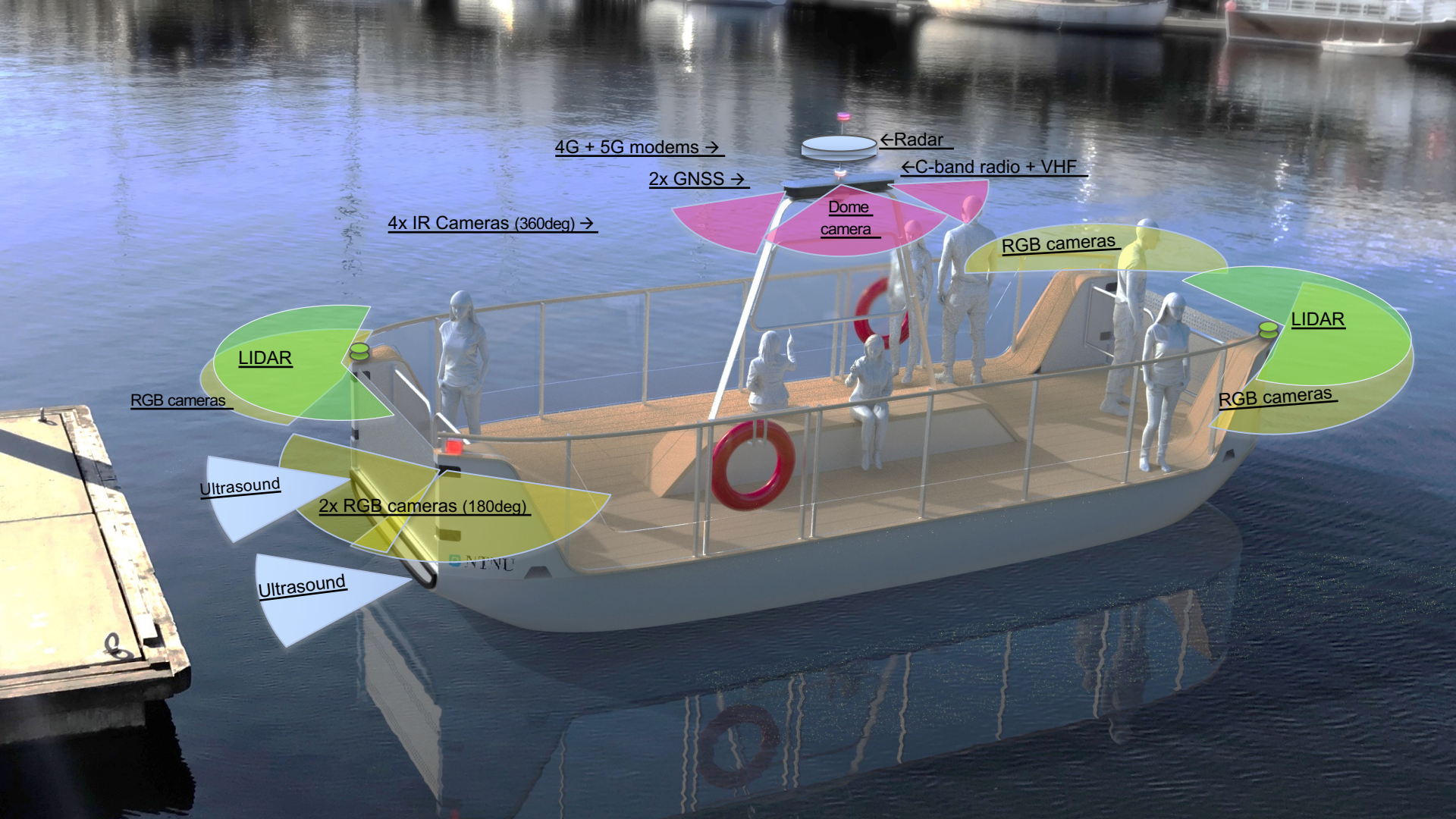
Observation room

For up to 20 persons


milliAmpere2


milliAmpere2


RÅVNKLO

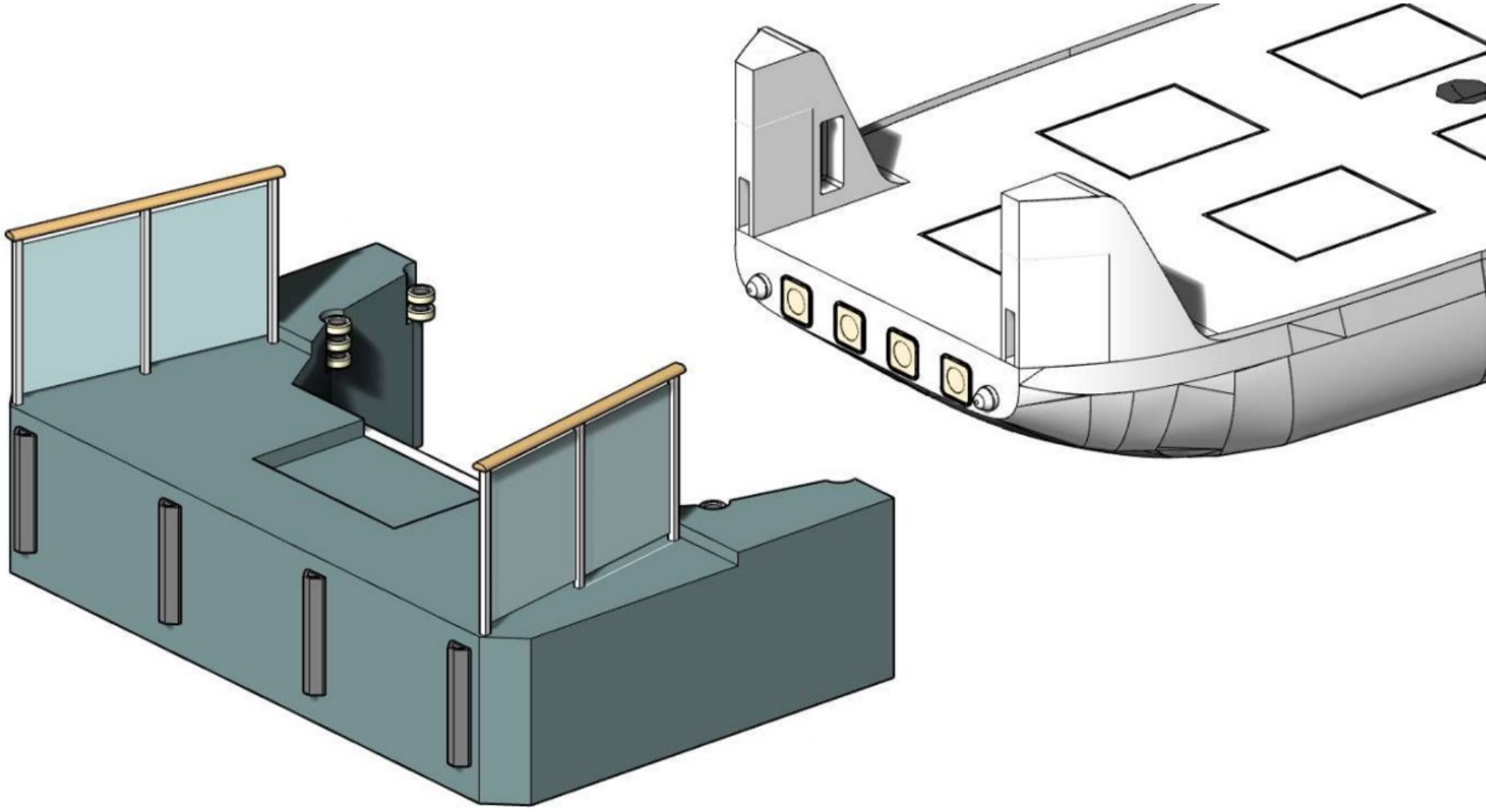

4G + 5G modems →
←Radar
←C-band radio + VHF
2x GNSS →
4x IR Cameras (360deg) →
Dome camera
RGB cameras
LIDAR
RGB cameras
LIDAR
RGB cameras
Ultrasound
2x RGB cameras (180deg)
Ultrasound


Mixed Reality Lab
for testing milliAmpere2

Gemini Simulator

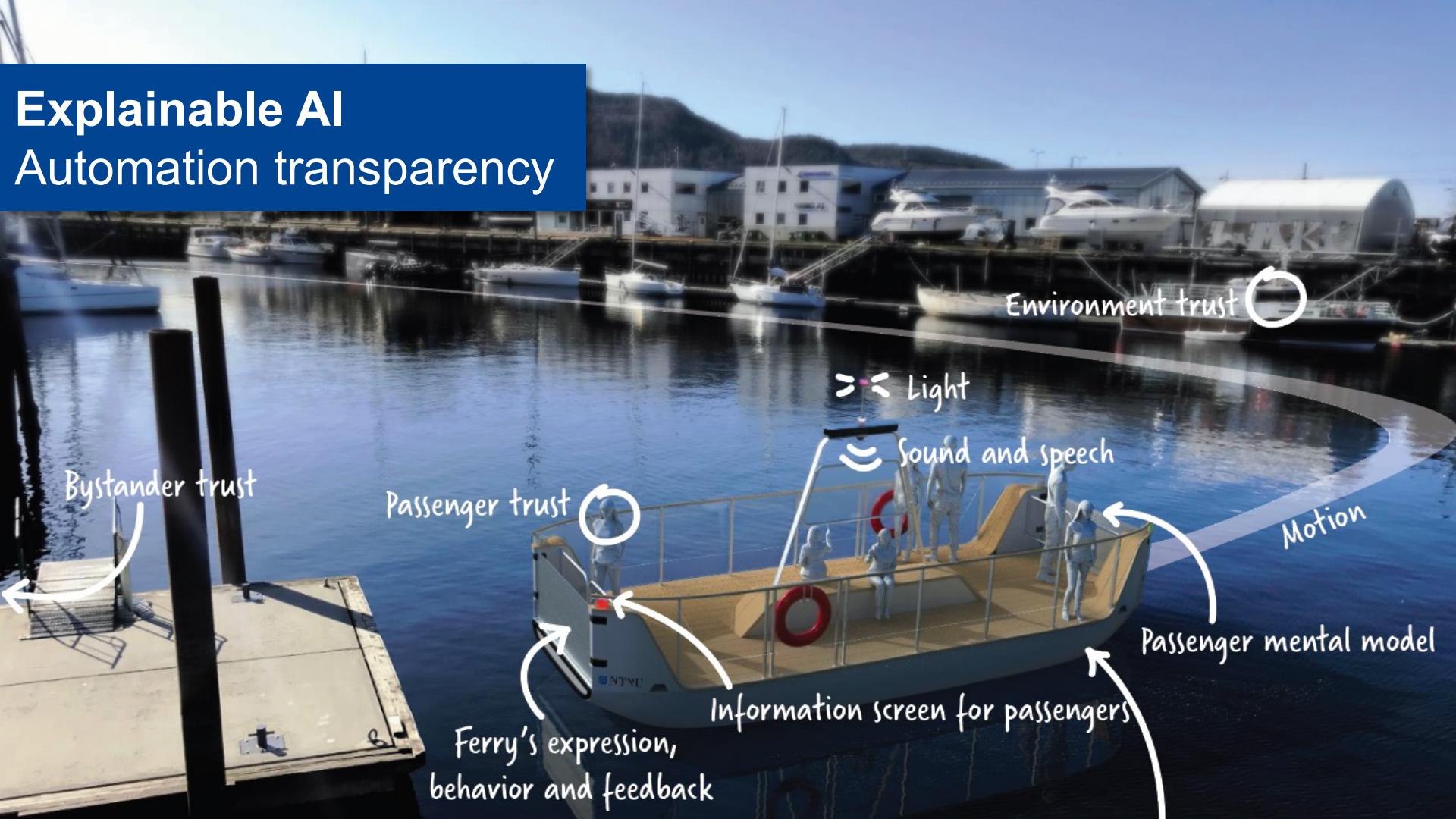
Simulator for testing milliAmpere2 and operators

Land based terminal and dock




Kjør
Go
Plasser igjen
Spots left
3
9/12
Maks 12 passasjerer
Max 12 passengers
Kjør
Go
Plasser igjen
Spots left
3
9/12
Maks 12 passasjerer
Max 12 passengers
Kjør
Go
For mange passasjerer
Too many passengers
13/12
Maks 12 passasjerer
Max 12 passengers
Tilkall fergen
Call the ferry
Avganger
Finn ferjekai
Nærmeste kai: Brattøra
Neste ferje til
Nidaros
Forlater kaia om
3 min
ankomst 15:20
Nidaros
15 min
ankomst 15:45
Solsiden
35 min
ankomst 16:05
Se mer
Solsiden (400m)
Nidaros (1.2 km)
Lerkendal (6 km)
Live kart
Ferje: MilAmper 1
Antall passasjerer: 8
Sakker fart
Neste stopp: Nidaros 4 min

Explainable AI
Automation transparency



Automation transparency

MASS

***Express* current state and future intention**

Nearby ship

Automation transparency

MASS

Express **current state and future intention**

Perceive **current state and future intention**

Nearby ship

Stakeholders of autonomous ships

Developers

Operators

Passengers

Non-SOLAS ships

SOLAS ships

(Veitch & Alsos, 2021)

Journal of
Marine Science and Engineering

MDPI

Article

Human-Centered Explainable Artificial Intelligence for Marine Autonomous Surface Vehicles

Erik Veitch * and Ole Andreas Alsos

Department of Design, Norwegian University of Science and Technology (NTNU), Kolbjørn Hejes Vei 2b, 7491 Trondheim, Norway; ole.alsos@ntnu.no
* Correspondence: erik.a.veitch@ntnu.no

Abstract: Explainable Artificial Intelligence (XAI) for Autonomous Surface Vehicles (ASVs) addresses developers' needs for model interpretation, understandability, and trust. As ASVs approach wide-scale deployment, these needs are expanded to include end user interactions in real-world contexts. Despite recent successes of technology-centered XAI for enhancing the explainability of AI techniques to expert users, these approaches do not necessarily carry over to non-expert end users. Passengers, other vessels, and remote operators will have XAI needs distinct from those of expert users targeted in a traditional technology-centered approach. We formulate a concept called 'human-centered XAI' to address emerging end user interaction needs for ASVs. To structure the concept, we adopt a model-based reasoning method for concept formation consisting of three processes: analogy, visualization,

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A systematic review of human-AI interaction in autonomous ship systems

Erik Veitch *, Ole Andreas Alsos

NTNU, Department of Design, Kolbjørn Hejes Vei 2b, 7491 Trondheim, Norway

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Safety management
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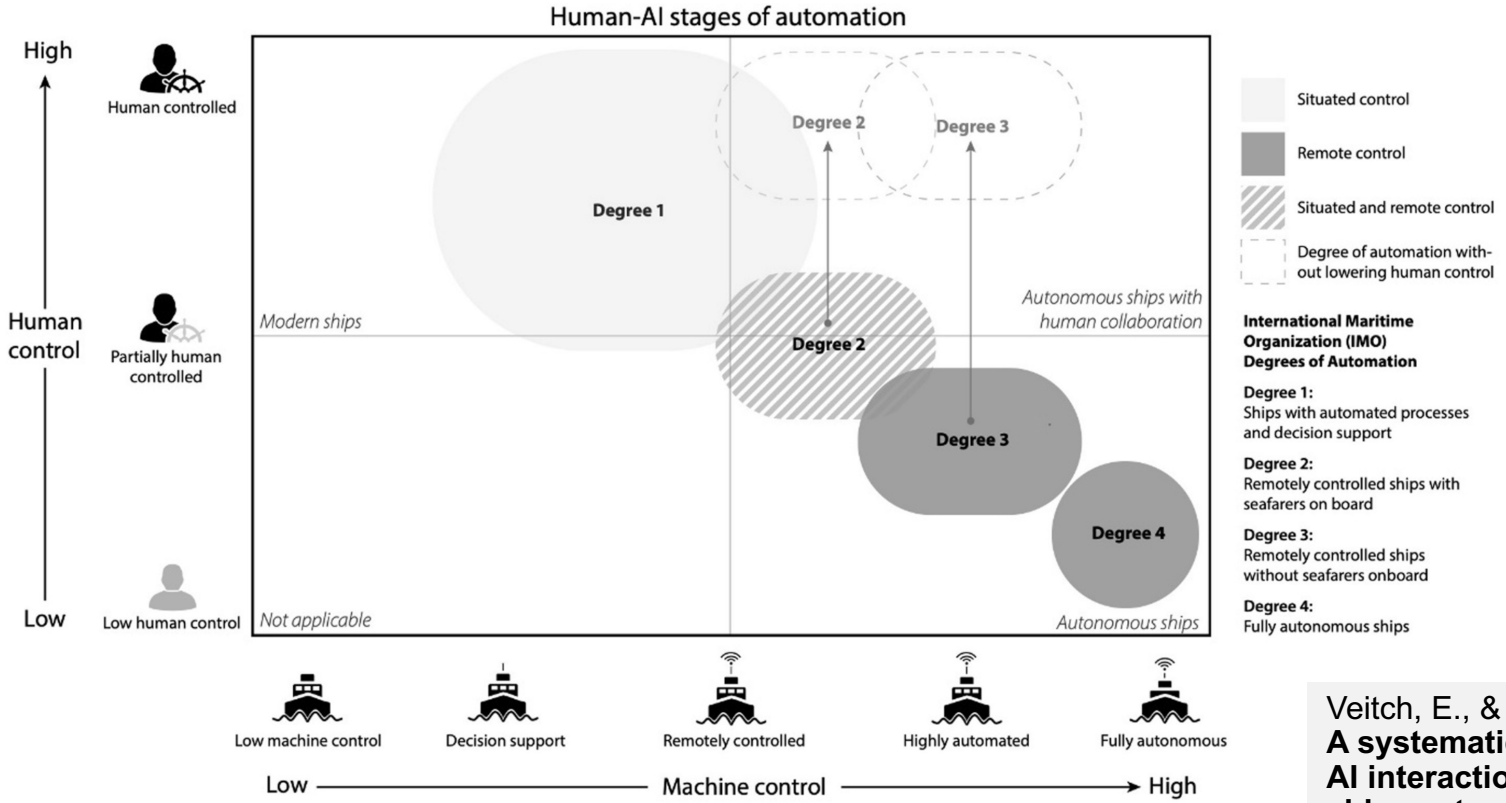
Maritime Autonomous Surface Ships
STPA
Bayesian Networks

ABSTRACT

Automation is increasing in shipping. Advancements in Artificial Intelligence (AI) applications like collision avoidance and computer vision have the potential to augment or take over the roles of ship navigators. However, implementation of AI technologies may also jeopardize safety if done in a way that reduces human control. In this systematic review, we included 42 studies about human supervision and control of autonomous ships. We addressed three research questions (a) how is human control currently being adopted in autonomous ship systems? (b) what methods, approaches, and theories are being used to address safety concerns and design challenges? and (c) what research gaps, regulatory obstacles, and technical shortcomings represent the most significant barriers to their implementation? We found that (1) human operators have an active role in ensuring autonomous ship safety above and beyond a backup role, (2) System-Theoretic Process Analysis and Bayesian Networks are the most common risk assessment tools in risk-based design, and (3) the new role of shore control center operators will require new competencies and training. The field of autonomous ship research is growing quickly. New risks are emerging from increasing interaction with AI systems in safety–critical systems, under-

Two-dimensional degrees of automation



Veitch, E., & Alsos, O. A. (2022). **A systematic review of human-AI interaction in autonomous ship systems.** Safety Science, 152, 105778.

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Kapasitetsløft for å styrke kompetanse og forskning for regionalt næringsliv

Publisert 15. apr 2021 | Oppdatert 15. des 2021

Last ned

GJENNOMFØRT

SE RESULTAT

Søknadstype: Kompetanse- og samarbeidsprosjekt

Søknadsfrist: 15. september 2021, 13.00 CEST

Aktuelle temaområder: Bransjer og næringer

Målgrupper: Forskningsorganisasjon

Støttegrenser: Kr 18 000 000-30 000 000

Antatt tilgjengelige midler: Kr 240 000 000

Prosjektvarighet: 72-72 måneder

Utlysningskontakt: Kaj Mjøsund

Utfordringer med dagens situasjon

Teknologibedriftene er allerede gode på teknologi, men

- mangler kompetanse og kapasitet rundt **design og menneskelige faktorer**.
- har liten kunnskap om hvordan **designe for tillit** slik at brukere aksepterer og stoler på autonom teknologi.
- fokuserer for **lite på forretningsutvikling**
- må **tilpasse eksisterende metodikk** for design og innovasjon til autonom teknologi
- **mister nyutdannede teknologer** til Østlandet

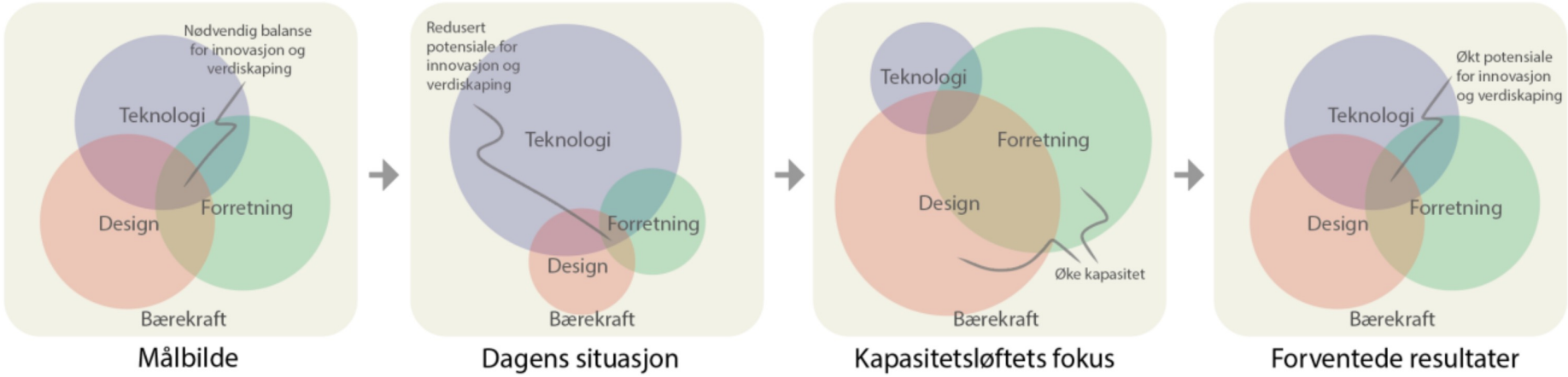
Mennesket i fremtidens havromsoperasjoner (MIDAS)

Visjon: Styrke midtnorsk næringslivs innovasjonsevne, utvikling og eksport av autonom havromsteknologi

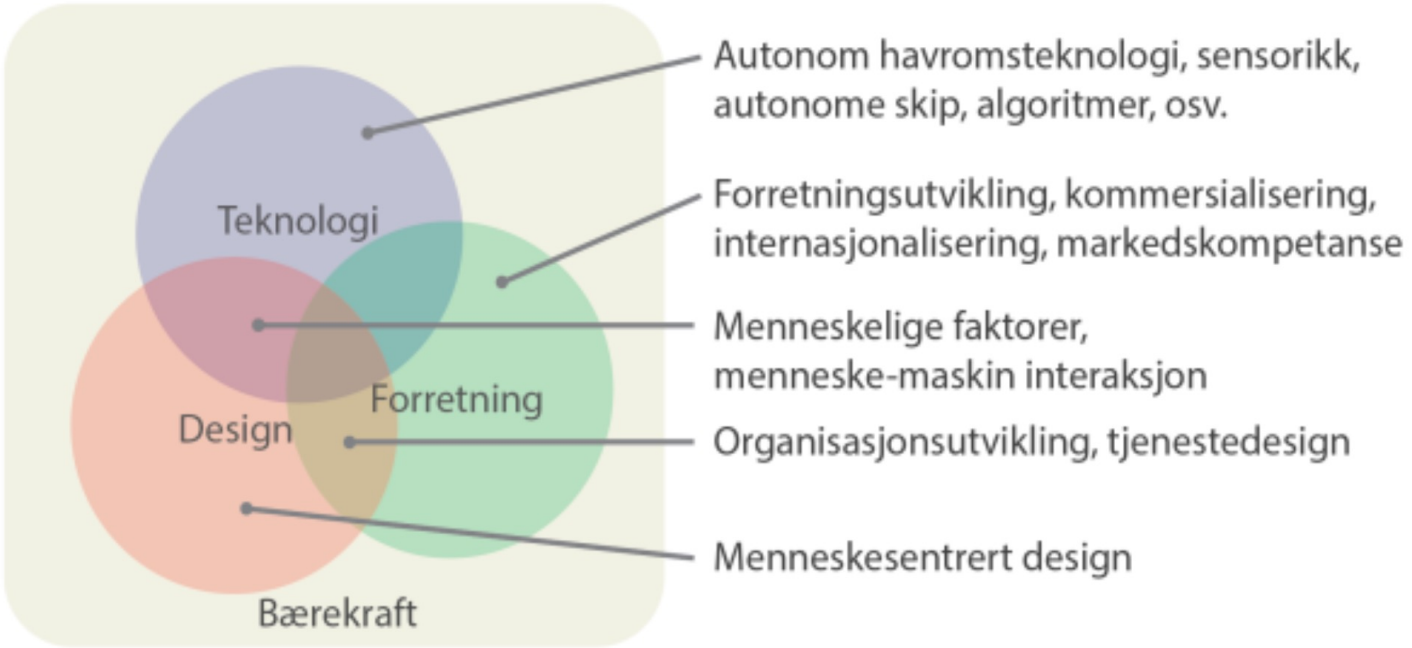
Hovedmål: MIDAS skal bygge en kompetanse- og samarbeidsplattform mellom regionalt næringsliv og FoU som skal løfte regionens kapasitet innen kompetanseområdene design og forretning, og sørge for sterkere samhandling og mer effektiv bruk av eksisterende kompetanseressurser.

MIDAS: Mennesket i fremtidens havromsoperasjoner

38 MNOK, 6 år

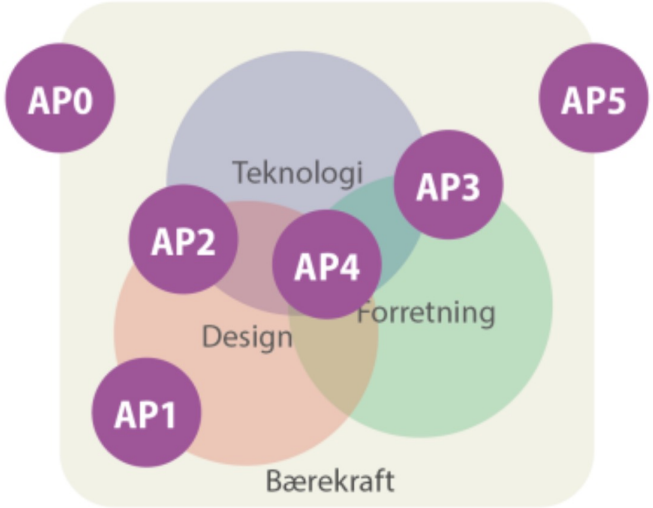


Figur 2: Våre begrepsdefinisjoner og fokus

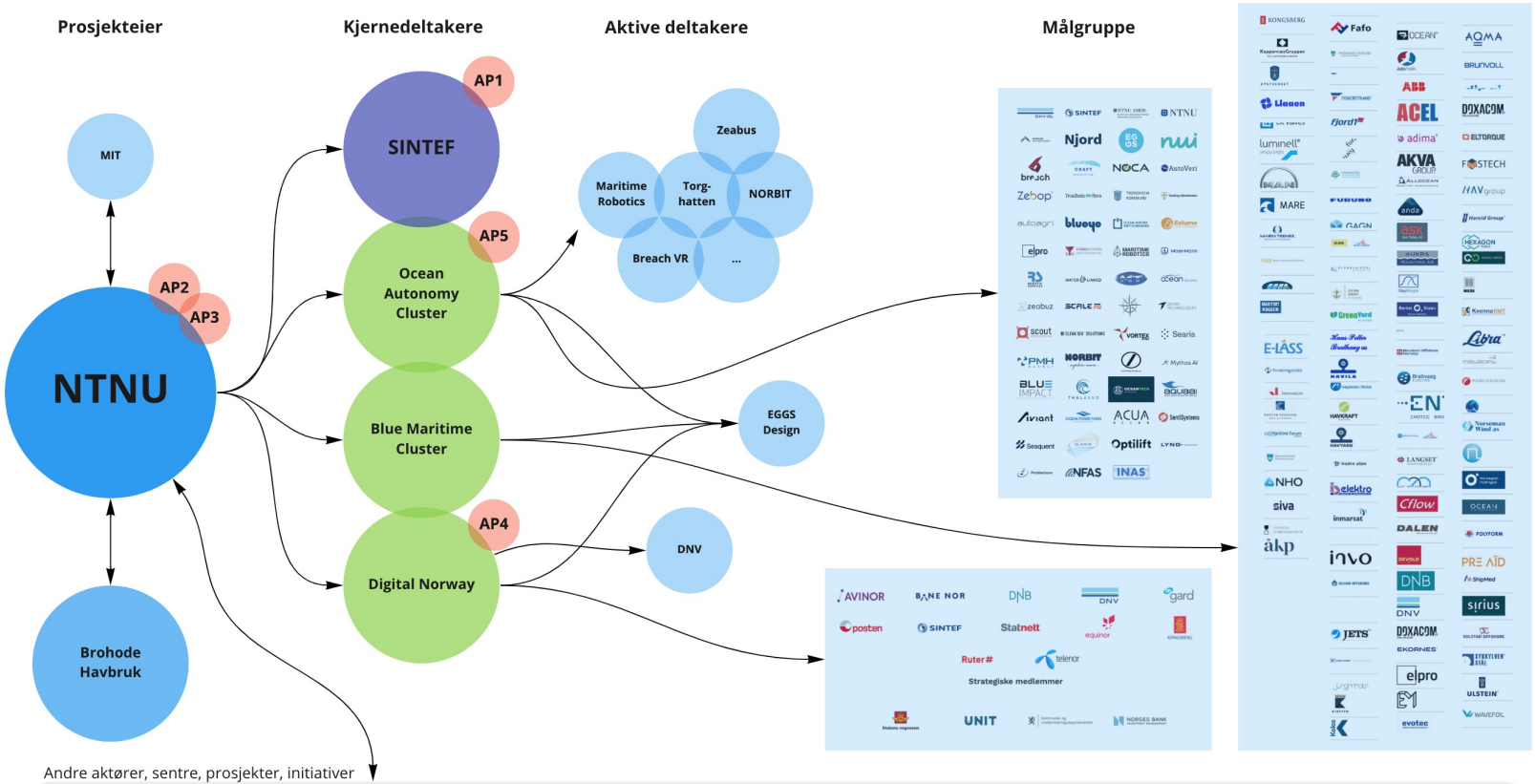


Arbeidspakker

1. Menneskelige faktorer i autonome systemer
2. Tillit til autonomi gjennom systemforståelse og –design
3. Forretningsutvikling, kommersialisering og internasjonalisering
4. Nye metoder innen design og forretningsutvikling for autonome systemer
5. Midt-Norge som attraktiv arbeidsplass og studenter som ressurs



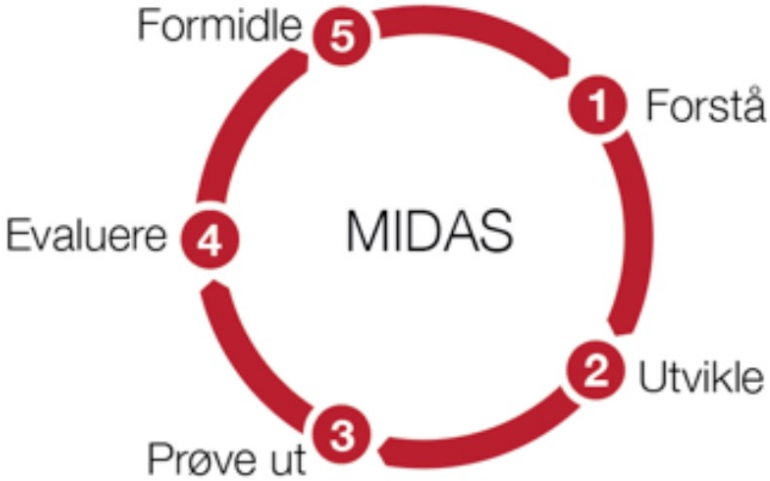
MIDAS: Partnere



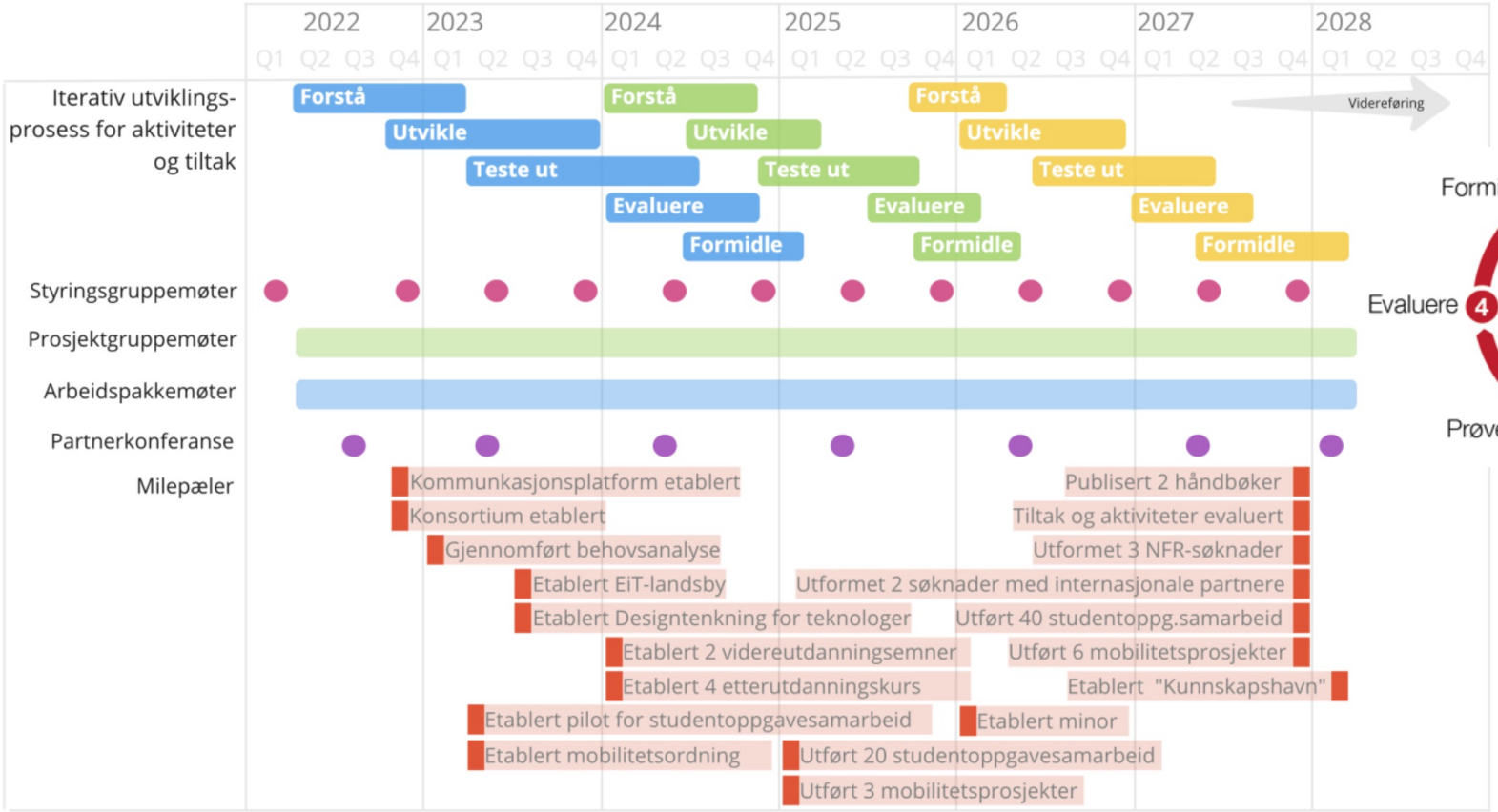
Eksempler på virkemidler

Nettverk	*Kompetanse*	*Studentsamarbeid*	*Publikasjoner*	*Mobilitetsordninger*
Kurs	Emne: Maritime work system design	Master-oppgaver	Lærebok i HF	"Lån en forsker"
Konferanse	Emne: Designtenkning for teknologer	Student-oppgaver	Kronikker og Populær-vitenskapelige publikasjoner	Toer-stilling
Arbeids-møter	Minor i Human factors	Student-konkurranser	Vitenskapelige artikler	Sommer-jobber

Prosess



Prosjektplan



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