Avikus
MARITIME AUTONOMOUS PIONEER

BEYOND NAVIGATION:

Development status of autonomous navigation solution

CEO DOHYEONG LIM

27th Oct. 2023

Table of Contents

1. MASS OVERVIEW

Maritime Autonomous Surface Ship

Maritime Autonomous Surface Ship

MASS could include ships with different levels of automation,
from partially automated systems to fully unmanned autonomous systems.

Why would stakeholders invest in MASS?

Improve Safety

80% of human-caused accidents can reduce from maritime accidents

Assist Seafarers

Assist with algorithms to incorporate experienced captains' know-how

Protect Environment

Reduce GHG emissions by increasing fuel efficiency

Cause Ripple Effect

Expanding influence to all-round business areas

2. CURRENT STATURE

ADAS in the Maritime Industry

HiNAS

Navigation Assistant System

HiNAS is a partially autonomous navigation system with functions that include route optimization, autonomous navigation, maneuvering, collision detection, and collision avoidance

KEY FEATURES

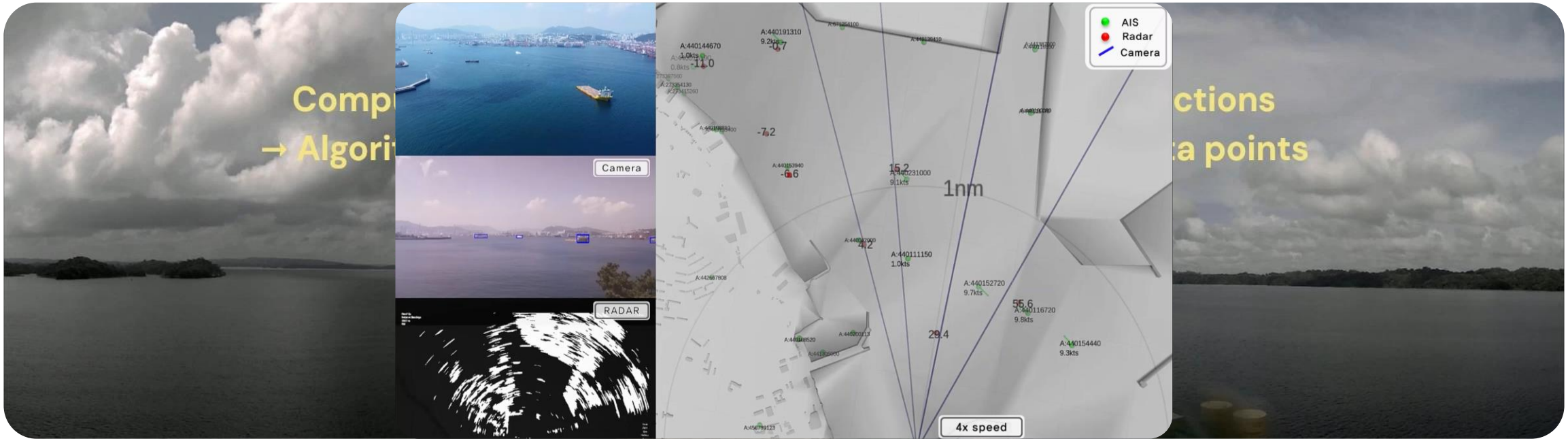
- Situational Awareness
- 360º Real-Time View
- Autonomous Navigation
- Route Optimization

Situational Awareness

- Using sensor fusion technology(RADAR, AIS, Cameras, LiDAR, etc.)
- Computer vision and deep learning-based target detection
- IR camera-based target detection at night or restricted visibility

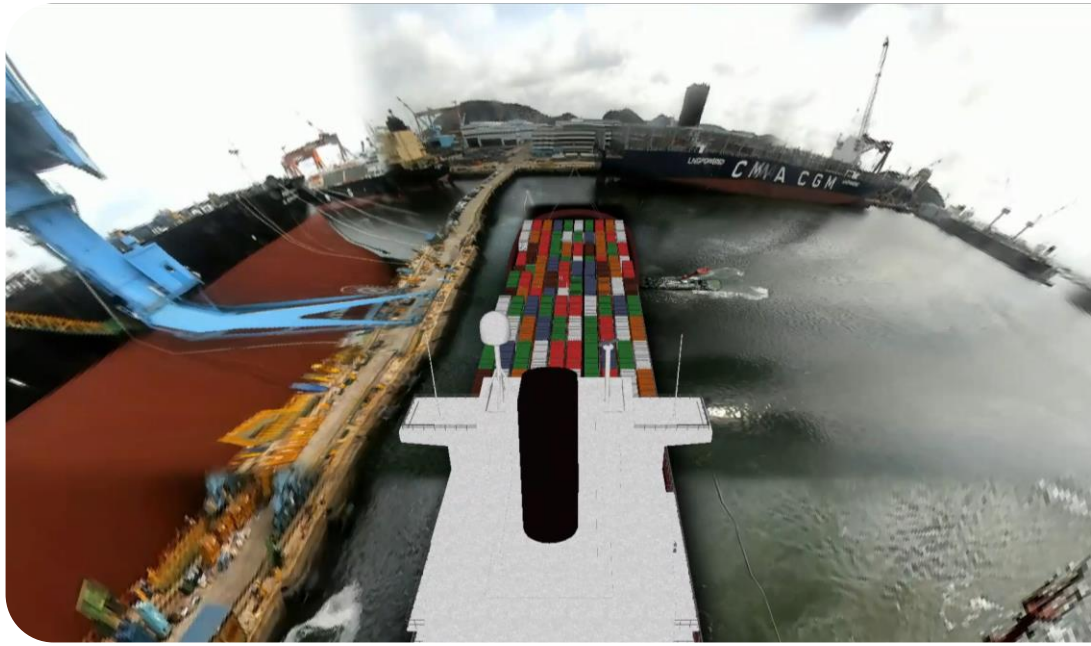
▶ IR(Infrared) Camera (120 deg. FOV)

▶ EO(Electro-Optical) Camera (180 deg. FOV)



360º Real-Time View

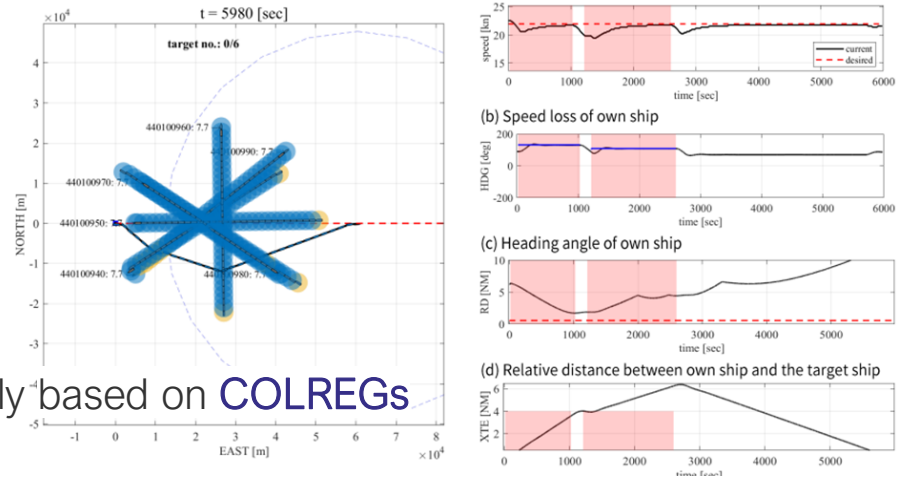
- Useful when passing canal, narrow channel, berthing/unberthing
- Prevent the risk of armed robbery, stowaways, smugglers, etc.
- Actual Example from Korean Ship Owner
  → They caught an attempt of a stowaway in advance using HiNAS

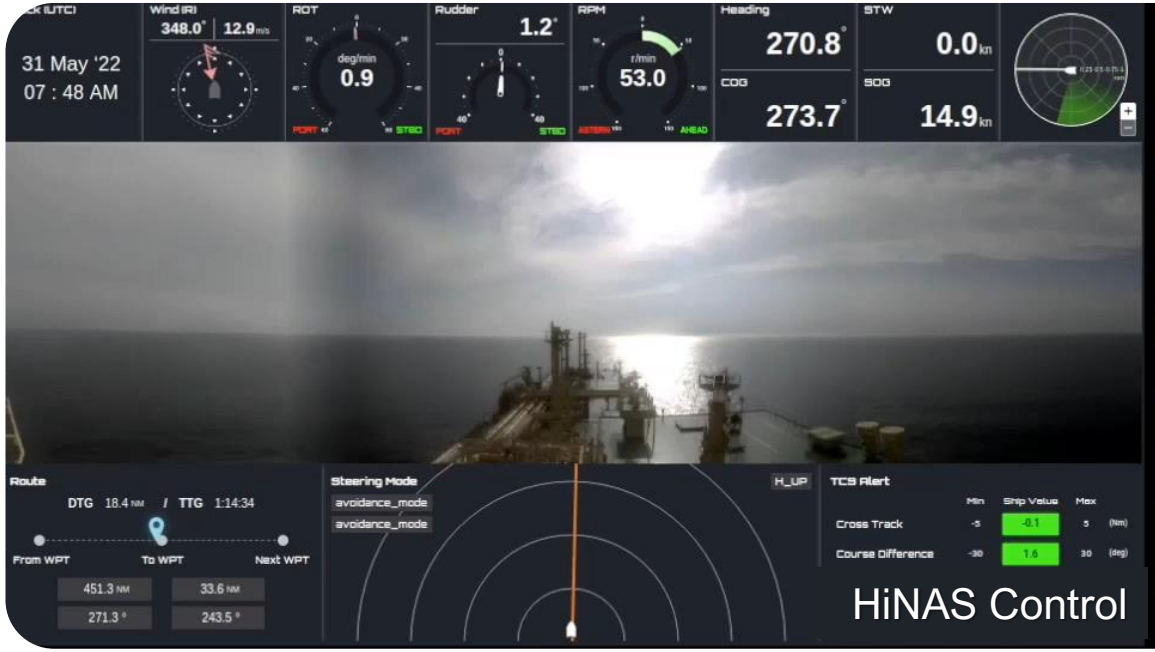


- Monitoring from anywhere onboard using the portable device

Autonomous Navigation

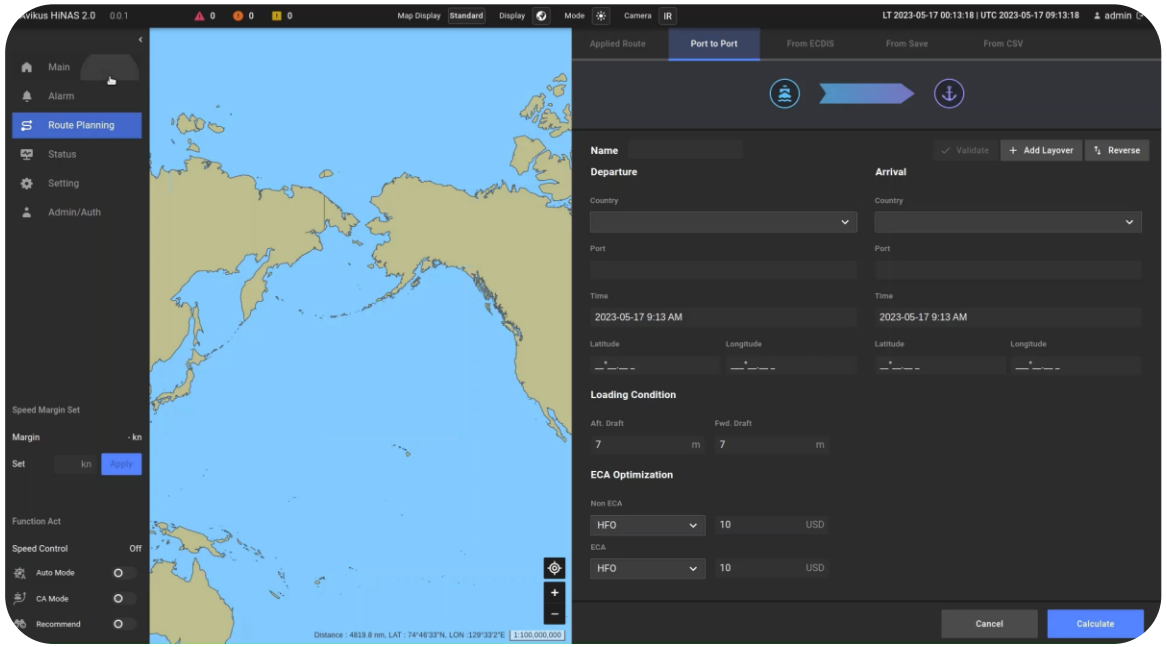
- Following optimal and fuel-efficient route autonomously
- Real-time collision detection and autonomous collision avoidance
- Incorporating experienced seafarers' know-how into algorithms, basically based on COLREGs

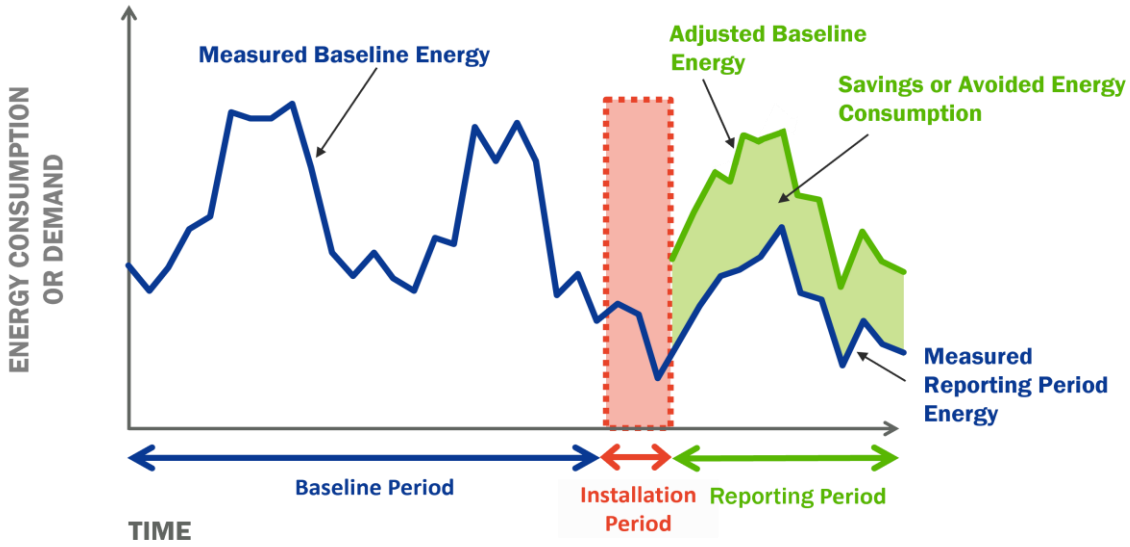




Route Optimization

- Providing optimal route and speed considering weather information and ship dynamics, etc.
- Increasing fuel efficiency by 7%, while reducing greenhouse gas emissions by 5%
- Conducting a long-term statistical verification study for fuel consumption & GHG emission reduction
- Executing autonomously through the interface with Autopilot and BMS





3. STEPWISE APPROACH

Stepwise Approach to a Higher Degree of MASS

Current Stature of HiNAS in the Market

"THE FUTURE IS HERE"

Received orders of more than 350 sets

Actual operation for more than 30 ships

Equipped in all of HD Hyundai's new building ships

HD HYUNDAI(HHI) Group builds about 200 new ships every year
(This accounts for 20% of the total shipbuilding)

Not just for new buildings, available of retrofit

Stepwise Approach to Higher Degree of MASS

’21

Pohang Canal Cruise Autonomous Navigation Demonstration

World’s 1st Canal Cruise Autonomous Navigation Demonstration

’22

Autonomous LNG Carrier Trans-Ocean Project

World’s 1st Autonomous Large Merchant Vessel Trans-Ocean

'23~

Fort Lauderdale International Boat Show Demonstration

World’s 1st Autonomous Boat Live Demonstration at the Boat Show

Autonomous Marine Taxi in the city of BUSAN

A new means of transportation for marine tourism

Stepwise Approach to Higher Degree of MASS

Ship with automated processes and decision support

Remotely controlled ship with seafarers on board

Remotely controlled ship without seafarers on board

Fully autonomous ship

PRESENT **FUTURE**

- In compliance with current regulations
- Relatively easier to advance toward commercialization

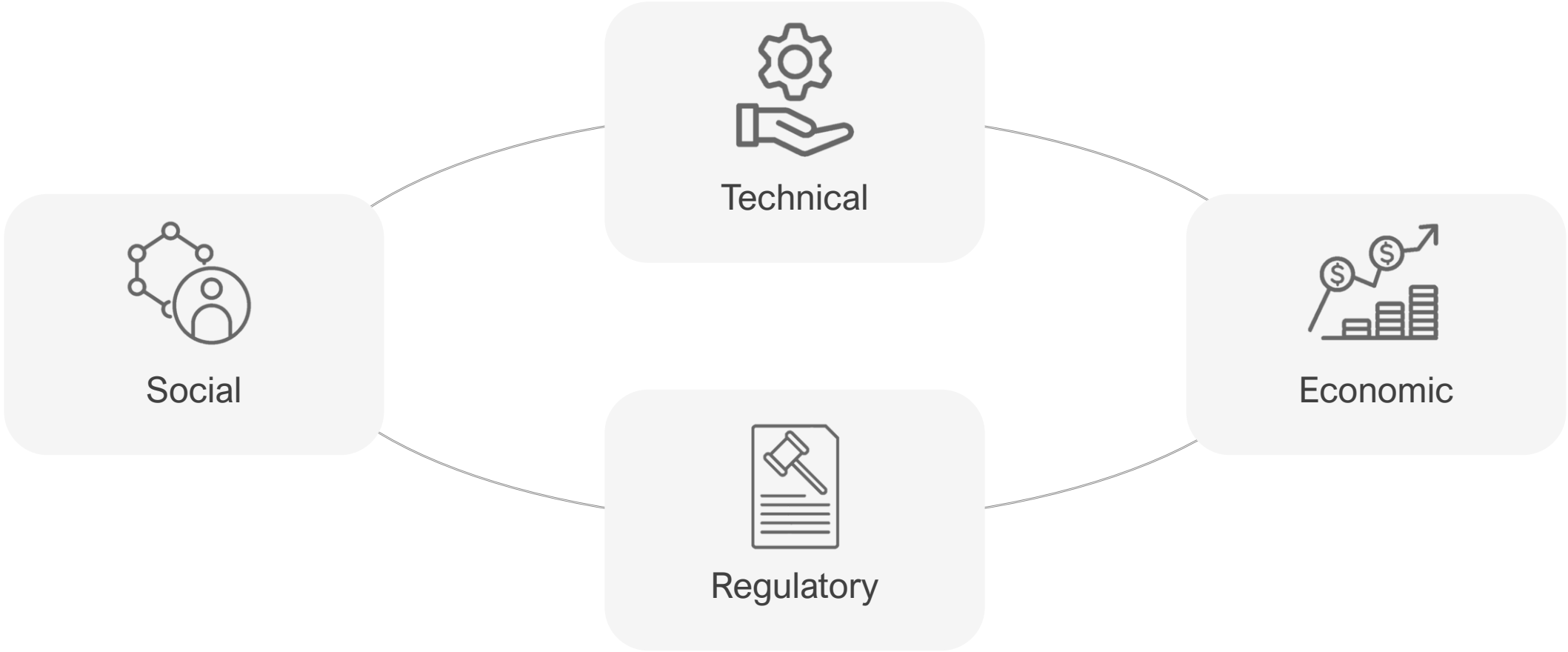
- Need to consider product liability
- May vary depending on the concept of the ship

- Uncertain&technically challenging realm
- Prospect for the very distant future

4. CONSIDRATIONS

Barriers for the Higher Degree of MASS

Barriers to the Higher Degree of MASS



Technical Barriers to the Higher Degree of MASS

Development of AtoN suitable for MASS

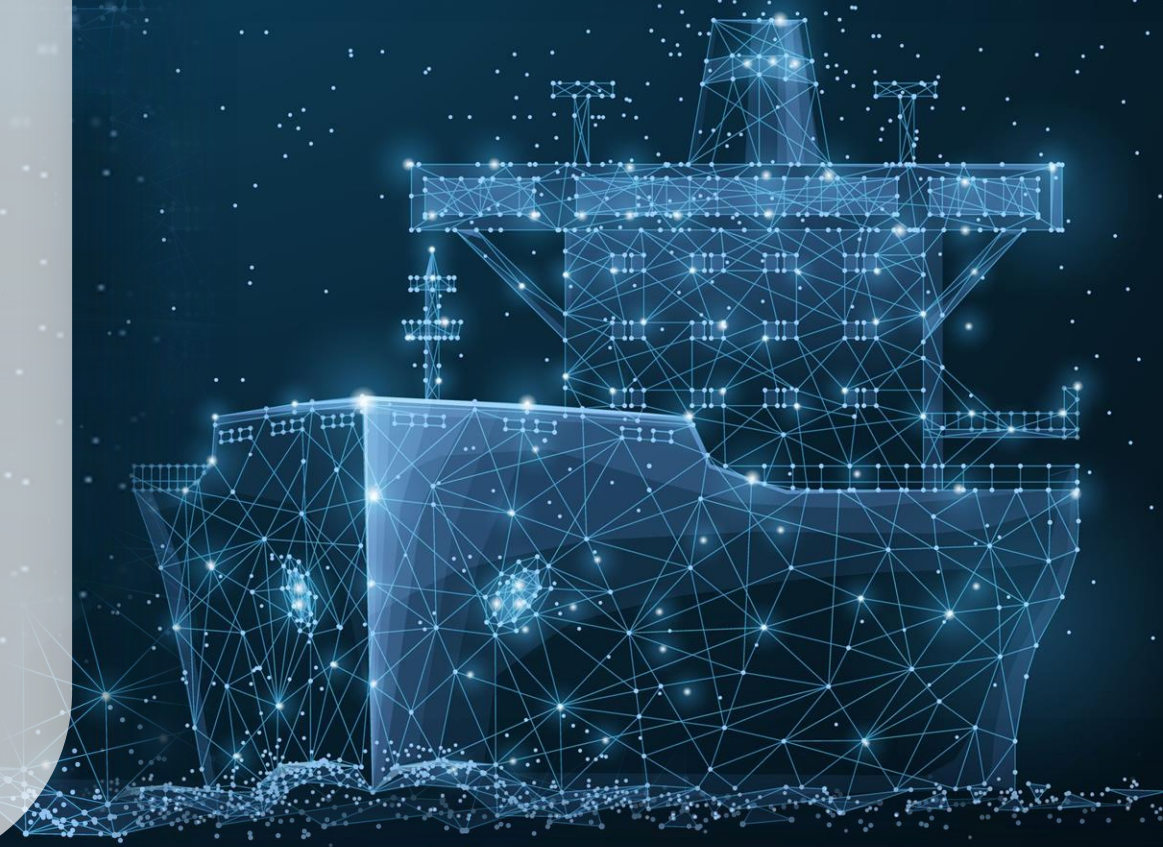
Developing and maintaining standards for signal lights and information services to enable proper recognition of MASS.

Cooperation with VTS

Maritime traffic management and collision avoidance can be optimized by sharing information about MASS such as real-time location and status data etc. with VTS.

Data and Communications Standards

MASS generates and transmits large amounts of data, so data security, management, and communication standards should be developed and maintained.



Economic Barriers to the Higher Degree of MASS

Initial investment cost

Higher degrees of MASS often require substantial initial investments, including remote operation centers and operator training.

Operational efficiency

MASS without seafarers onboard should demonstrate improved operational efficiency and economic benefits compared to traditional crewed vessels for successful adoption and commercialization.

Optimized DoA for each vessel

Considering factors such as technology maturity, CAPEX (Capital Expenditure), OPEX (Operating Expenditure), and operation mode, it is essential to evaluate and select the optimal degree of autonomy tailored to each vessel.

Social Barriers to the Higher Degree of MASS

Acceptance and trust

Social acceptance and trust in MASS are essential to ensure efficient and responsible utilization of this autonomous navigation technology.

Safety awareness

The level of safety awareness such as technological trust and societal acceptance for the high degree of MASS needs to be significantly higher than that of conventional vessels.

Employment impact

When becoming an unmanned ship, it is necessary to consider crew members such as seafarers and remote operators, and since it is a new technology, additional education aspects should be considered.

Regulatory Barriers to the Higher Degree of MASS

Consideration of potential risks

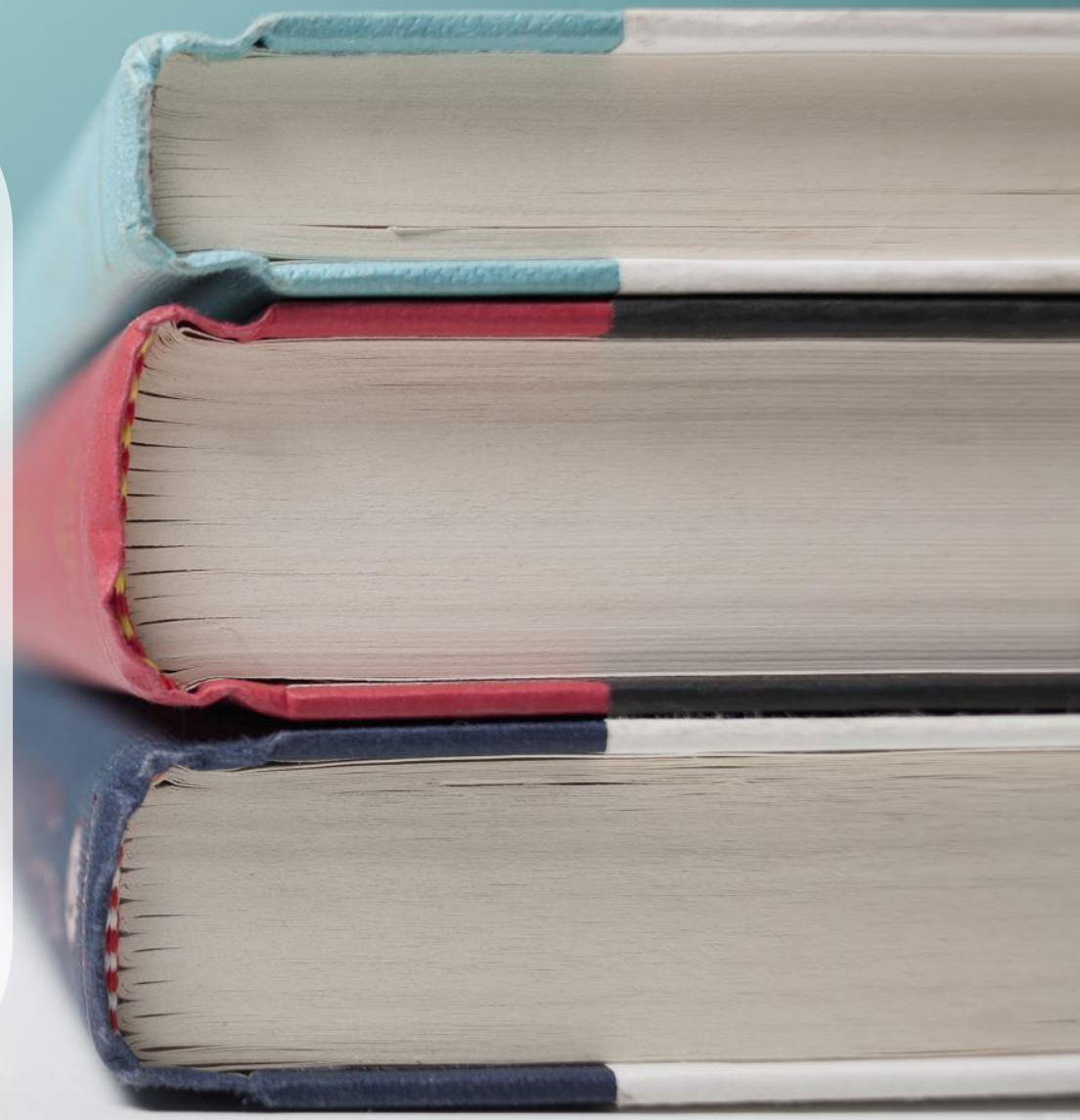
There is a possibility of unrecognized potential risks, so it is crucial to identify these potential risks and take them into account when applying and operating relevant regulations.

Regulations for unmanned MASS

Current regulations do not account for situations where the crew is not on board, so appropriate regulations should be enacted and revised in such cases.

Practical regulatory framework

It is imperative to dispel uncertainties and foster an environment of shared knowledge and collaboration between the industry and stakeholders to develop practical regulatory framework (e.g. product liability and insurance for system provides.)



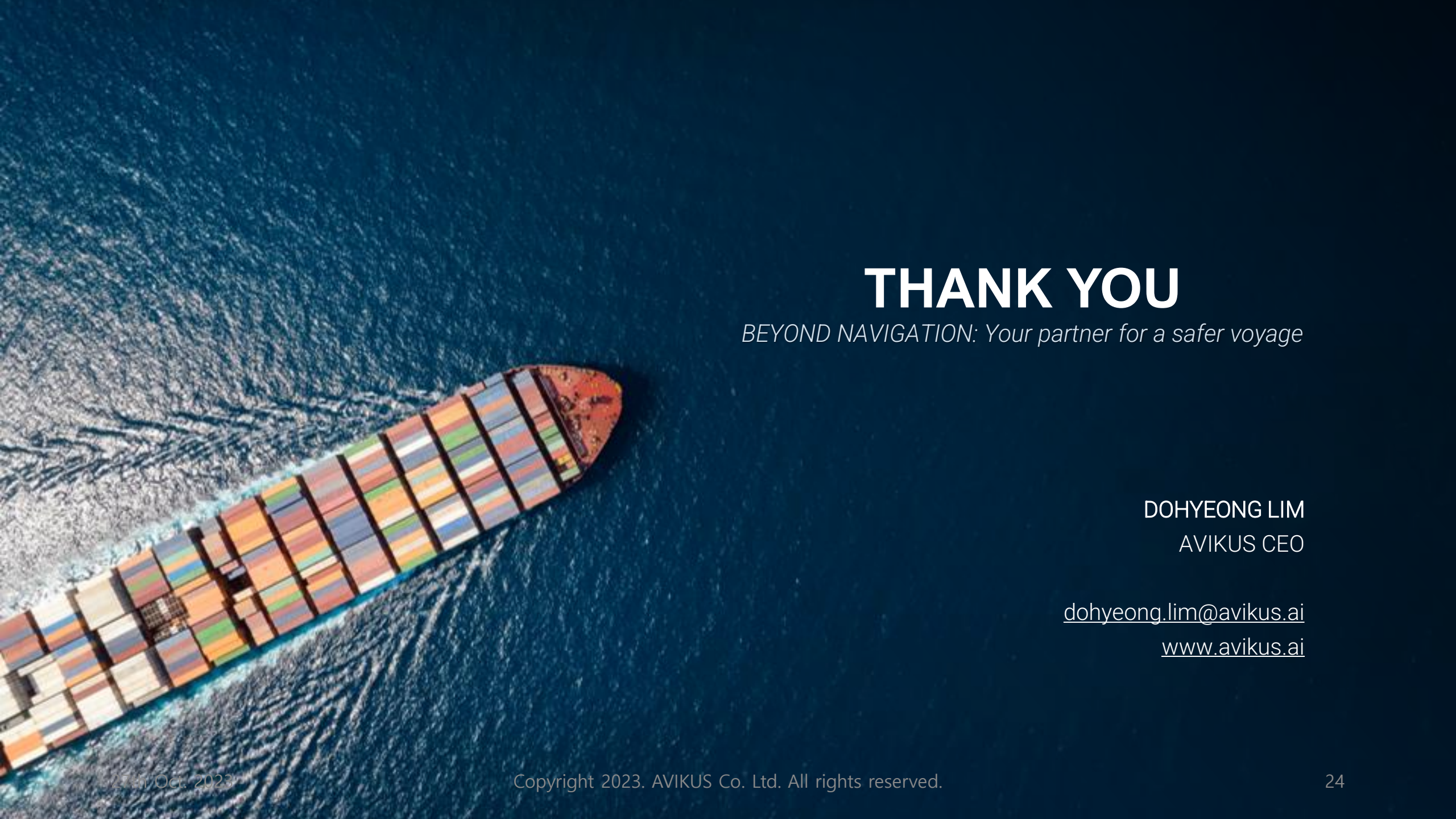
5. CONCLUSION

Partner for a Safer Voyage

Avikus
MARITIME AUTONOMOUS PIONEER

Strengthening Cooperation and Sharing Insights with Various Stakeholders

We should cooperate with various stakeholders such as shipowners, ports, and infrastructure, manufacturers, VTS service providers, pilots, IMO, IHO in the way of technology, infrastructure, and rule/regulation, etc. to improve maritime safety and environment.



THANK YOU

BEYOND NAVIGATION: Your partner for a safer voyage

DOHYEONG LIM

AVIKUS CEO

dohyeong.lim@avikus.ai

www.avikus.ai