# Space for smart and uncrewed shipping downstream services enabled by 5G and advanced PNT

Norwegian Event Webinar

21/04/2021 11:00 CEST

# Smart & Uncrewed Shipping

New Norwegian space strategy from 2019

- Promoting profitable businesses, growth and employment
- Cover important societal and user needs

# Smart & Uncrewed Shipping

New Norwegian space strategy from 2019

- Promoting profitable businesses, growth and employment
- Cover important societal and user needs

New maritime strategy from 2020 – Greener & Smarter

Maritime business / shipping is important to Norway. Employs 90 000 people / 14 billion Euro annual turnover

Global maritime value creation expected to double within 2030 (Source; OECD)

High level of digital skills in Norway but labour costs are also high

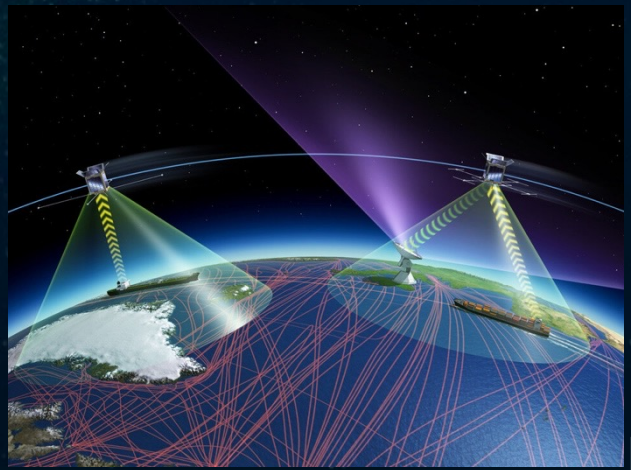

# Smart & Uncrewed Shipping

Development of new innovative services/applications and related technologies may

- create value for industry and their customers
- create value for government actors
- support the focus on maritime sustainability
- boost the use of space assets

Linking the use of ARTES BASS and other ESA funding schemes is «fresh thinking» and may demonstrate how to better use R&D funding through ESA!

Source; ESA



# Agenda

**11:05-11:50**

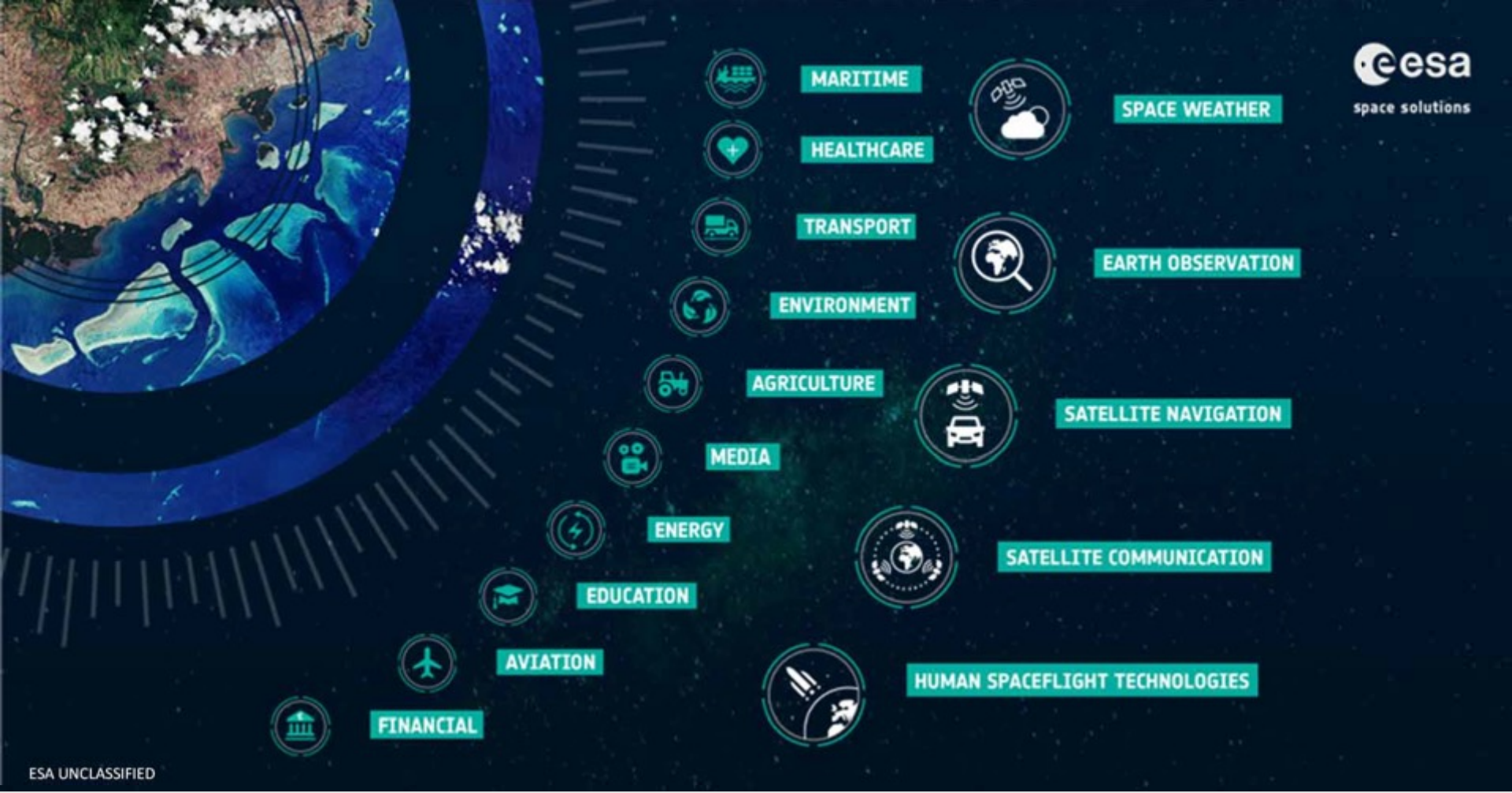
**Part 1 - Space Solutions and maritime related opportunities**

- The “Smart and Uncrewed Shipping” call
  Rita Rinaldo (ESA)
- Introduction to Trondheimsfjorden for autonomous shipping
  Chairman Gard Ueland (Kongsberg Seatex)
- Test site Trondheimsfjorden for autonomous shipping
  Kay Fjørtoft (SINTEF Ocean)
- Ocean Space Centre – Fjordlab
  Beate Kvamstad-Lervold (SINTEF Ocean)

# Purpose of the European Space Agency

"To provide and promote, for exclusively peaceful purposes, cooperation among European states in **space research** and **technology** and their **space applications.**"

**Article 2 of**
**ESA Convention**


esa
space solutions
MARITIME
HEALTHCARE
TRANSPORT
ENVIRONMENT
AGRICULTURE
MEDIA
ENERGY
EDUCATION
AVIATION
FINANCIAL
SPACE WEATHER
EARTH OBSERVATION
SATELLITE NAVIGATION
SATELLITE COMMUNICATION
HUMAN SPACEFLIGHT TECHNOLOGIES
ESA UNCLASSIFIED

# ESA SPACE SOLUTIONS OFFERS

- Zero-equity funding (from €50k to €2M+ per activity)
- A personalised ESA consultant
- Technical support and commercial guidance
- Tailored project management support
- Access to our international network of ESA and partners
- Access to our network of investors
- Credibility of the ESA brand

# Strategic Partnerships

esa space solutions

## European Institutional Actors

Frontex
EMSA
EU SatCen
EDA
EASA

## Vertical Industry and associations

ENTSO ENEL
Friends of the Supergrid
CarbonTrust
Indian Energy Storage Alliance
OneSea Alliance
SINTEF Ocean

## International Institutional Actors

UNICRI
IOM
Eurocontrol
WWF

## National Governments

DCMS (UK)
DfT (UK)
MID (IT)
MISE (IT)
IT Ministry of Education
OPRED (UK)
Traficom (FI)

## Technology toppers

Vodafone
AWS
IBM

## Smart Cities/Regions

Roma
Torino
L'Aquila
Abruzzo
Groningen
Bari

## Platforms

Toilet Board Coalition
The Plastic Bank
Mirpuri Foundation
Genius100 Foundation

# ESA – SINTEF Ocean Cooperation

## Objectives:

1. Support of emergence of smart and autonomous shipping space-based applications based on advanced technologies such as advanced Position, Navigation and Timing (PNT) and digital connectivity

2. Support the emergence of new space-based applications for improved maritime safety, coastal monitoring and environmental sustainability at sea and in coastal areas

# Next step…

**Space for Smart and Uncrewed Shipping**

**to foster innovation enabled by space technologies and data**

# Call for Proposal Objectives

- Promote the development of sustainable integrated downstream services in the domain of smart shipping and/or uncrewed shipping;
- Develop any necessary innovative space-based technologies such as converged 5G networks and advanced PNT (Positioning, Navigation, Timing),
- Advance the safe integration of uncrewed maritime vessels in the maritime traffic
- Provide pre-operational demonstrations to the prospective users and customers of the proposed services show-casing the benefits deriving from the utilization of space

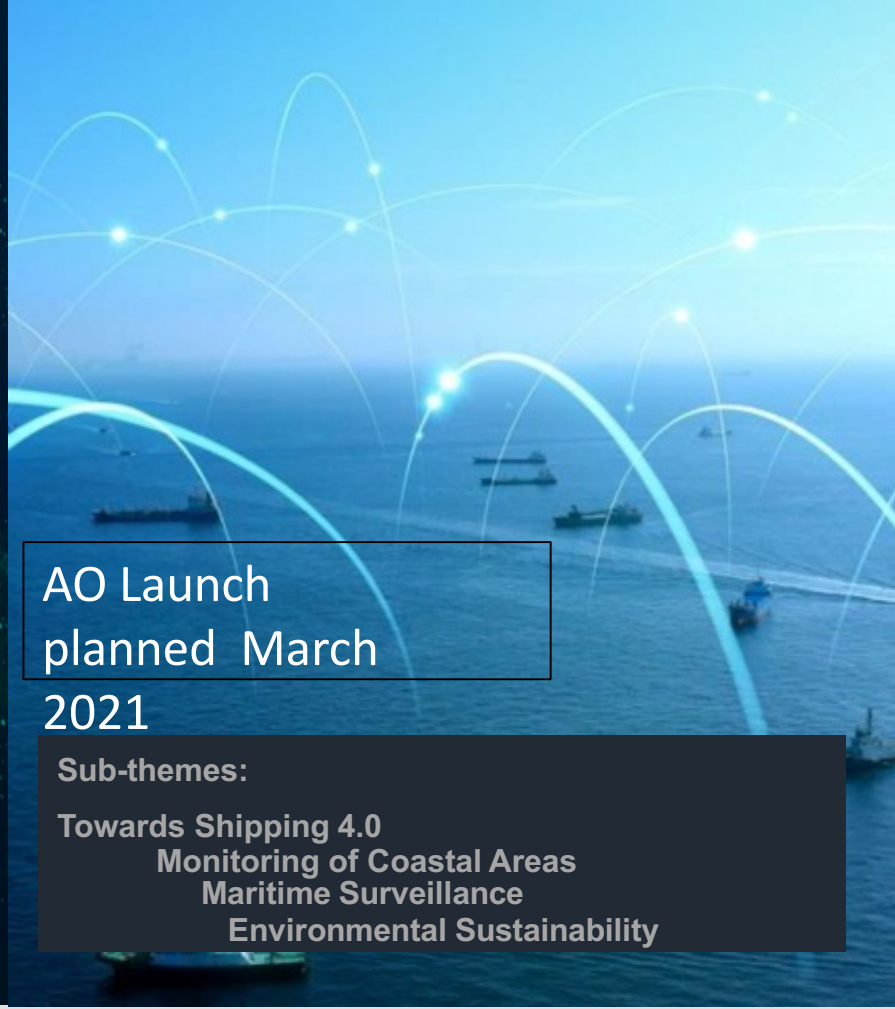
# Space for smart and uncrewed shipping downstream services enabled by 5G and advanced PNT

"Space for smart and uncrewed shipping"

Announcement of Opportunity (AO) aims to support the development of space based downstream services and solutions relying on advanced technologies such as 5G and PNT (Positioning, Navigation and Timing) in the smart and uncrewed shipping domain.

Discussions held with several stakeholders:

Germany, Norway, UK, Finland and Italy



AO Launch planned March 2021

**Sub-themes:**

**Towards Shipping 4.0**
**Monitoring of Coastal Areas**
**Maritime Surveillance**
**Environmental Sustainability**

# Space for smart and uncrewed shipping: Use Cases

## Sub-theme 1: Towards Shipping 4.0

- Digitalization of maritime services and data platforms at sea and ports
- Developing predictive and digital maintenancesolutions
- Support to efficient remote operations atsea
- Uncrewed shipping for inland waters and short term shipping
- Safe autonomous navigation and operations of uncrewedvessels

## Sub-theme 2: Monitoring of coastalareas

- Detection and monitoring of threatened coastalareas
- Monitoring land and water infrastructure in coastal areas
- Mitigating climate change impact risks alongcoastlines

## Sub-theme 3: Maritime surveillance

- Surveillance of maritimetraffic
- Detection of illegal actions related to illegalfisheries
- Detection of oil-spilling and environmentalpollution

## Sub-theme 4: Environment sustainability

- Impact of weather and current data on navigationalfootprint
- Reduction of emissions and environmental footprint ofmaritime transport
- Monitoring of marine-protected areas – preservation ofbiodiversity

## Enablers

- Secure converged 5G networks
- Precise navigation
- Situational awareness data
- AI/machine learning, Blockchain
- Robotics
- Micro constellations

# Towards Shipping 4.0: Digitalization at Sea and Ports

## Possible applications include:

Digitalization of maritime services and data platforms at sea and ports

- Near real-time monitoring of port capacities and capacity-oriented statistical analysis of container ports, with the help of frequently updated high-resolution EO imagery that is interpreted by machine learning, to identify the number of shipping containers in the picture and used as input to statistical algorithms.
- Predictive and digital maintenance solutions
- Support to efficient remote operations at sea
- Real-time monitoring of cargo in individual containers, using cargo-specific sensors (temperature, humidity, motion, etc.) exploiting as example on blockchain-protected satellite link to transmit their data

# Towards Shipping 4.0: Digitalization at Sea and Ports

## Possible applications include:

- Uncrewed shipping for inland waters and short term shipping
- Safe autonomous navigation and operations
  - Remote monitoring and operation of autonomous vessels, by combining blockchain-secured 5G with satellite links as well as using satellite positioning to achieve accurate and reliable navigation.
  - Prevention of ship collisions in densely trafficked shipping lanes, by continuously monitoring the position and course of vessels, and externally inducing course corrections if necessary.

## Monitoring of coastal areas

Possible applications include:

- Detection and monitoring of threatened coastal areas
- Monitoring land and waterinfrastructure in coastal areas
- Mitigating climate change impact risks along coastlines

esa space solutions

# Maritime Surveillance

Possible applications include:

- Surveillance of maritime traffic
- Detection of illegal actions related to illegal fisheries
- Detection of oil-spilling and environmental pollution

## Environmental Sustainability

Possible applications include:

- Impact of weather and current data on navigational footprint
- Reduction of emissions and environmental footprint of maritime transport
- Monitoring of marine- protected areas – preservation of biodiversity

# The Power of Space

## Advanced PNT

- Provide positioning, navigation and tracking capabilities to vessels, cargo and relevant machinery utilised at ports.

## 5G/Satellite Communications

- Provide connectivity to vessels out of range of terrestrial connectivity means.
- provides broadband internet, voice over IP, real-time video and reliable communications.
- Act as a back-up to terrestrial communications.

## Earth Observation data

- Detecting and monitoring environmental impact such as coastal erosion, effects of dredging, water quality and pollutant output.
- Surveys of protected areas to ensure the safety of marine animal populations (with respect to shipping operations).
- Mapping, radar and bathymetry data to support navigation, and as input to shipping simulation models.

KONGSBERG

SMART AND UNCREWED SHIPPING

# Introduction to Trondheimsfjorden for Autonomous Shipping

Webinar 2021-04-21

Gard Ueland, President Kongsberg Seatex AS

KONGSBERG

# WE HAVE TAKEN LEADING INDUSTRIAL POSITIONS IN GROWING MARKETS

Ocean Space

Green shipping

Digitalization

Surveillance &

Security

KONGSBERG

# STRONG POSITION IN GREEN TRANSFORMATION

IMO INTERNATIONAL MARITIME ORGANIZATION

KONGSBERG

# WE ARE COMMERCIALISING AUTONOMOUS SHIPPING


KONGSBERG

# Inauguration – Autonomous Vessels Test Area

## Trondheim, September 30, 2016


Sjøfartsdirektoratet
Norwegian Maritime Authority

KYSTVERKET

KONGSBERG

NTNU

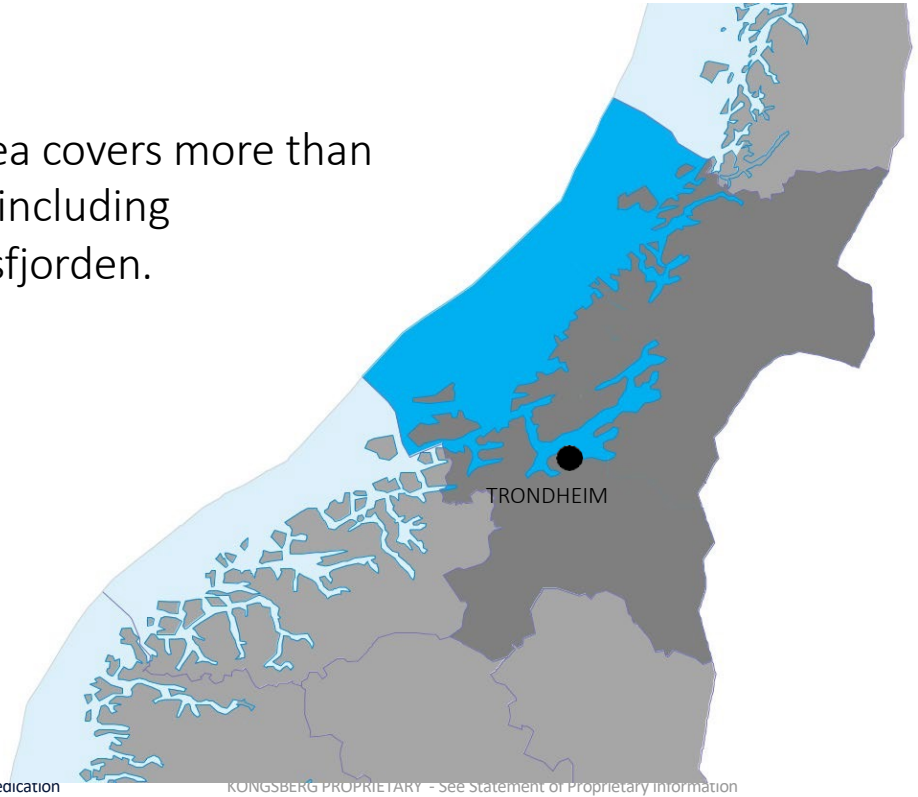
SINTEF

MARITIME ROBOTICS

Trondheim Havn

# TRONDHEIMSFJORDEN MASS TEST AREA

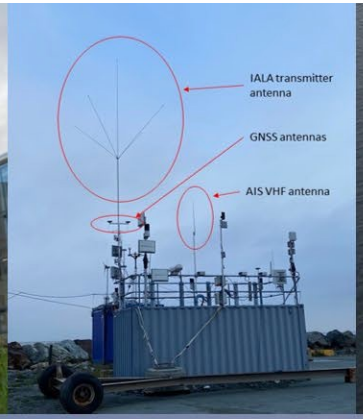
The test area covers more than 17000 km$^2$ including Trondheimsfjorden.



KONGSBERG

# KONGSBERG infrastructure in Trondheimsfjorden

Examples







# TRONDHEIMSFJORDEN MASS TEST AREA - BENEFITS

- Valuable test platform for the development of new sensor solutions and control systems
- Collaborative projects with universities, research institutions, port authorities, the Norwegian Coastal Administration and the Norwegian Maritime Authority
- Trondheimsfjorden test area - Great attention and contributes to new initiatives and identifies important opportunities for the future – nationally and internationally.
- Maintaining the moment created in Norway and securing a leading position for Norwegian industry in the shipping of the future.
- Norway has natural advantages for the development of autonomous ships - a strong maritime cluster, proactive authorities and transport systems that will benefit greatly from these solutions.

# Trondheimsfjorden Test Area for Autonomous Ship

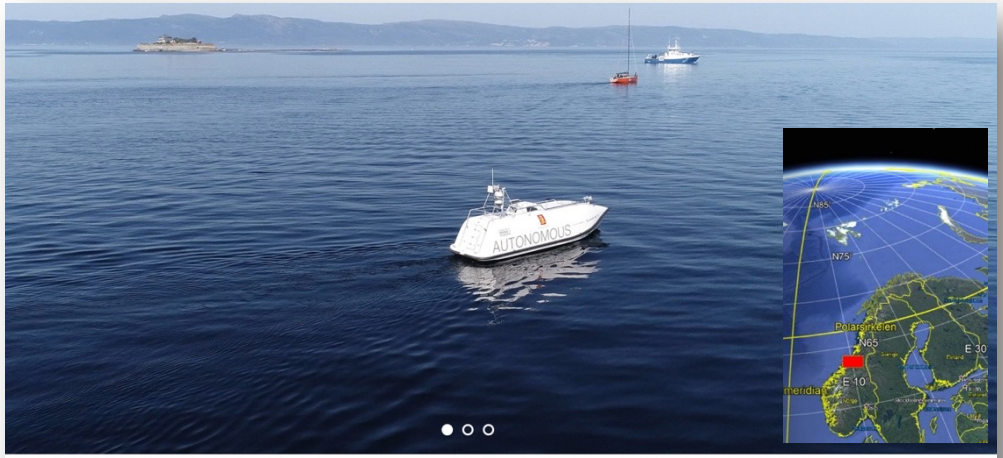
## Smart & Uncrewed shipping webinar – 21.4.21

Kay Fjørtoft, Senior Research Scientist, SINTEF Ocean

Kay.fjortoft@sintef.no

# Trondheimsfjorden Test Area for Autonomous Ship

1. Founded in 2016
2. Foster knowledge building
3. Stimulate technology development
4. Drive innovation
5. Develop rules and regulations
6. Test and verify concepts and solutions
7. Collaboration with other test sites and initiatives
   - SAMS, OAC, Storfjorden, INAS, NFAS, …
   - ESA, EU and Norwegian Research projects
   - Between academia, research and industry




Trondheimsfjorden: World's first test site for autonomous ships

KONGSBERG NTNU MARITIME ROBOTICS Trondheim Havn KYSTVERKET NORWEGIAN COASTAL ADMINISTRATION Sjøfartsdirektoratet Norwegian Maritime Authority OCEAN AUTONOMY CLUSTER DNV·GL SINTEF

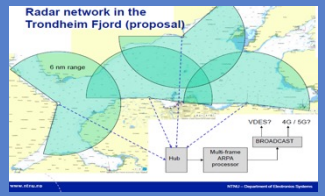
Søk etter innhold i valgte kilder

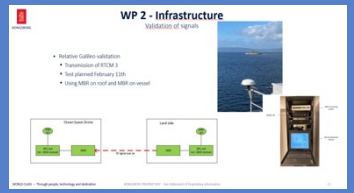
For whom:
- Service providers
- Infrastructure owners
- Government
- Academia
- Research
- Network and end users



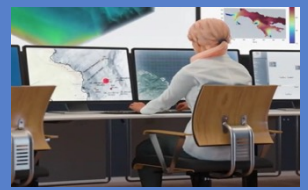


- Logistic opportunities



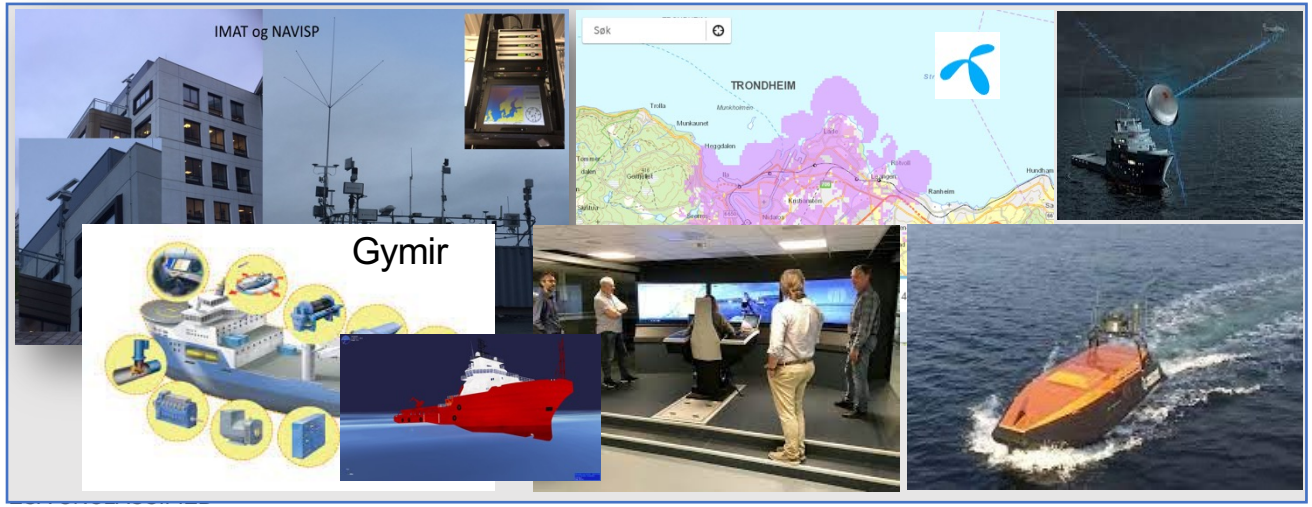

- Communication and navigation opportunities



- Operational opportunities

# Products and infrastructure

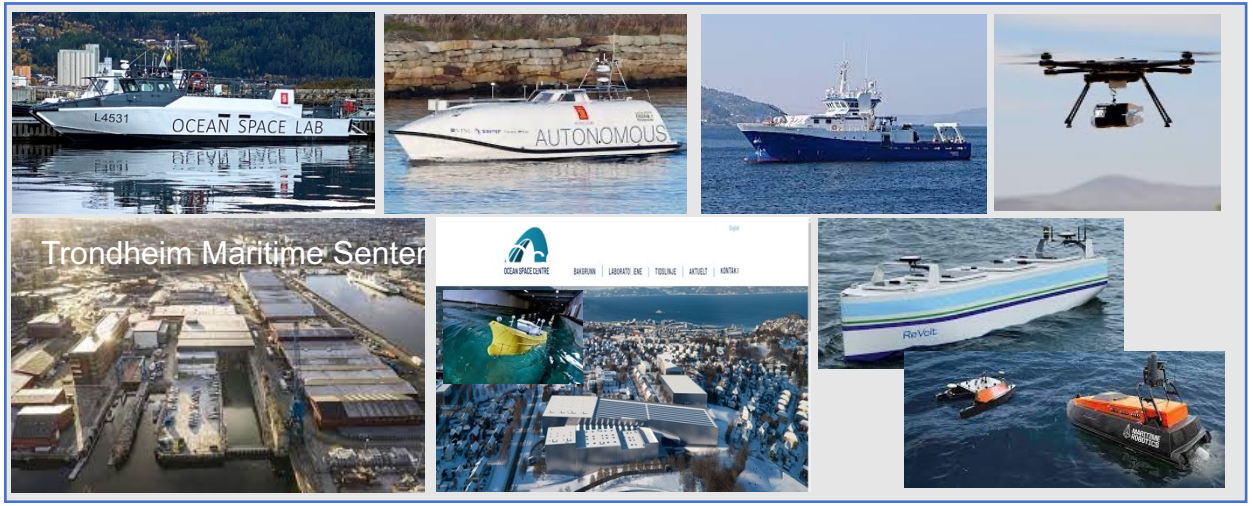
| Products and infrastructure | | | | |
|---|---|---|---|---|
| **Technologies** | **Description** | **Owner** | **Terms and conditions** | **Link** |
| AIS base station | AIS information from Norwegian Coastal Administration. | NCA | Available for rental | https://www.kystverket.no/ |
| Otter USV | 2m-long fully electric unmanned surface vehicle (USV) for sheltered waters, e.g. rivers, ports, lakes, or Trondheimsfjorden | Maritime Robotics | Available for rental. Buy: commercially available, rental: available pending other bookings, contact MR sales | https://www.maritimerobotics.com/otter |
| Mariner USV | 6m-long unmanned surface vehicle for coastal and offshore operations. | Maritime Robotics | Available for rental. Buy: commercially available, rental: available, pending other bookings, contact MR sales | https://www.maritimerobotics.com/mariner |
| .... | | | | |




- AIS base station, transponder
- USV, Otter USV, Mariner USV
- Payload sensor integration
- AidsToNavigation
- Maritime broadband radio, 5G, 4G, EDGE
- VDES (transponder, base)
- DGNSS
- GNSS monitoring station
- RADAR
- Camera, Infrared, Optical machine vision camera,
- C-Scope
- Weather stations
- Operation room, offices

# Resources

| Resources | | | | |
|---|---|---|---|---|
| **Resources** | **Description** | **Owner** | **Terms and conditions** | **Link** |
| Ocean Space Drone 1 & 2 | Vessels used for testing and demonstrations in the Trondheimsfjorden test area. The vessels are equipped with multiple sensors such as radar, GNSS, AIS, ECDIS, camera, autopilot, VHF and MBR. | Kongsberg Seatex | Available for rental | https://www.kongsberg.com/maritime/contact/our-offices/kongsberg-seatex-as/ |
| R/V Gunnerus | University owned research vessel, 36.25 m LoA, equipped with several cranes, ROV hangar, work-boat, wet and dry laboratories, offices, and sleeping quarters. R/V Gunnerus is fitted with a modern dynamic positioning system with electrical propulsion. | NTNU | See cruise prices here. | https://www.ntnu.edu/gunnerus |
| ... | | | | |




- Ocean Space Drone I & II
- Ocean Space Lab
- RV Gunnerus
- Ocean Lab Control Room
- Ocean Lab Subsea docking station
- Control Room
- Offices
- Otter, MR R&D vessel
- Work boat
- Skyranger R70 UAS

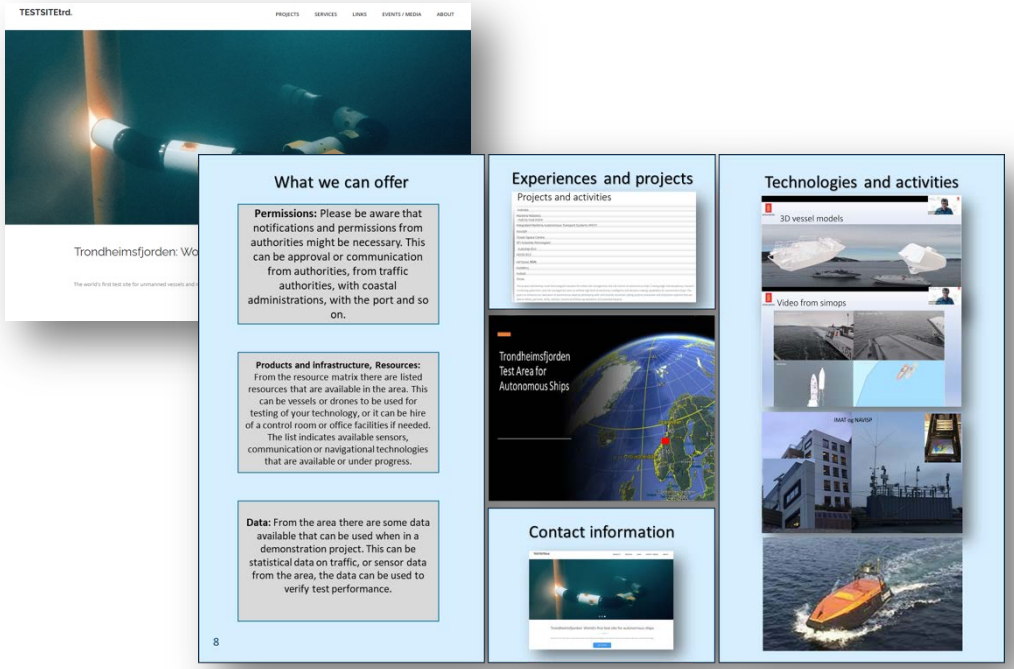
# Administrative services

| Administrative services | | | | |
|---|---|---|---|---|
| **Services** | **Description** | **Owner** | **Terms and conditions** | **Link** |
| Permissions | Applications for permissions (NKOM, Maritime Directorate, Norwegian Coastal Administration) | SINTEF Ocean | Available | |
| Communication with Traffic authorities | Set up communication with traffic authorities, the port and the fairway | SINTEF Ocean | Available | |
| Video and publication work | Help to do publications as video recording of test and documentation of results for public purposes. | SINTEF Ocean/NTNU/ OAC | Available | |
| ..... | | | | |

| Data | | | | |
|---|---|---|---|---|
| **Data** | **Description** | **Owner** | **Terms and conditions** | **Link** |
| AIS data bank | Real-time and historical data from the NCA | NCA | Available, need agreement with NCA | https://www.kystverket.no/ |
| Weather data bank | Real-time and historical data from the Port of Trondheim and open sources | Port of Trondheim | Available | https://trondheimhavn.no/ |
| Data from sensors in the fjord | Data from boys installed in the Trondheimsfjorden | SINTEF Ocean | Some available, new sensors to be installed in Q2-21 | https://www.ntnu.edu/oceanlab |
| ... | | | | |


- Permissions
- Communication with traffic authorities
- Video and media production
- AIS data bank
- Weather data
- Data from sensors
- Previous tests
- AIS, Radar, EO, IR,..
- SafeSeaNet
- Historic data
- Real time data
- Data analytics

# How to contact us?




- Testsitetrd.no
  - Contact kay.Fjortoft@sintef.no
- Specify what you are looking for in the request sheet
- The partners in the Trondheimsfjorden testarea are available to participate in project proposals

# Ocean Space Centre
# Fjordlab

Beate Kvamstad-Lervold,
Special Advisor, SINTEF Ocean
Beate.Kvamstad-Lervold@sintef.no

https://oceanspacecentre.no/

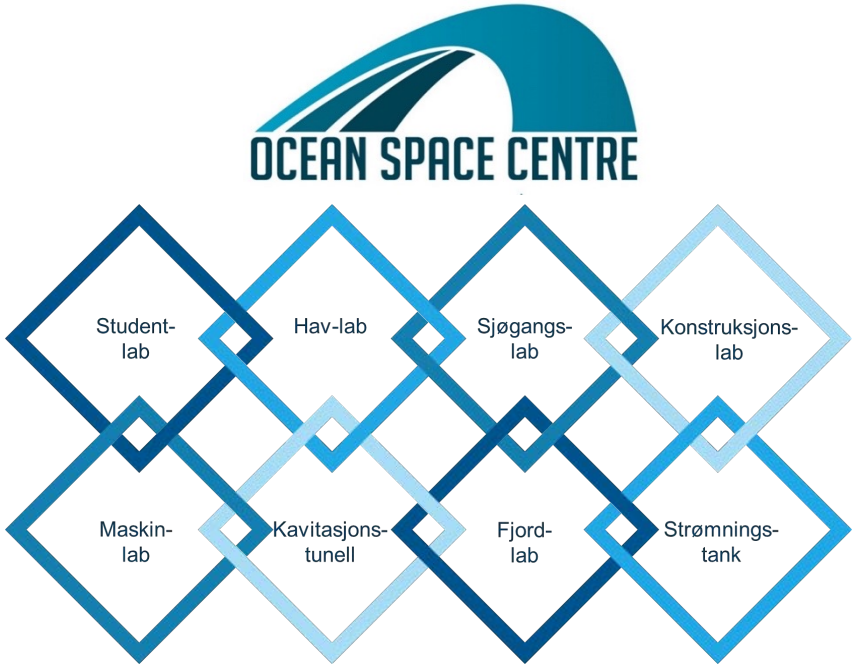
English

OCEAN SPACE CENTRE

BAKGRUNN | LABORATORIENE | TIDSLINJE | AKTUELT | KONTAKT

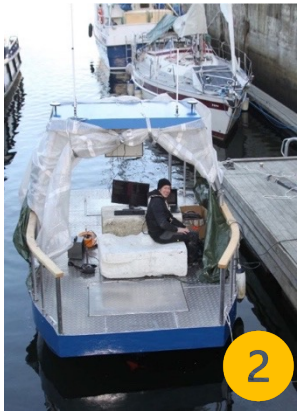
# Ocean Space Centre – A knowledge centre for future ocean space technology

# Fjordlab – The full-scale capability of OSC

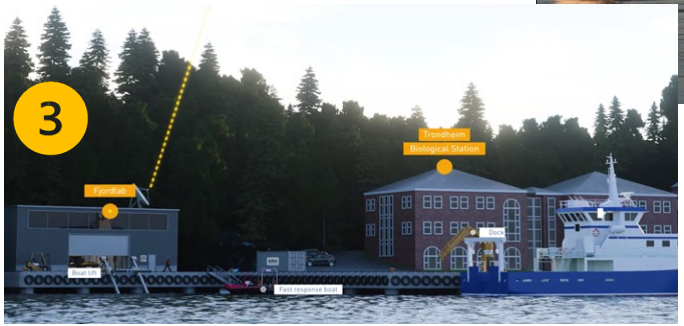



- A total of eight Ocean Space Laboratories (OSL) constitute the laboratory infrastructures of Ocean Space Centre
- Fjordlab is the fullscale field laboratory of Ocean Space Centre
- Fjordlab is a world-leading research infrastructure with a focus on digitization and autonomy, sustainability and environment in the ocean space.

# Fjordlab – reinforced full-scale infrastructure





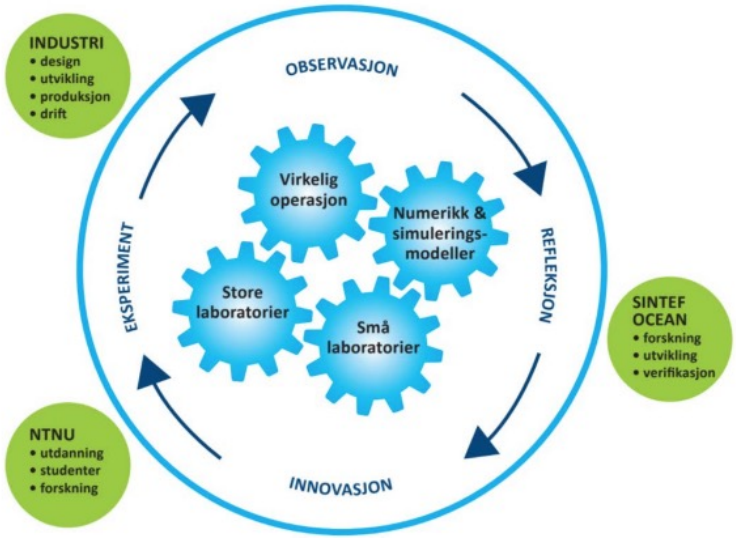




1. Test area for autonomous ship
2. Milliampére
3. AUR-lab
4. ACE
5. Technology for cost-effective ocean environment monitoring

# Why full-scale infrastructure?

- Completing the loop

1. Numeric models and analyses
2. Verification in controlled enviroment (laboratories)
3. Verification in real enviroment (full-scale)



# Timeline and phases

**Phase I OceanLab** 2020-2023 → 2025

- Establish HUBs - equipment's, instrumentation /facilitates installation/e-infra.
- Research Council of Norway – Infrastructure program: 60 mnok
- SINTEF Ocean: 30 mnok, NTNU: 3,9 mnok
- Industry: 3,25 mnok (Equinor)

***Milestone: Phase 1 OceanLab operating from Q2 2023***

Phase III (TBD, possible application NFR)

- Completing HUBs with instrumentation and logistics functions - Operations Centers
- Research Council
- Tentative budget 140-160 mnok

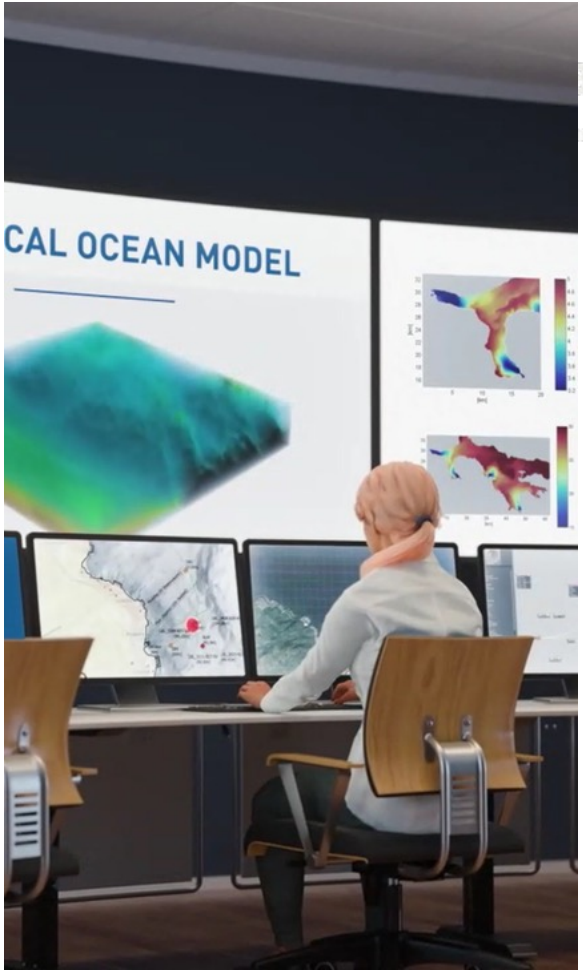
**2022–2025**

**2020–2023**

2024–2026

**Phase II** 2022-2025 Ocean Space Centre Fjordlab

- Supplement and further develop of HUBs instrumentation, e-Infrastructure, equip. operating centers
- Include Ålesund HUB
- Building activities at Trondhjem Biologiske Stasjon
- 307 mnok State budget

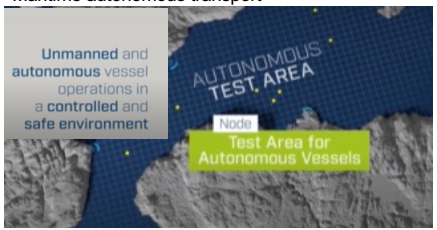


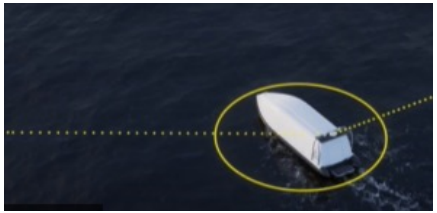
# Phase 1: The OceanLab project

Transfer of basic skills and technology between different research applications and industries

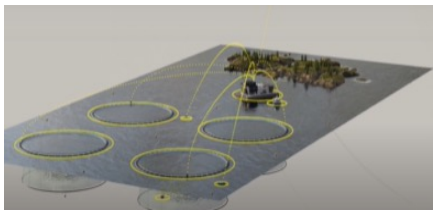
Subsea inspection & intervention


Maritime autonomous transport

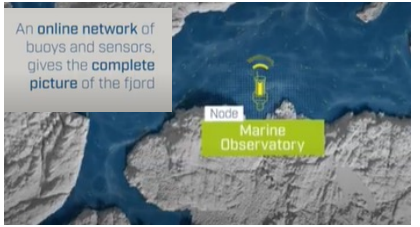


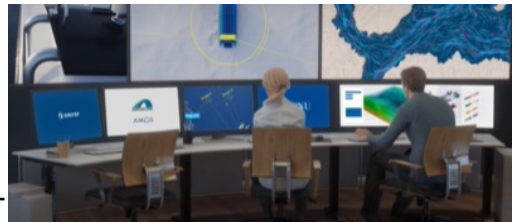
Aquaculture

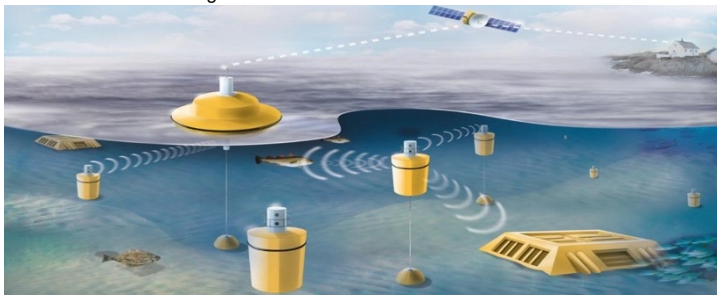
Marine observatory




Control and supervision



Connecting: Wireless communication and e-infrastructure



# Agenda

**11:50-12:30**

**Part 2 - Maritime and shipping perspectives**

- Norwegian polices regards autonomous test infrastructure
  Trond Langemyr (Norwegian Coastal Adm.)
- The industry perspective
  Vegard Hovstein (Maritime Robotics)
- The research perspective; Milliampere
  Egil Eide (NTNU)
- NFAS and INAS
  Ørnulf Rødseth (SINTEF Ocean)

# Norwegian policies regards autonomous test infrastructure

## Norwegian Coastal Administration (NCA)

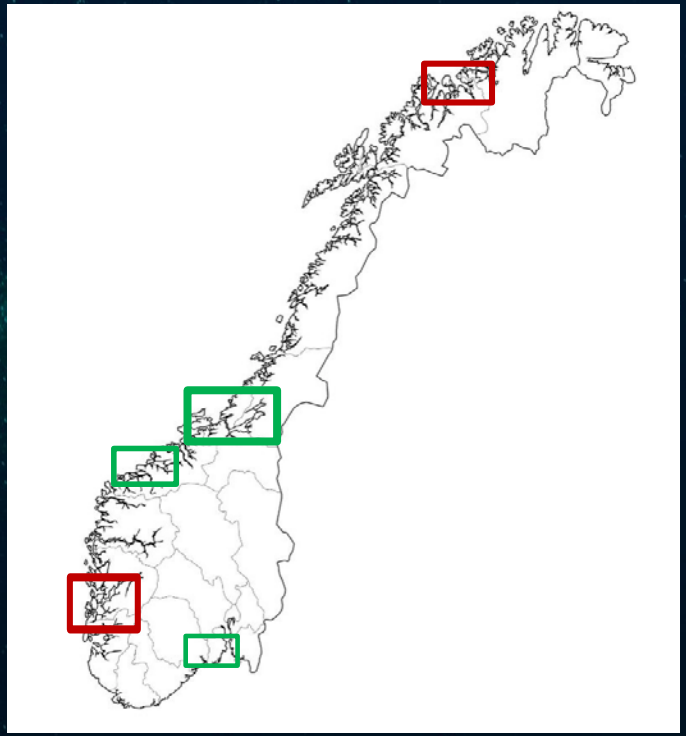
Trond Langemyr

Senior Advisor NCA
trond.langemyr@kystverket.no

# OUR APPROACH

**Seeking to be part of the solutions – not the problems**

- We want to find the future solutions for an efficient and sustainable maritime transport that safeguards or improves current maritime safety
- We believe in an industry-friendly and innovation-promoting approach
- Collaboration/cooperation is important – maritime clusters (“The Norwegian Model”)
- National legislation is already being amended to facilitate the development
- Test areas are already in place



## Relevant NCA Infrastructure

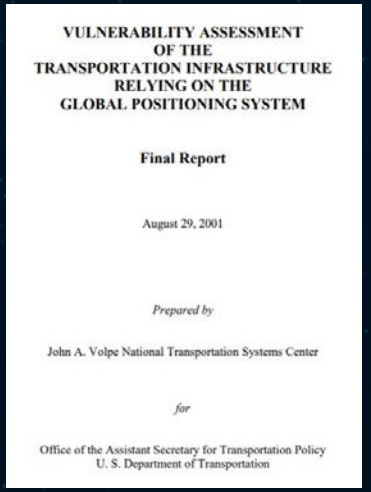
**Available by agreement – provided it does not interfere with the main functions**

- AIS (satellite and ground based)
- Radar
- VTS
- VDES (satellite and ground based)
- DGPS
- VHF
- Various digital services
- Data warehouse with access to long term quality assured AIS data (also raw data), some SafeSeaNet data and Ship registry data
- Drones with MBR, camera and other relevant sensor payloads
- Own ships (sensor platform)

## Some R&D AOIs and CHALLENGES

- Future support system for pilots (robust PNT) – incl potential use of Galileo OS NMA
- Maritime ITS / e-navigation
- Security
- VTS interaction with (autonomous) ships
- Artificial Intelligence
- Communication solutions
- Solutions within digital services

- Cyber Security
- Over-reliance in GNSS and known challenges
- Bandwith
- Comms coverage
- Frequencies



VULNERABILITY ASSESSMENT
OF THE
TRANSPORTATION INFRASTRUCTURE
RELYING ON THE
GLOBAL POSITIONING SYSTEM

Final Report

August 29, 2001

*Prepared by*

John A. Volpe National Transportation Systems Center

*for*

Office of the Assistant Secretary for Transportation Policy
U. S. Department of Transportation

# The industry perspective

Vegard Evjen Hovstein
CEO, Maritime Robotics
vegard@maritimerobotics.com

# UNMANNED SYSTEMS

COST EFFICIENT AND RISK-REDUCING
MARITIME DATA ACQUISITION



MARITIME ROBOTICS

- Established in 2005
- Located in Trondheim, Oslo and Eggemoen, Norway
- Main markets are geospatial mapping, environmental monitoring, transportation and defence/security

- Turnover: 5 mill EUR (2020)
- Growth:  20% per year
- Employees: 30+

# TESTING IN THE TRONDHEIMSFJORD IN 2007


MARITIME
ROBOTICS

MARITIME ROBOTICS

# MARITIME ROBOTICS
# USV SYSTEMS

**SHELTERED WATERS**

OTTER

**COASTAL/OPEN WATERS**


MARINER

## REFERENCES

- Delivered more than 40 USVs to customers worldwide
- Hydrography, seismic exploratiion, military and RnD market
- Several conversions of boats for unmanned operation

UNMANNED BY
MARITIME
ROBOTICS


MARITIME
ROBOTICS
A leading provider of innovative unmanned solutions


Unmanned by
MARITIME
ROBOTICS

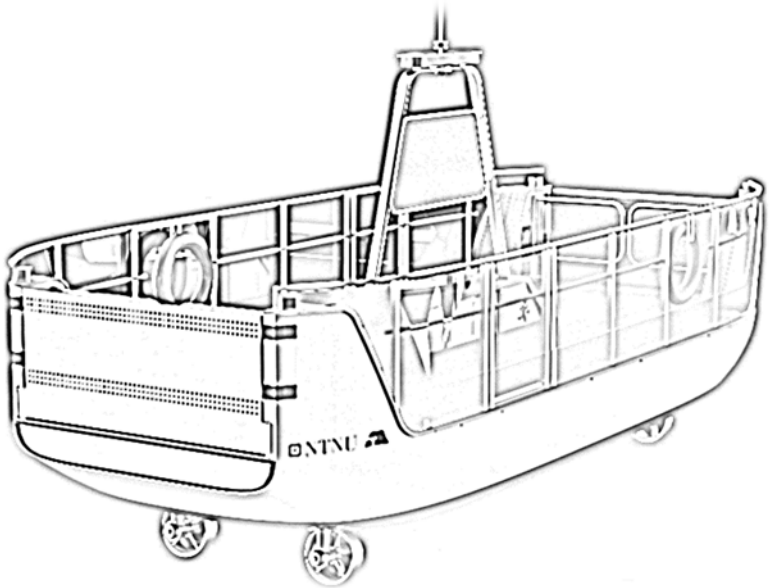
# The research perspective milliAmpére

Egil Eide

Associate Professor, NTNU

egil.eide@ntnu.no

# Autonomous urban ferries - milliAmpére




- “On-demand ferry” for urban public transportation
- Length 8.5 meter, 12 passengers
- Fully electrical propulsion
- Navigation: GNSS + LIDAR + RADAR
- Situation Awareness System: Camera, IR, LIDAR + RADAR
- Autonomy system developed by NTNU

www.ntnu.edu/autoferry

# Autonomous urban ferries - milliAmpére


## Phase I:

- Project initiated in 2016
- Scale model trials
- Shore based sensors

## Phase II:

- First prototype “milliAmpére” launched in 2017
- Development of Dynamic Positioning system
- Testing of sensors and control systems
- Testing of automatic docking system
- Research project Autoferry: 9 Phds, 40+ Msc students

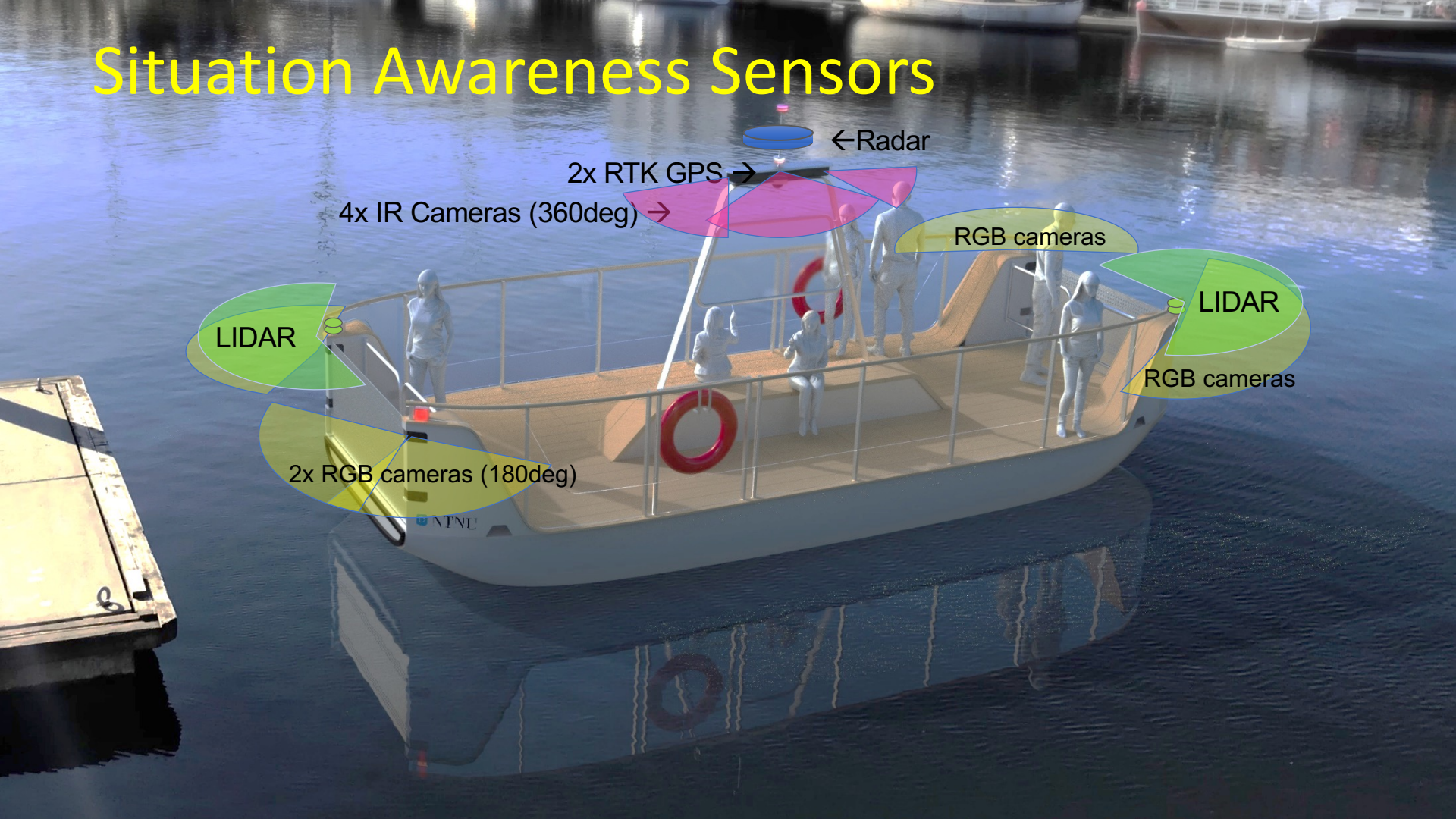
www.ntnu.edu/autoferry

# Autonomous urban ferries - milliAmpére

## Phase III:

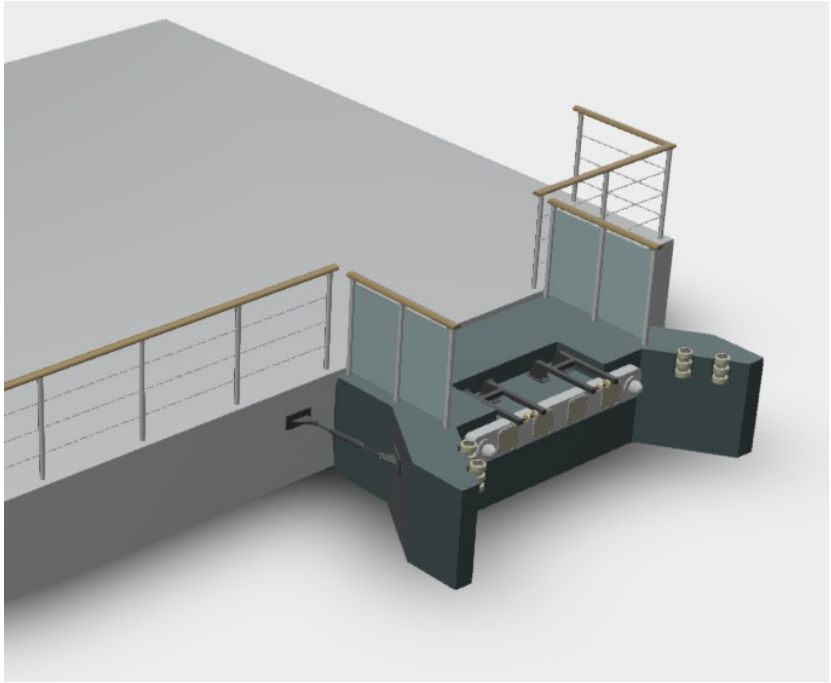
- Full scale ferry 8.5 meter launched March 2021
- Testing with invited passengers August 2021
- Regular traffic from 2022
- Full simulation model (Digital Twin) developed

# Situation Awareness Sensors




weber

# Infrastructure



## Docking system:

- Automatic onboarding of passengers
- Safe locking mechanism
- Automatic Induction charging

## Sensors and communication:

- RTK Base station
- Communication system: C-band, VDES, 4G/5G, AIS
- Shore based cameras

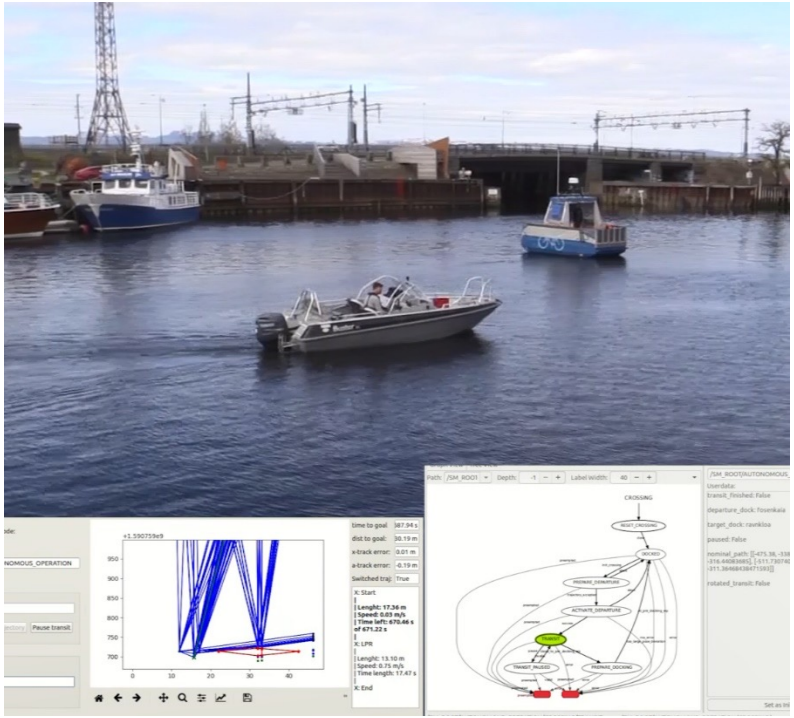
# User interface


Illustrasjon: Henrik Midtvåge Ellingsen, Peter Kristian Glesaaen, NTNU

- Booking/registration by smart phone app
- Integration with public transportation system
- Automatic passenger handling (including counting of passengers)
- Two-way emergency communication with Shore Control Center

# Research outcome

Illustrasjon: Henrik Midtvåge Ellingsen, Peter Kristian Glesaaen, NTNU



- Development of autonomy systems
- Interaction between uncrewed and ordinary ship traffic
- Electrical propulsion and charging
- Sensor fusion for Situation Awareness
- Operations and Shore Control Center
- Passenger handling and HMI
- Safety and reliability
- Integration with public transportation
- Impact on urban development / city planning

# International MASS activities

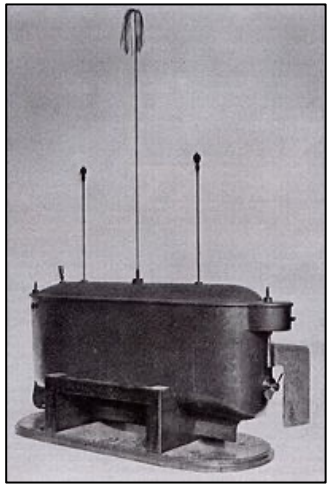
# INAS and NFAS

Ørnulf Jan Rødseth, Senior scientist, SINTEF Ocean

Manager, Norwegian Forum for Autonomous Ships

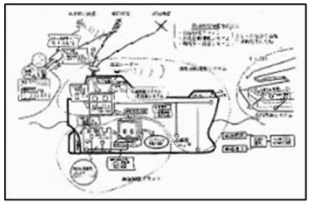
OrnulfJan.Rodseth@sintef.no

# Remote control ships are not new

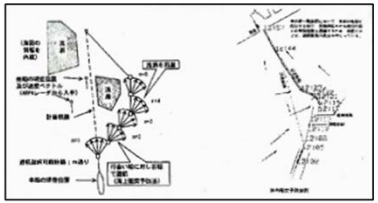


Nikola Tesla 1898

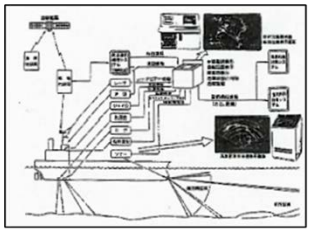
Various papers in "Bulletin of the Society of Naval Architects of Japan", Vol 721-729



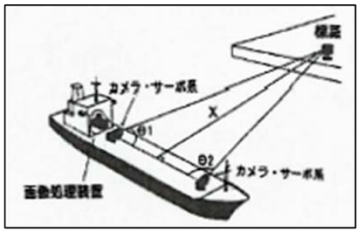
*Intelligent control*



*Collision avoidance*



*Anti grounding*




*Automatic berthing*

Japan 1982-1988:
Highly reliable intelligent ship project


LP Odyssey / SeaLaunch 1999-2014
Class: DNV, Flag: Liberia

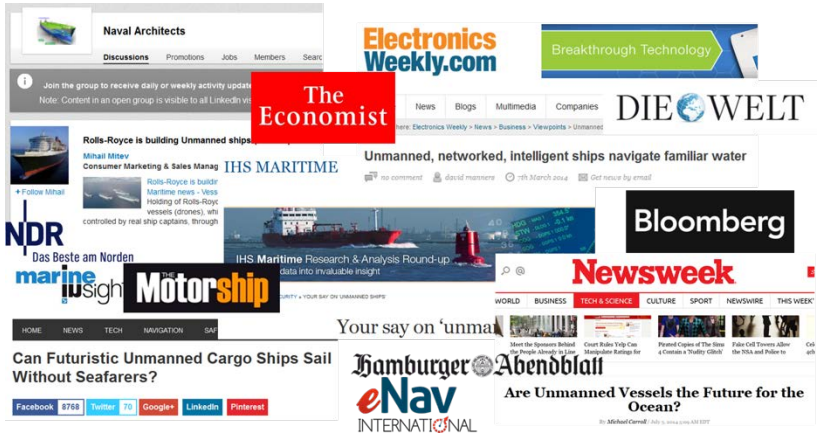
## EU Project MUNIN: 2012-2015

### First large concept study

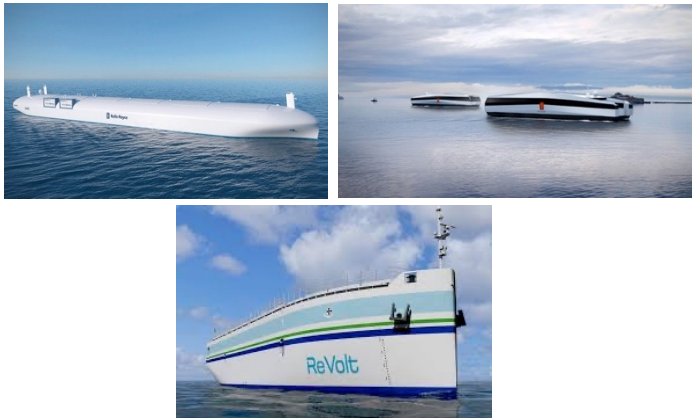
- Fully unmanned handymax dry bulk carrier on intercontinental voyage
- Duration: 01.09-2012 – 31.08.2015
- Funding:  2.9 million EUR of budget 3.8 million EUR
- Activity code: SST.2012.5.2-5: E-guided vessels - the 'autonomous' ship

http://www.unmanned-ship.org/munin/

# MUNIN sparked much interest




In media




… and in industry

# Today: Two vessels on order

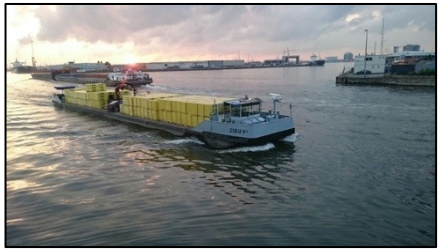
Yara Birkeland

- Fertilizer for export
- Replace 40 000 trucks/year
- 100-150 TEU, 70 m x 15 m
- Batteries – Fully electrical

ASKO Maritime AS

- Connects wholesale warehouses at the opposite sides of the Oslo fiord
- Part of a zero-emission transport system. Battery powered.
- Two 16-trailer RORO vessels, crewed initially, uncrewed later.

# Some other developments



Inland waterways

Aquaculture/wind/off-shore service

Automatic tugs

Surveys

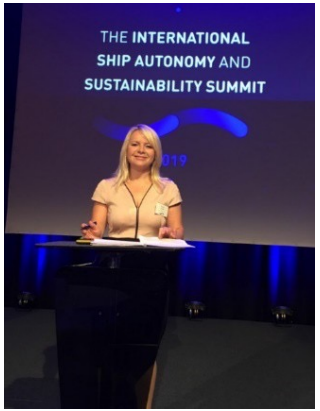

Automated road ferries

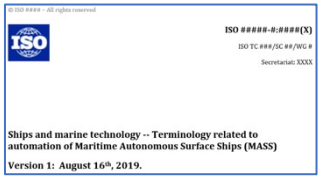

Autonomous urban mobility

# Norwegian Forum for Autonomous Ships

NFAS

- Established October 4th 2016
- Operated as a joint industry project at SINTEF Ocean.
- General Manager is Mr. Ørnulf Jan Rødseth.
- A board of governors overseeing operations. General assembly approves budgets and strategies.
- 42 Institutional Members
  - Including Industry, authorities, class, insurance research, universities, ports …

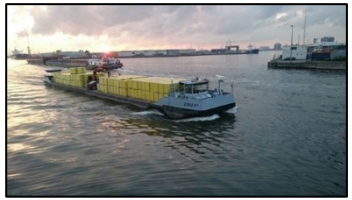


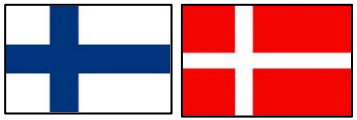



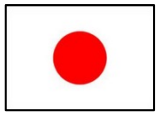


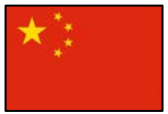
http://nfas.autonomous-ship.org

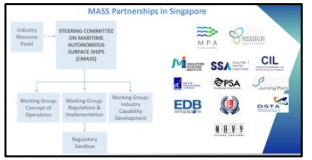
# International activities














# International Network for Autonomous Ships

INAS
International Network for Autonomous Ships

- Agreed on at meeting in Oslo Oct. 30th 2017
- Hosted by NFAS and SINTEF Ocean
- 14 active countries
- 3 correspondent countries
- 3 regional organizations

esa
European Space Agency

EMSA

www.autonomous-ship.org

# Network activities

NFAS

http://nfas.autonomous-ship.org

INAS
International Network for Autonomous Ships

www.autonomous-ship.org

**National and international networks**

European Commission | THE INTERNATIONAL SHIP AUTONOMY AND SUSTAINABILITY SUMMIT EU 2020 | NFAS


**International conferences**

European Commission | esa European Space Agency | EMSA

**European cooperation**

ISO | IMO | IEC

**International standardization**

# Agenda

## 12:30-13:00

**Part 3 - How to apply**

- Roberta Mugellesi (ESA)
- Kristine L Koslung (Business Applications Ambassador, Norway)

**Part 4 - Q&A**

- Q&A
- Closure


How to apply:
Funding and Tender Information

# ESA AO INFORMATION

Funded participation is open to any company and/or organisation, be it as group of users, public body or non-governmental organisation, that have subscribed to BASS GPL or to the 5G SPL.

In case the Bidder's proposal includes tasks related to PNT technologies/product development, the team members involved in those tasks shall reside in any of those States that have subscribed to NAVISP Element 2 Programme.

https://business.esa.int/funding/invitation-to-tender/smart-and-uncrewed-shipping

# Smart and Uncrewed Shipping : first wave timeline

| ACTIVITY | ESA PROJECT (UP to % of ELIGIBLE COST) | FUNDING |
|---|---|---|
| Demonstration Project | 50%** (BASS) | |

# BASIC PRINCIPLES - ESA-STAR

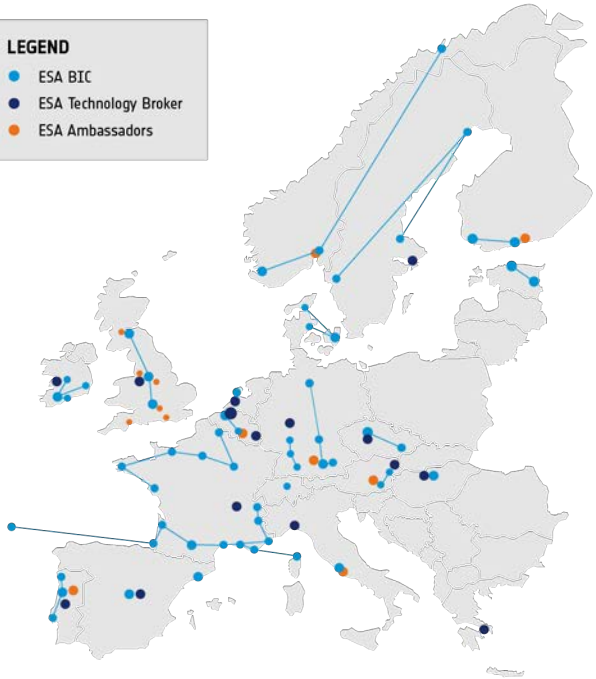
Registration (minimum 'light registration') on ESA-STAR Registration (https://esastar-emr.sso.esa.int)

Please note that esa-star allows two levels of entity registration: "Light" and "Full". This allows new users wishing to do business with ESA to carry out their registration in two steps. A "Light" registration will grant access to all esa-star services up to and including proposal submission. The award of ESA contracts requires "Full" registration.

# Business Application Ambassador

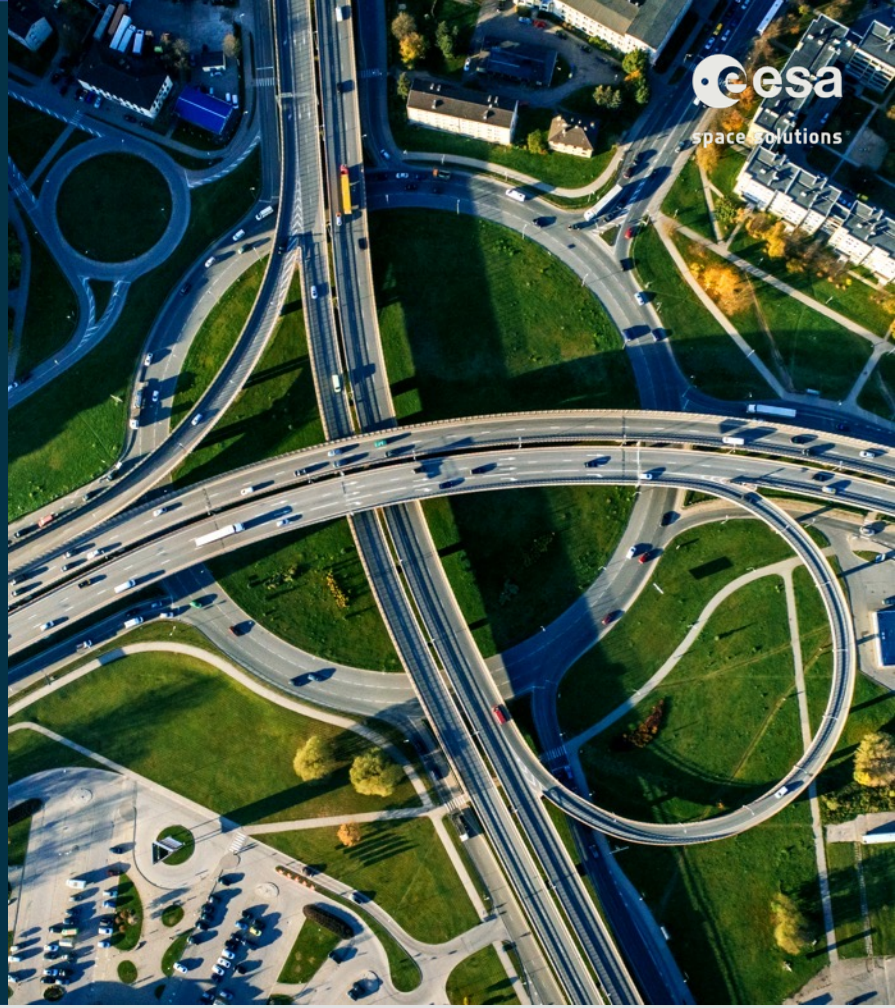
## ESA is Near You

- Wherever you are in Europe, we are near you.
- ESA is present in all Member States.
- Norway has an own ambassador helping bidders with APQ and application process.



# How we help

- Discuss your idea
- Ready for kickstart, feasibility or demo project?
- Thematic- or open call?
- The process
- Guidance and feedback on your APQ
- When to get in touch with the Norwegian Space Agency, and how to get in touch?
- Potential mentors?



Get in touch:

Kristine Løvflaten Koslung
BA Ambassador Norway
kk@kjellerinnovasjon.no
Tlf: +47 416 83 970

Business Incubation

Business Application

For more information, please visit

business.esa.int

**THANK YOU!**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Davide Coppola Davide.Coppola@esa.int

Roberta Mugellesi Roberta.Mugellesi.Dow@esa.int

Christopher Frost-Tesfaye Christopher.Frost-Tesfaye@esa.int


esa space solutions