Maritime Autonomous Surface Ships
Development Challenges on Domestic and International Fronts

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Québec
November 27, 2019
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Purpose of Presentation

- Impacts of disruptive technology
- Disruptive technology in the marine transportation sector
- Overview of the political developments on maritime autonomous surface ships (MASS)
- Transport Canada’s role regarding MASS
- Policy questions surrounding future control centres
- Moving forward with MASS
Disruptive Technology

• Defined as a process by which a product or service takes root initially in simple applications at the bottom of a market and then relentlessly moves up the market, eventually displacing established competitors
• Recent trends have shown that the introduction of disruptive technologies raise questions regarding existing legislation and regulatory guidelines
  – New business models tend to challenge the status quo

Examples

- Airbnb
- Amazon
- Uber
- Netflix
Disruptive Technology in Marine Transportation

- A MASS is defined as a ship which, to a varying degree, can operate independent of human interaction
- The degrees of autonomy are as follows (still under development):
  1. Ship with automated processes and decision support
  2. Remotely controlled ship with seafarers on board
  3. Remotely controlled ship without seafarers on board
  4. Fully autonomous ship
- MASS technological advancements are rapidly progressing
  - In November 2018 and within days of each other, Rolls-Royces & Wärtsilä undertook successful dock-to-dock navigation tests aboard ropax ferries
- Some solutions are being driven by industries that are not traditional shipping companies
  - Yara Project - Norwegian fertilizer company - The world's first autonomous, zero emission container ship

Political Developments

- MASS gaining political traction in North America
  - October 2017: Conference of the Great Lakes and St. Lawrence Governors and Premiers adopted a resolution to aim at developing the region into global centres of excellence for MASS
  - August 2018: Conference launched a Smart Ships Action Plan
    - A Smart Ships Coalition of the Great Lakes and St. Lawrence was formed
    - Michigan Tech University unveiled its Marine Autonomy Research Site and the first freshwater testbed
- International Maritime Organization initiated a regulatory scoping exercise
  - Interim guidelines for autonomous vessel trials are to be developed
  - Member states and organizations were requested to submit proposals for consideration by December 2018
- In addition, countries in the Baltic States, Finland, Japan, Norway, United Kingdom and South Korea, to name a few, are working on MASS concepts, in some cases developing domestic guidelines for operations (i.e., U. K.)
- Singapore has vested interests in shore-based control centres
Transport Canada and MASS

- Undertaking fact-finding missions to fully grasp the developments of MASS and its associated technologies (i.e., Norway, Finland)
- Participated in workshop on ‘Transport maritime durable et intelligent’ with the Réseau Québec Maritime May 31, 2018
- Took part in the International Maritime Organization Correspondence Group on the MASS Regulatory Scoping Exercise
- Engaged internationally to position Canada in appropriate organizations
- Founding member of the Smart Ships Coalition of Great Lakes and St. Lawrence (USA)
- Proactively engaging stakeholders through workshops:
  - Enables stakeholders to share their understanding of related commercial, legal, and operational issues associated with MASS
  - A first workshop, limited to the Canadian federal government, was held in April 2018 (29 individuals were present)
  - A second workshop was recently held on September 12–13, 2018. 100 participants from diverse private and public sectors
- Feedback and information gathered will serve to develop legislative and regulatory frameworks for MASS on the domestic, transborder and transoceanic fronts

Control Centres

- Highly unlikely that MASS will be fully autonomous with no human interaction in the near future
- It is foreseeable that control centres will remotely operate shipping fleets in the medium to long term
- This brings to light a series of questions:
  - Where would they be located?
  - How would they be regulated?
  - What economic model would govern its operations?
  - How would they be certified and who would be responsible for certification?
  - What type of competencies would be required to remotely operate ships?
  - Would ship owners adhere to external control centres remotely operating their ships from a foreign jurisdiction?
  - How would countries react to a foreign control centre operating flag ships from other countries in its territorial waters or exclusive economic zone?
  - Should a tragic event occur, who would be legally held responsible? The flag state? The country in which is located the control centre? The country that accepts that a ship is remotely operated in its waters?
  - From an insurance perspective, how would this work?
  - What would be the recourses for affected parties in case of disputes?
Moving Forward

- MASS developments and in particular control centres are projected to create economic opportunities and potentially generate high-quality jobs
- The Government and interested parties’ role is to prepare the ground for the development, testing and full-scale deployment of MASS
- TC’s MASS policy developments and future regulatory and legislative frameworks require that we
  - Continue to take into consideration private and government stakeholders’ needs
  - Take into consideration international developments by foreign governments and regulatory bodies
  - Ensure that all appropriate parties are working in a common fashion (see next slide)
- TC is working with both the Ocean and the Artificial Intelligence Superclusters to ensure that MASS supports, and is integrated in, future Smart Supply Chain logistics developments
- TC is working on establishing a Mirror Committee of ISO’S Technical Committee 08
- TC is supporting IMO’s work related to MASS interim guidelines, which will be presented at MSC 101, and hopefully be in place for Fall 2019

Canadian Forum for Maritime Autonomous Surface Ships

- Through our engagement efforts, Canadian public and private stakeholders expressed the need for a Forum to:
  1. Foster a Canadian approach to support the MASS development and implementation
  2. Strengthen co-operation among Canadian public and private stakeholders
  3. Be a Canadian consolidated voice
  4. Collaborate and exchange with national/international counterparts fora
- Forum launched on April 11, 2019
- To support the above four pillars, the Forum is composed of three Sub-Committees that have distinct functional areas:
Next Steps for Subcommittees

Test/Research and Development:
• Proceed with the selection of an interoperability framework that answers subcommittees needs
• Workshop in Quebec City in September on MASS

Domestic and International Frameworks Development:
• Analysis of MASS at the international level
• Review of scientific literature on MASS

Strategic Orientation and Multilateral Cooperation:
• Identification of best links with Artificial Intelligence in the purpose of developing digital chain logistics
Leveraging SCALE AI & Ocean Super Cluster for MASS

1. **Ocean Companies**
   - Boat building
   - Adhesives
   - Offshore oil and gas
   - Marine renewables
   - Shipping
   - Marine bio-products

2. **Providers of Enabling Technologies**
   - Sensors, CPP, and sensors, cars, etc.
   - Develop and provide services and mapping
   - Software and services
   - Information technology services
   - Autonomous systems
   - Robotics
   - Internet technology
   - Renewable technology
   - Ocean science

3. **Ocean Supercluster**
   - SHARE job cluster super computing lists out the main applications, sustainable, and valuable components of the oceanic science
   - Biotech
   - Bioinformatics
   - Agriculture
   - Ocean science
   - Renewable technology
   - Robotics
   - Internet technology
   - Autonomous systems
   - Sensors
   - CPP

4. **Shared Innovation Roadmap**
   - Open call for innovation projects
   - Shared resources
   - Internet technology
   - Ocean science
   - Agriculture
   - Bioinformatics
   - Biotech
   - Shipping
   - Marine bi-products

5. **Cluster Outcomes**
   - Biotech
   - Agriculture
   - Ocean science
   - Renewable technology
   - Robotics
   - Internet technology
   - Autonomous systems
   - Sensors
   - CPP

6. **Supercluster Outcomes**
   - Biotech
   - Agriculture
   - Ocean science
   - Renewable technology
   - Robotics
   - Internet technology
   - Autonomous systems
   - Sensors
   - CPP

- Raw materials/physical products are modally transferred at ports towards final destination
- Ports act as data hubs containing a wealth of information that is currently underutilized
- Enhances traditional approach by enabling the convergence of all supply chain data hubs in a single window, thus providing AI with mineable information for logistics optimization