International Workshop on
Maritime Autonomous Surface Ships and IMO regulations

Monday, 14 May 2018
Main Hall, IMO Headquarters, London

Organized by

National Maritime
Research Institute (NMRI)

Ministry of Land, Infrastructure,
Transport and Tourism of Japan
(MLIT)

Japan Ship Technology
Research Association (JSTRA)

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18 May 2018
Opening address by Mr. Kitack Lim
Programme

Opening address by Mr. Kitack Lim, the Secretary General of IMO

Keynote speech by Ms. Heike Deggim, Director, Maritime Safety Division, IMO

Session 1 - R&D on autonomous ships

Dr. Akihito Hirayama, Director, Strategic Marketing Division, Akishima Laboratories (Mitsui Zosen) Inc.
Mr. Carl Magne Rustand, Business Developer Aftermarket, Kongsberg Maritime AS
Mr. Bernard Twomey, Regulatory Development Lead (Marine), Rolls-Royce Plc

Dr. Hideyuki Ando, Senior General Manager, Maritime Technology Division, MTI Co., Ltd. (NYK Group)

Session 2 – Regulatory study

Mr. James Fanshawe CBE, Chairman, UK Maritime Autonomous Systems Regulatory WG
Mr. Per Sønderstrup (SFS), Director, Maritime Regulation and Legal Affairs, Danish Maritime Authority
Mr. Tomotsugu Noma, Maritime Bureau, MLIT

Session 3 - Panel discussion

Moderator: Dr. Koichi Yoshida, Ship Equipment Inspection Society of Japan and Yokohama National Univ.
Mr. Akira Fukaishi, 1st Secretary, Embassy of Japan in London UK
Framework of the regulatory scoping exercise

- Definitions and concepts
- Type and size of ships
- Instruments
- Methodology
- Deliverables
- Plan of work
- Intersessional arrangements
- Coordination mechanism
Session 1 - R&D on autonomous ships

Activities for Realization of Autonomous vessels, by Dr. Akihito Hirayama

R&D Flow

- Analysis for Onboard Work
- Function Classification of Onboard Works
- Identification of Required Functions for Autonomization
- List of Required Technologies
- Investigation into Required Technologies
- Grasp of Core Technology

Output

- Assessment Technology
- Verification Test of Core Technology
- R&D Road-Map for Autonomous Vessel
- Concept of Autonomous Vessel
Analysis for Onboard Work

Session 1 - R&D on autonomous ships

4 categories over 200 works

26 works

62 works

Analysis for Onboard Work

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Session 1 - R&D on autonomous ships

Yara Birkeland - a global game changer, by Mr. Carl Magne Rustand

Shore Control Center

Main roles and tasks:

- Captain role
- Chief Engineer role

- Monitor operational information
- Monitor equipment condition
- Approve voyage plan
- Approve loading condition
- Initiate voyage
- Voice communication
- Safe state
- Remote Control
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### Carriage requirements
- Radar
- ECDIS
- Steering control
- Autopilot
- ……

### Performance standards

### ISM Code
- Officer on watch
- Lookout
- Helmsman
- Standing orders
- ……

### STCW

#### Human Interface
Land Based Remote Operating Centre (ROC)

- For consideration:
  - Will the ROC need to comply with national HSE law?
  - Educational qualifications of the operators and maintainers of the autonomous infrastructure.
  - The land based requirements for the ROC, e.g., access, physical security, lighting, evacuation etc.
  - PSC, Vetting, Classification Surveyors, Pilots etc – what skills are required?
Session 1 - R&D on autonomous ships

- Remote and Autonomous Short Sea Vessel
- Remote and Autonomous Local Vessel
- Remote Support, Operation of Certain Functions
- Remote and Autonomous Ocean Going Vessel
Internet of Ships (IoS) Open Platform

Roles are defined and each player provides their expertise on the Internet of Ship (IoS) platform. Data governance and business rules have been built by IoS OP Consortium under ShipDC.
Data and Technology are more available  
In the era of digitalization, accessibility of data and technology becomes more available.

Identify right issues to solve is mostly important  
Shipping is a rich semantics domain so it is very difficult for external consultants or data scientists to identify right issues to solve. People internally in shipping themselves have to lead innovations.

Pursuing optimization of fleet operation and ship design  
Best combination of PPTO (people, process, technology & organization) and solving issues with right partners are indispensable. Step-by-step implementations of automation should be a part of this improving process.
Session 2 – Regulatory study

Regulatory Study at IMO, by Mr. James Fanshawe CBE

MASS Safety

- Responsible Ownership
- Safe Operation
- Recognised Accreditation, Training and Standards
- Effective Integration into the existing Maritime structure
Summary by Mr. Fanshawe

- IMO is about to embark on a very important body of work as it starts the scoping exercise for MASS.
- The pace of change is dramatic.
- Technological advances are likely to outpace regulatory development.
- The development of MASS should not be held up by the work IMO is undertaking.
- Patience will be critical and expectations shall be sensitively managed.
- While this work continues at IMO, ships will continue to ply their trade safely and efficiently across the globe; and
- MASS will begin to find their place in the natural order.
- There will be change but this is important, necessary and not a threat.
- The human element is as critical today as it has always been.
- The skills of the seafarer may change and develop but are as important as ever.
Analysis of regulatory barriers

Figure 3: Regulatory barriers (subdivided thematically)

1. Jurisdictional issues
2. Navigation and regulations for preventing collisions at sea
3. Crew and "seafarers" of the future
4. Protection of the marine environment
5. Construction requirements and technical conditions of ships
6. Liability, compensation and insurance issues
7. Cybersecurity and anti-terror safeguards
Need for a systematic and well-defined approach

Where is the decision made?

Who decides?

- On board
- Elsewhere

System

- Human
- AL0
- AL1
- AL2
- AL3
- AL4
- AL5
- AL6

Human

- Conceptual

Manually controlled. The operator is on board or controls the vessel remotely through radio link.

Decision-support on board. The operator monitors and changes course and speed if necessary.

Decision-support on board or from shore. Suggestions for interventions may be provided by algorithms.

Execution by operator who monitors and authorises actions.

Execution by operator who monitors and is able to intervene. Monitoring may take place from shore.

General goals are determined by the operator. Monitoring may take place from shore.

Fully autonomous. General goals may be determined by the system. Monitoring from shore.
Some conclusions by r. Per Sønderstrup

Issues to address for fully autonomous and unmanned ships is numerous
- Safety of Navigation
- Liability and insurance
- Manning
- Merchant shipping act

Short term goal
- The Conventions has some room for technology driven innovations but we need to have a common understanding of how far can we go under the existing regulatory framework

It should be carefully considered how to get things right
- technology is already far ahead of the existing regulations
- Is the right approach a new regulatory framework rather a very labour intensive and time consuming walkthrough of the existing instruments
**Way forward to MASS**

<table>
<thead>
<tr>
<th>-2020</th>
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<tbody>
<tr>
<td><strong>Scoping Exercise</strong></td>
<td><strong>Verify the experience from EBP</strong></td>
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<td><strong>Develop interim Guidelines</strong></td>
<td><strong>Experience Building Phase (EBP)</strong></td>
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Session 2 – Regulatory study

Conclusion by Mr. Tomotsugu Noma

✓ MASS covers manned ships with decision support tools/equipment and unmanned ship and new technologies will be gradually introduced to MASS

✓ Regulatory frameworks can be divided into two phases
  □ Early phase
    → Current regulatory frameworks + Interim Guidelines
  □ Developed phase
    → Development of specific regulatory frameworks

✓ Experience Building Phase can be introduced to gain experience and knowledge from new technologies which will contribute to assess further action including the unmanned operation
Session 3 - Panel discussion
Session 3 - Panel discussion
Discussions at the Panel

Session 1

• What sort of safety measures do you think would need to be considered in your research and development projects?

• With regard to the presentation made by Mr. Ando on Digitalization in Shipping, slide 20 showed the necessity of a new mechanism to share onboard data of each ship with other ships via Ship Data Centre, which would be an unprecedented concept. How do you think about such a new concept?

• In general, what kind of roles and action are you expecting the IMO to take in the field of Research and Development on autonomous ships?

Session 2

• It is expected that the regulatory scope for MASS will extend according to the level of development, such as in light of its autonomy. How should we address such extension in order to realize MASS as early as possible?

• Do you have any ideas on what sort of approach we should follow to consider the revision of existing conventions and codes as well as the establishment of new ones, taking into account the relevant safety measures?

• What kind of safety measures do you expect to be necessary for MASS at the moment?
Conclusions of the panel discussion

• It would be necessary for the IMO to establish regulatory frameworks for the implementation of necessary measures to ensure safety of MASS without discouraging relevant innovation.

• To this end, one of the best approaches could be the development and implementation of interim guidelines at the early phase, and the establishment of specific regulatory.

• As research and development in this area are rapidly progressed recently, it would be necessary to discuss regulatory frameworks taking into consideration the latest technologies. In this regard, it would be beneficial for the IMO to provide further opportunities like this Workshop to share such latest information among Member States and the relevant stakeholders.
Thank you for your attention!

Presentations at the workshop are available:

http://www.nmri.go.jp/mass.html