SINTEF
75 år

Autonomi på kurs:

Hvor langt er IMO – og hvor leder Norge?

Lars Andreas Lien Wennersberg, SINTEF Ocean.

Digital samhandling til sjøs, Trondheim, 16. oktober 2025.

- SITUASJONSFORSTÅELSE
- AUTONOM NAVIGASJON
- INTELLIGENT MASKINERIKONTROLL

Foto: Kongsberg Maritime

Foto: Kongsberg Maritime

A novel approach to risk analysis of automooring operations on autonomous vessels

Towards a Framework of Operational-Risk Assessment for a Maritime Autonomous Surface Ship

Towards system-theoretic risk assessment for future ships: A framework for selecting Risk Control Options

Challenges, solution proposals and research directions in safety and risk assessment of autonomous shipping

Risk assessment of the operations of maritime autonomous surface ships

Safety Risk Analysis of Unmanned Ships in Inland Rivers Based on a Fuzzy Bayesian Network

A system-theoretic approach to safety and security co-analysis of autonomous ships

A novel risk assessment process: Application to an autonomous inland waterways ship

A novel cyber-risk assessment method for ship systems

Risk Assessment for an Unmanned Merchant Ship

Structure model-based hazard identification method for autonomous ships

Towards supervisory risk control of autonomous ships

Toward a hybrid approach for the risk analysis of maritime autonomous surface ships: a systematic review

Operational risk identification of maritime surface autonomous ship: A network analysis approach

Cyber-Risk Assessment for Autonomous Ships

A novel quantitative and qualitative model for forecasting the navigational risks of Maritime Autonomous Surface Ships

A Collision Risk Identification Method for Autonomous Ships Based on Field Theory

Development and testing of a risk-based control system for autonomous ships

Safety Assurance of Maritime Autonomous Surface Ships

A systems-based application for autonomous vessels safety: Hazard identification as a function of increasing autonomy levels

A systemic hazard analysis and management process for the concept design phase of an autonomous vessel

Towards a framework for assurance of autonomous navigation systems in the maritime industry

Massterly (a Kongsberg Wilhelmsen joint venture)
4,998 followers
1h •

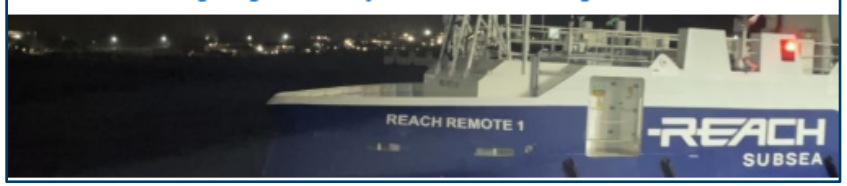
She's on her own!
During the summer, a support vessel, with standby crew and emergency controls have followed Reach Remote 1 while she has been remote controlled from Massterly (a Kongsberg Wilhelmsen joint venture) operations centre in Horten.
Yesterday she left port alone!

ROC operators Tom Roger and Remy together with technician Tore got the privilege to take Reach Remote 1 out on this historical voyage towards the Ormen Lange field. But they are only three of a large Massterly team that have managed more than 100 successful days of operation, performed rigidus testing of onboard safety and control systems, redundancy in communication links, and modified operational procedures to what concluded with permissions from the Norwegian Maritime Authorities to release the support vessel, and commence operations without.

Massterly CEO Tom Eysto, comments one the importance of this milestone: "Trough the summer we have proved that Remote Operations are not only possible, but safe and efficient. With the release of the support vessel, we will continue to show the true benefits of Remote control and future Autonomous operations".

The cooperation between vessel owner, operator/management company, system integrator and authorities set an example for the industry.

Reach Subsea Kongsberg Maritime Sjøfartsdirektoratet Norge DNV



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First voyage with Chief Engineer at shore!

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"Communication was the key", Bjørnar said after the voyage was completed; "keeping the audio link between the bridge and the control room open, allowed me to feel part of the crew". Captain Thomas Kvamsdal Lie and First Officer Bohdan Goncharenko even sent him a selfie after mooring.

A small step - but an important one in the journey towards remote operations; Massterly COO Roger Holm emphasizes the efforts and enthusiasm put forward by the complete operational team. Without their contribution this would not be possible.

Thank you to all involved; bon voyage

1. Autonome skipsteknologier modnes.
2. Mange metodeforslag for risikovurderinger.
3. Økende erfaring med godkjenningsprosesser.

Hvor langt er IMO kommet?

INTERNATIONAL CODE OF SAFETY FOR MARITIME AUTONOMOUS SURFACE SHIPS (MASS CODE)

1. PURPOSE, PRINCIPLES AND OBJECTIVES
2. MAIN PRINCIPLES FOR MASS AND MASS FUNCTIONS
3. GOALS, FUNCTIONAL REQUIREMENTS AND EXPECTED PERFORMANCE

DRAFT INTERNATIONAL CODE OF SAFETY
FOR MARITIME AUTONOMOUS SURFACE SHIPS (MASS CODE)

Contents

“**A ROC may be considered by the Administration as a directly associated location to the navigational bridge or part of the machinery space,** as applicable, to ensure that the watchkeeping provisions of the STCW Convention and Code, 1978, as amended may also apply to remote operators”

“The master responsible for a MASS may be located **physically onboard or at a ROC**”

“If there is crew or persons on board, the **master should be physically present on board** to ensure the safety of personnel and operations”

“The approval process for MASS should be based on and follow the main principles of the **Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments (MSC.1/Circ.1455) taking into consideration parts 2 and 3 of this Code. “**

KONKRETE AVKLARINGER

“The infrastructure for connectivity, and its performance, should be acceptable to the Administration // Connectivity should be established and maintained according to quality of service accepted by the Administration.“

“Software should have an explicit and well-defined operational design domain. The use of software should not go beyond what is provided for in the ConOps and risk assessment”

“Task allocation summary; A task and function allocation summary should be submitted describing the distribution of functions and tasks between human and machine/systems in both normal, abnormal and emergency situations. “

KRAV SOM MÅ SVARES UT

Mål, funksjonelle krav og forventet ytelse

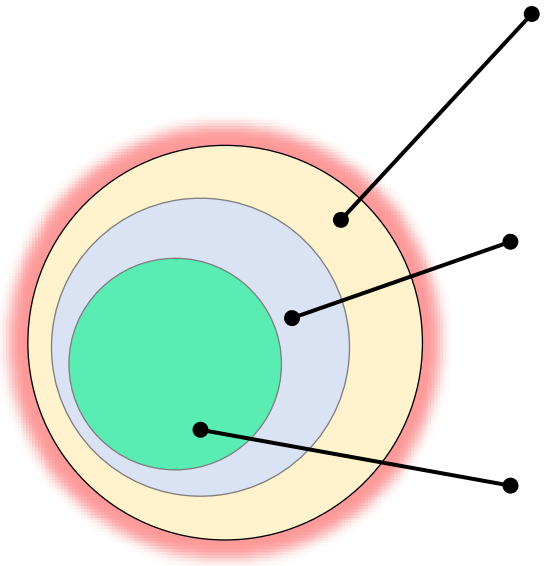
“Task allocation summary; A task and function allocation summary should be submitted describing the distribution of functions and tasks between human and machine/systems in both normal, abnormal and emergency situations. “

International Organization for Standardization

Løsningsforslag til industrien

“Method for defining and allocating capabilities and responsibilities between maritime autonomous surface ships and their remote operators.”

Samarbeid mellom automasjon og operatør



Operator control:

An operator may be assisted by the automation but is in control and needs to be immediately able to intervene.

Operator assisted:

The automation can control the ship but needs continuous attention by the operator. The operator is in control but can use own judgement to leave the control position for shorter periods.

Constrained autonomous:

Automation is safely in control and will alert operator before intervention is needed.

International Organization for Standardization

Technical Committee TC8 – Ships and marine technology, Sub Committee SC26 Smart Shipping.

1. Method for defining and allocating capabilities and responsibilities between maritime autonomous surface ships and their remote operators.
2. Software functional safety management.
3. MASS connectivity requirements.

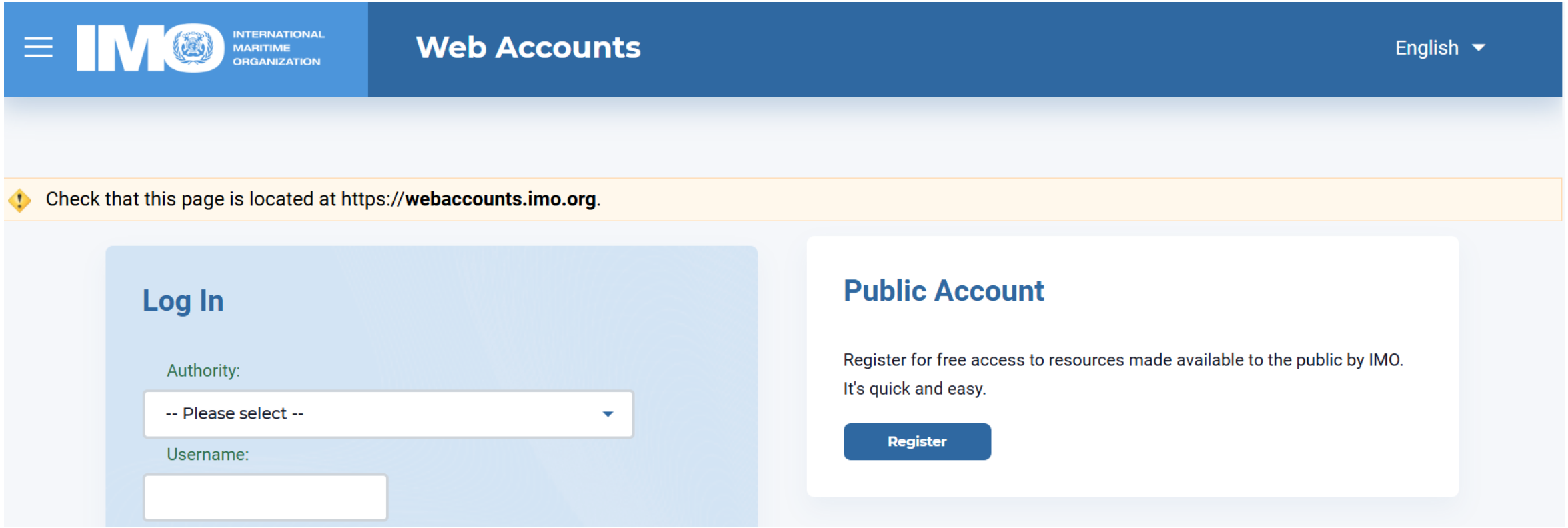
International Electrotechnical Commission

Technical Committee TC80 – Maritime navigation and radiocommunication equipment and systems.

1. Proposal to establish an Ad Hoc Group for MASS to investigate the impact of IMO MASS Code in IEC standards.

- INTERSESSIONAL WORK GROUP 4 – HUMAN ELEMENT.
- KORRESPONDANSEGRUPPE – TERMINOLOGI OG KONSISTENS.
- MSC 111 MAI 2026 – VEDTAK PÅ VOLUNTARY CODE.
- RAMMEVERK FOR ERFARINGSBYGGING.

DETALJER ER TILGJENGELIG




Hvor leder Norge?

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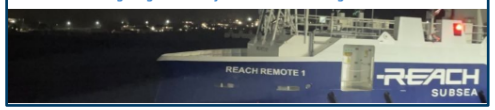

Norges travleste fergestrekning blir førerløs

På strekningen mellom Moss og Horten skal en rekke fergeturer gjennomføres helt uten at kapteinen trenger å være nær roret.

AVSLAPPET: Kaptein Christian Larsen trenger knapt løfte en finger på overfarten mellom Moss og Horten.
FOTO: HEIDI SIVERTZEN-OKSMO/NRK

Sara Vilde Solås
Journalist

Heidi Sivertzen-Oksmo
Journalist

Publisert 1. nov. 2020 kl. 16:28

Artikkelen er flere år gammel.

– Vi sitter her og følger med, og passer på at vi finner Moss og Horten. Vi har fjordens beste utsikt, forteller Christian Larsen.

Zeabuz
5,074 followers
22m •

New project announcement!

Trafikverket Färjerederiet and Stockholms Reparationsvarv AB has selected Zeabuz and Metstech to deliver key technologies for the conversion of the road ferry Neptunus to battery-hybrid operation. The SEK 97 million retrofit represents a major step forward in sustainable ferry operations and national transport infrastructure renewal.

Zeabuz and Metstech will provide a complete automation and energy solution supporting safer, cleaner, and more efficient operations on the Gullmarsleden route between Finnsbo and Skår.

As part of the retrofit, Zeabuz will supply an automated transit system enabling Neptunus to navigate precisely between docks, with automated control of acceleration, steering, and positioning. This technology optimizes battery use, reduces operator workload, and ensures stable and predictable operations on one of Sweden's most active public ferry routes.

Read more:
https://lnkd.in/dvwPqRmd

#MaritimeAutonomy #AutonomousFerry #MaritimeInnovation #FerryRetrofit #UrbanMobility #UrbanWaterways #WaterborneMobility

Skipsrevyen KONTAKT OSS STILLINGER BÅTOMTALER SHIP OF THE YEAR AIS LOGG INN

Foto: ASKO Maritime

Nå starter prøveperioden for «Marit» og «Therese»

Den norske dagligvaredistributøren ASKO Maritime har gjennomført en navneseremoni for to autonome "sjødroner" som skal inn i tjenesten som transporterer mat mellom ASKOs varehus på hver side av Oslofjorden.

Skipsrevyen KONTAKT OSS STILLINGER BÅTOMTALER SHIP OF THE YEAR AIS LOGG INN

DeepOcean og joint venture-partnerne Solstad Offshore og Østensjø Rederi har mottatt sitt første ubemannede fartøy (USV), «USV Challenger». Illustrasjon: DeepOcean

Fjord1 Ruteoversikt Meny

Aktuelt

Ubemannet fartøy overlevert – klart for subsea-arbeid

Nå tar DeepOcean i bruk et ubemannet fartøy som kan revolusjonere offshorearbeidet. «USV Challenger» styres fra land og skal gjøre jobben til tunge fartøy – til en brøkdel av kostnaden.

Byggestart for kontrollsenteret for verdas første autonome ferjer

Florø Bygg vert totalentreprenør for ombygging og rehabilitering, og Novaform er med som prosjektkoordinator.

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Teknologilederskap gjennom flerpartssamarbeid

Eier

Teknologileverandør

Klasseselskap

Operatør

Fartøy

Myndighet

Barrierer og forenklingsbehov i pågående godkjenningsprosesser for autonome skip.

Lars Andreas Lien Wennersberg, SINTEF Ocean.

Oppsummering av foreløpige funn

- Transparente krav og akseptansekriterier.
- Sterk kobling mellom tester og argumenter.
- Robust prosess som er forutsigbar og kan repeteres.
- Færre prosessteg.
- Omfattende dokumentasjon.
- Vage testprosedyrer.
- Lite bruk av resultater fra pilottesting av teknologier.
- Preskriptive regler vs. tilsvarende sikkerhet.

SEAMLESS

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Konklusjoner

- IMO MASS Code er rett rundt hjørnet.
- Norsk teknologilederskap med betydelig opparbeidet erfaring gjennom prosjekter som tar i bruk teknologi på skip og fartøy.
- Pilotprosjekter peker på noen barrierer og forenklingsbehov i godkjenningsprosesser.
- Bygge videre på erfaringer for å lage løsningsforslag og standarder som gjør det enklere å oppfylle mål, funksjonelle krav og forventet ytelse.

SINTEF
75 år

Takk for oppmerksomheten!

lars.andreas.wennersberg@sintef.no