



**Developments in Marine Autonomous  
Surface Ships - MASS  
CISMaRT Online Workshop - Advancing  
Canadian Marine Technology  
November 25-26, 2020**

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# ➤ Agenda

- Introduction
- International Overview
- Domestic Overview
- Transport Canada Activities
- Conclusions
- References



# ➤ Introduction - Definition

- A ship which, to a varying degree, can operate independently of human interaction (IMO)
- MASS is a disruptive technology



# ➤ Introduction - Levels of Autonomy (IMO)

**Degree one:** Ship with automated processes and decision support: Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated and at times be unsupervised but with seafarers on board ready to take control.



**Degree two:** Remotely controlled ship with seafarers on board: The ship is controlled and operated from another location. Seafarers are available on board to take control and to operate the shipboard systems and functions.



**Degree three:** Remotely controlled ship without seafarers on board: The ship is controlled and operated from another location. There are no seafarers on board.



**Degree four:** Fully autonomous ship: The operating system of the ship is able to make decisions and determine actions by itself.



# ➤ Introduction - Advantages

- Augments human perception and helps reduce accidents due to human error
- Reduces fatigue/improves quality of work by using automated systems to carry out routine or dangerous tasks (e.g. ocean mapping, short sea shipping, spill recovery)
- More efficient ship designs (elimination of crew quarters, bridge structures, garbage/sewage systems, safety & lifesaving equipment, etc.)
- Address labour shortages/reduce labour costs



# ➤ Introduction - Challenges

- Safety issues: interaction with crewed vessels, search & rescue, failsafe conditions in case of an emergency, maintenance
- Cyber security
- Liability/Legal Framework
- Qualifications of seafarers verses remote operators



# ➤ International Overview

- IMO
  - Regulatory Scoping Exercise
  - Interim Guidelines for MASS Trials
- The Leaders
  - Norway
  - Finland
- Others
  - Netherlands
  - Belgium
  - Singapore
  - Korea
  - Japan
  - China
  - USA
  - UK
  - Russia



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# ➤ Domestic Overview (1)

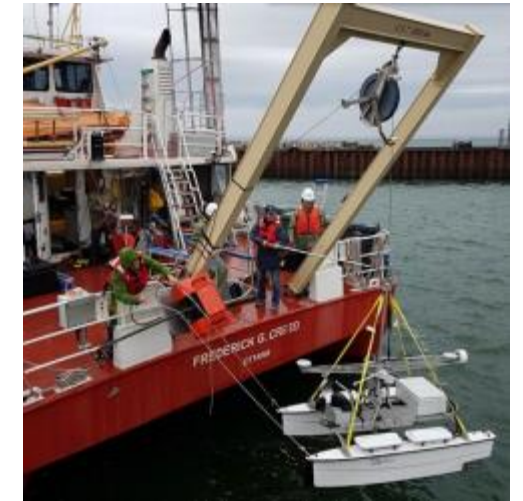
- The Participants
  - Open Ocean Robotics
  - MetalCraft Marine
  - Shift Environmental Technologies - Ocean Sled
  - XOCEAN
  - CISMART
  - PRNL





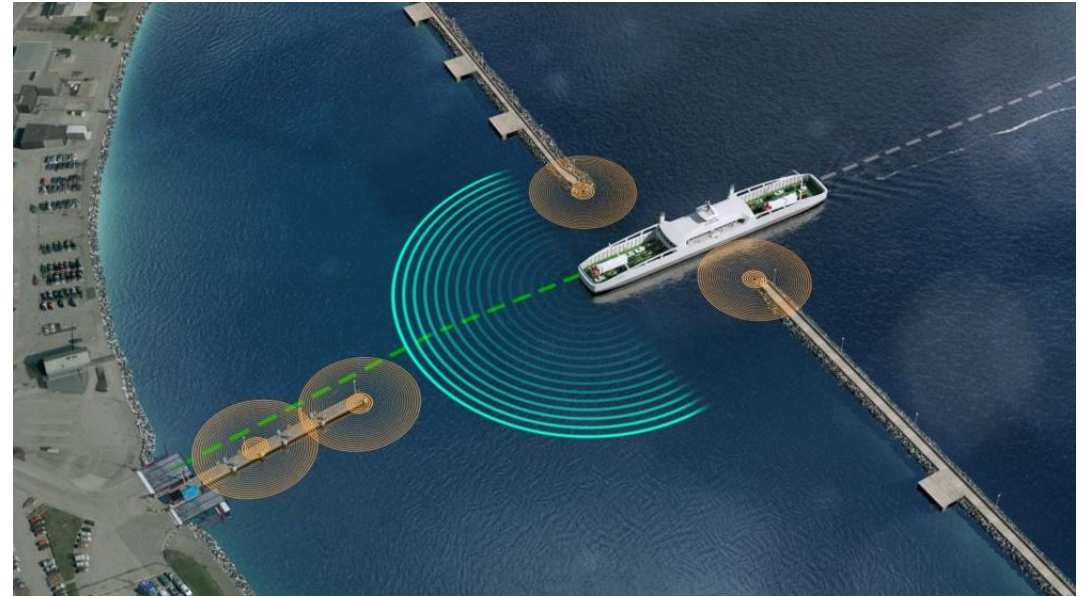
# ➤ Domestic Overview (2)

- The Participants
  - Canadian Hydrographic Service (DFO)
  - Algoma Central
  - Robert Allen
  - UBC Autonomous Sailboat



# ➤ Transport Canada Activities

- Innovation Centre
  - Testing, Innovation, R&D
  - Canadian Forum for MASS (CFMASS)
- Marine Safety & Security
  - MASS policy for small vessels
  - Cyber Security
  - Canadian representation at IMO



# ➤ Conclusions

- MASS is being introduced to the world via pilot projects
- MASS will significantly shift the marine industry paradigm, with commercial applications expected within the next 10 to 20 years
- MASS is nascent within Canada
- Canada should be prepared for this disruptive technology



# ➤ References

- IMO Guidelines for MASS Trials
  - MSC.1/Circ.1604 14 June 2019
- Maritime UK MASS Industry Conduct Principles and Code of Practice, Version 3, November 2019
- Norwegian Forum for Autonomous Ships (NFAS) (<https://nfas.autonomous-ship.org>)
- International Network for Autonomous Ships (INAS) (<http://autonomous-ship.org>)
- CISMART (<http://cismart.ca/>)
- Smart Ship Coalition of the Great Lakes - St Lawrence (<https://smartshipscoalition.org>)
- OneSea (<https://www.oneseaecosystem.net/>)
- DNVGL (Det Norske Veritas - Germanischer Lloyd)
- Autonomous Ships HQ Podcast (<https://www.autonomousshipshq.com>)
- AutoShip (<https://www.autoship-project.eu/>)



# ➤ References

## 2020 CISMART ONLINE WORKSHOP ADVANCING CANADIAN MARINE TECHNOLOGY

Workshop venue:  
**Zoom Webinar**

- Topic of Nov. 25 session:  
Ship underwater radiated noise
- Topic of Nov. 26 session:  
Maritime autonomous surface ships

**NOV 25-26<sup>th</sup>**  
**2020**

TIME:  
**12:30PM – 5:00PM**  
Newfoundland Time Zone



For more information, please visit  
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**CISMART**

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EU 2020



What is the *real* future of autonomous ships?

Virtual event - 30 November 2020



**LVM** MINISTRY OF TRANSPORT  
AND COMMUNICATIONS



**MASS framework for Regulation and AI Ethics virtual workshop and virtual showroom of MASS solutions, projects and trial results**  
**1 December 2020**



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