

Summary - Virtual workshop on “Maritime automation and autonomous surface ship (MASS) framework for Regulation and Ethical AI”

Roundtable 1: DEFINITIONS, ACCOUNTABILITY, COMPANY CULTURE

Definitions

- One could look at defining levels of automation for other modes of transport; in road transport, five level definitions are used; aviation safety thinking.
- In definitions of levels of automation, the stage when responsibility is transferred from machine to person is important.
- Some consider that the definition of levels is not so important, but the discussion of autonomous systems would be more important.
- Levels are significant, especially for technology developers (different from legally defined levels).
- Only two levels when someone is on the bridge and when the bridge is empty. The critical point is whether there is anyone on the bridge, another critical point is whether there is anyone on board.
- In the US, levels vary during the voyage; the definitions are: voyage, manouever period, harbor region.
- Based on the risk assessment, the ship’s automation levels may vary during the voyage.
- Definitions or levels of definitions must not limit technologies.
- As IMO, IACS and ISO determinants, including industry standards.
- The OneSea Alliance is doing the leveling of definitions.
- Open standards are needed.
- Standardization ASTM Committee free of charge.
- Definitions - One should ask what the definitions are intended to achieve; there are several definitions and their different dimensions of levels of automation; they should be universally understood.

Legislation

- Regarding the legislation challenges to be addressed at international level (IMO).
- Regional rules are complementary and must not conflict with international rules.
- Regional regulation only when the international is badly late.
- Regional regulation usually for pilots, experiments, etc.
- IMO Guidelines utilized.
- Specific legislation with better performance criteria.
- Remote control centers - a new regulated entity under the jurisdiction of which state?

Accountability

- Accountability STCW Chapter 8 Watch Out needs to be resolved.

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- When talking about accountability, the most important thing to remember is what you want to achieve.
- To define the legislative tools in terms of accountability, first consider the legislative objectives SOLAS accountability. What is safe enough?
- Strict liability also to MASS. No one has full access to the algorithms. Liability requirements are ok already.
- The master still exists even if she/he is no longer on board.

Company culture

- The culture of corporate responsibility is high.
- Company values are a different matter from legal liability and should not be confused with each other.
- There is a need for an open culture of dialogue between legislators and companies.

Roundtable 2: PERFORMANCE REQUIREMENTS, VALIDATION AND CERTIFICATION

- It is more important to consider, HOW the validation and certification is done than to consider by WHOM. The who is easier to answer after the how is clear.
- Rule-based algorithms can be tested by making models and simulations. Machine learning is tested statistically. Data sets are needed to test machine learning, which means that the data needs to be shared. Who is going to organize that collaboration? The standards should be created together so that they will be applied.
- A combination of virtual and real world tests are needed. The question is how much testing is needed for the validation. Safety cases should be made to the authorities in the same way as in the nuclear industry (except lighter version). Self-certification requires precise targets. Open source would help with the data sets, but there are no examples of open source in security critical domains. Transparency to accident investigations & liability issues would require an enormous change to maritime culture.
- Unmanned autonomous vessels have to be able to operate in any possible domain. There must be equal safety requirements for autonomous and traditional ships but some can reach a higher safety level than required.

Roundtable 3: ETHICAL ARTIFICIAL INTELLIGENCE AND OVERSIGHT

- Based on discussions, the AI ethical basis should focus on promoting safety, security and sustainability of shipping in line with overall objectives of the IMO. The question should also be extended to address the ethical values of societies, including e.g. coastal ecosystem services, employment of seafarers and the like. Further, the AI based solutions should be transparent and traceable in order to understand their decision-making functions, and to facilitate open discussions, oversight and testing. Such possibilities would increase the overall trust on the AI based solutions, while improving their robustness.
- Following the discussions, difficulties arises particularly when one has to prioritize different ethical values. This emerges new questions such as, what kind of decisions AI should make when there are only bad choices, who should be responsible for such decisions, etc. To

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overcome these and other issues, many of the participants considered necessary to maintain humans onboard also in the future. In other words, the AI based solutions should mainly focus on supporting the decision-making of human beings.

- In the context of ethical basis for AI, there are also lessons to be learned and good practices from other transport and industrial sectors that should be considered in the maritime domain. This includes, for instance, standards, procedures and tests that are made in aviation, road transport and railways as well as nuclear and space industry. In addition, EU has published documents on the AI ethical matters that should be addressed, see e.g.
 - <https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai>
 - https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf
- Based on discussions, the ethical basis of AI should be the starting point for the associated legal requirements, standards and guidelines. While the goal-based approach has certain advantages within this framework, it also comprises a number of risks that should be first identified, analyzed and evaluated. At this point, it was also stressed that it is not always a role of the government to define what is right or wrong. In other words, the blunt-end and sharp-end people of different organizations have also their own responsibilities in different decision-making contexts.
- Transparency and traceability were considered as key elements when designing an ethical legal framework for the AI based solutions. However, it was also strongly emphasized that the business secrets of the shipping companies and their stakeholders should not be jeopardized within this process. Thus, there should be an adequate balance between the governmental legislative interests and business interests of private organizations.
- According to discussions, the IMO should have a key role when defining the legal requirements for ensuring the compliance with the new AI legislation. At this point, the importance of transparency and traceability was once again emphasized to enable the third independent parties to ensure the validity and reliability of the AI based solutions. However, these third parties should be e.g. registered organizations, and there should also be a process which enables governmental bodies to verify their performance.

Roundtable 4: LEGISLATIVE GAPS: SHARING DATA, CONNECTIVITY, COMMUNICATIONS, INTERFACES, CYBER SECURITY

- With digital infrastructure there is a big difference between the high seas and near the coast. The amount of data varies: for some purposes even 3G networks would offer enough capacity and speed, but there will be a need for enhanced data sharing that requires 5G networks. On the high seas it would be possible to operate with short-range communication systems (vessel-to-vessel).
- You need to know what kind of connectivity is available, i.e. mapping the infrastructure would be very important.
- Reliability is essential. There would be a need for standards of what happens if the connectivity fails. Then again, there might be situations when the connectivity is not necessary constantly. E.g. on the high seas it might be enough to have spots of connectivity every now and then.
- Necessary data: regulation, standards and data models needed on the international level.
- For example location data would be valuable dynamic data to share more efficiently.

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- It would be important to ensure the quality of data, e.g. by establishing the reliability of the source and creating mechanisms for time-stamping.
- Machine readability is important and the interoperability of systems is needed (e.g. standards for data models and data sharing).
- With cyber security, clear definition of responsibilities and liabilities is important. A quantitative operational risk model would be needed. Frequent cyber security updates and penetration testing should be required.
- Level of regulation – Are national requirements enough?

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