



Autonomous Ships – Putting the Human in the Headlines

The Joint IMarEST Maritime Autonomous Surface Ships (MASS)
Special Interest Group (SIG) and MASSPeople Working Group
Quarterly Report

November 2023 – January 2024



Foreword by IMarEST MASS SIG Chair – Neil Salter

Welcome to the joint IMarEST MASS SIG and MASSPeople Working Group Quarterly Report

The subject of MASS and autonomous shipping in general is one that is sometimes viewed with wariness by the wider maritime community. I am convinced that this wariness is purely based on a fear of the unknown. We are fortunate in this SIG in that we have many knowledgeable experts amongst us who can draw the disparate threads together and demonstrate that MASS is not something to be feared. The development of MASS will yield benefits for all aspects of the maritime world, both MASS and conventional shipping.

With that, I invite and encourage you to read our brief report. Where you have questions, I encourage you to challenge and contribute to the ongoing discussion by logging into your IMarEST account and visiting our [discussions page](#).

Foreword by MASSPeople Chair – Gordon Meadow



MASSPeople

The [MASSPeople](#) working group contribution to knowledge is assisting the international community to safeguard progression in the technology-people partnership, underpinning the workforce's changing needs, and providing recommendations on new competency standards for consideration by the International Maritime Organization. The group is focusing on the capabilities of operators, and other persons involved in the operation of Maritime Autonomous Surface Ships / Maritime Autonomous Ship Systems (MASS).

The MASSPeople working group works with the IMarEST, an IMO NGO, and with the IMarEST's MASS technical leads to propose or support papers at the IMO. The most recent IMO submission was entitled '[Bridging Competency Gaps for MASS Operators in Alignment with the STCW Framework](#)' for consideration by the IMO's Intersessional Working Group on Maritime Autonomous Surface Ships [2nd Session], on 15th September 2023.

How and why are IMarEST and MASSPeople Collaborating?

MASSPeople is delighted with this new collaboration between IMarEST and MASS Special Interest Group (SIG). This collaboration marks a pivotal moment in the commitment to fostering innovation within maritime transport, with a keen focus on ensuring these advancements benefit not just the industry, but society at large.

The heart of this collaboration lies in a shared vision: to champion a human-centric approach in the maritime sector. As the industry stands on the brink of a technological revolution, with automated and autonomous solutions promising to redefine maritime transport, there's a crucial need to ensure that these technologies are developed and implemented with the utmost consideration for safety, commercial viability, and environmental sustainability.

MASSPeople, IMarEST, and the MASS SIG are coming together to tackle these challenges head-on. By pooling their collective expertise and resources, they aim to steer the conversation and actions towards solutions that prioritise human well-being, efficiency, and the protection of our marine ecosystems. This initiative is not just about leveraging new technologies for the sake of innovation; it's about making sure that these advancements consider wider implications—enhancing the maritime industry in a way that is inclusive, sustainable, and forward-thinking.

This collaboration is a call to action for stakeholders across the maritime industry to join forces. By embracing a human-centric approach to the development and implementation of automated and autonomous technologies, we can ensure the creation of maritime transport systems that are not only advanced but are also safe, commercially viable, and environmentally responsible. The partnership between MASSPeople, IMarEST, and the MASS SIG symbolises a united effort to navigate the challenges of tomorrow with wisdom, empathy, and innovation.

Overview – Supporting the people and technology journey towards MASS

We have seen regulatory developments continue to develop at pace. As seen in this report, the UK developed an annex for Remotely Operated Unmanned Vessels in the latest edition of the [Workboat Code](#) with further information to industry expected to be released soon by the MCA. Internationally, work continues to develop the MASS Code which IMarEST is contributing to during Intersessional Working Groups (ISWG). Various countries continue to develop legislation to cover uncrewed vessels, as seen in both Brazil and Russia recently. As uncrewed and autonomous vessels are operated increasingly both in defence and commercial sectors worldwide, legislation and regulation is adapting and becoming part of the maritime landscape in addition to the vessels that conduct their activities alongside other marine users. The same development continues in other areas of maritime, such as autonomous vessel-specific P&I and other insurance coverage products.

In other international developments, International Association of marine aids to navigation and Lighthouse Authorities (IALA) held a workshop for MASS in Q4 of 2023 in which several members of the IMarEST MASS SIG participated. The report from the seminar can be downloaded [here](#).

The second half of 2023 also saw the conclusion of a research study into Intersectional Approaches to Design and Deployment of Trustworthy Autonomous Systems in maritime. The report, co-authored by MASS SIG committee member Caitlin Bentley, can be found [here](#). This study highlights the opportunities that remote operation of vessels can bring. These benefits are especially notable for individuals who have been historically excluded or otherwise are underrepresented in the maritime industry. The study also highlights some threats if not managed effectively, including qualifications of those operating remotely operated vessels. Much food for thought as to how MASS can create a more equitable industry, or present new opportunities to existing industry personnel.

People and Skills

Technology in Balance

In the ever-evolving realm of maritime operations, both in defence and commercial sectors, the interplay between human capabilities and advanced technology stands as a pivotal element for current and future successes. This crucial synergy is not merely a trend but an essential strategy in meeting the intricate challenges of today's and tomorrow's maritime environments. For the current maritime workforce, as well as for the next and subsequent generations, grasping this dynamic is vital. The integration of advanced automation, particularly within naval and commercial maritime contexts, signifies a transformative shift in the execution and management of maritime missions.

Human-technology partnerships in this field transcend the simple use of sophisticated tools; they represent a fundamental change in operational paradigms. In this context, technology should not be seen as a substitute for human expertise but as an augmentative force, enhancing human skills and broadening operational capabilities. This perspective becomes critically important when considering advanced automation, where the complexity and sophistication of technology is overshadowing the human component.

At the heart of this partnership is the combination of human and machine strengths. Machines bring precision, speed, and the ability to process large data volumes, while humans contribute with critical thinking, contextual insights, and adaptability. This amalgamation is particularly relevant in high-stake environments like naval defence and commercial maritime operations, where decision-making carries significant consequences.

As a sector we must unpack the multifaceted role of human-technology partnerships in the realm of advanced automation. Importantly, we must also highlight the role of the human operator as a significant and empowered player in this technological era.

We should further explore the trajectory of artificial intelligence and its symbiosis with human competence, underlining the importance of behavioural assessments in evaluating aptitude within new advanced technological environments. By combining theoretical insights with practical anecdotal case studies, further analysis will provide greater focus on the

comprehensive and criticality of human-technology partnerships for the effective implementation and adoption of advanced automation in the maritime sector, impacting the current workforce and shaping the future for upcoming generations.

Human Factors

Human Maritime Autonomy Enable (HUMANE) is a Norwegian based research project from the Western Norway University of Applied Sciences. This research project is based on human-element issues of advanced and autonomous technology. From this project, a book was published in November 2023 called [Human-Centred Autonomous Shipping](#) and information presented in an IMarEST run webinar, in collaboration with the AI and Human Element SIGs. Furthermore, a presentation was held at the IMO about the HUMANE project where information was disseminated to the MASS ISWG.

The focus of work on this topic is expert input into the IMO MASS Code. In November 2023, a sub-group (a 'splinter-group' of the larger Correspondence Group that is writing the draft of the Code) was established under the leadership of the International Transport Workers Federation (ITF). The group includes several MASS SIG committee members. The splinter-group has produced good, focussed input for a draft Code that addresses both the sociotechnical and competence issues, however the schedule of the project and the lack of understanding of Human Element ideas and topics within the Correspondence Group is challenging.

IMO Regulatory Progress

The International Maritime Organization (IMO) is now in the final stages of developing the non-mandatory Maritime Autonomous Surface Ships (MASS) code. The report of the Correspondence Group (CG) was submitted to MSC 108 as planned on the 13th of February 2024. The following activities are now planned:

1. Before MSC 108, there will be a discussion in the Facilitation Committee (FAL) in April 2024 including presentations, all focusing on ports and port interactions with MASS.
2. The Legal Committee (LEG)(also April 2024) will have substantial discussions on legal issues, and especially on jurisdiction. There might be a Working Group (WG) on MASS at LEG.
3. Just before MSC 108 in May 2024 the joint MSC-FAL-LEG WG will assemble in order to discuss the cross cutting issues.
4. Thereafter, there will be an intersessional WG in quarter two (June or July) or three (September), as well as one in November 2024.
5. MSC 109 will take place in December 2024, and here we hope to be able to approve the MASS Code.

Next steps are still to be decided after these committees, sub-committees, correspondence groups and working groups have convened.

Please be aware that we still miss the revision of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) Convention and Code in order to make manned MASS legal, and we have not touched upon MARPOL and all the other instruments under the Marine Environment Protection Committee (MEPC).

Finally, remember that a “non-mandatory” code will have to be implemented by the individual IMO member states in order to be of any use, and that operation in other nations' waters will still be dependent on positive approval by the coastal/port states in question.

Only when we develop the mandatory International Convention for the Safety of Life at Sea (SOLAS) text and this has been adopted by MSC and implemented by the IMO member states, a

MASS may expect to be allowed to operate internationally without explicit prior consent by all involved nations.

Other Policy Updates

One very significant subject that has arisen in the November to January period, particularly relating to the UK MASS Sector for vessels less than 24 load line length is the UK Maritime and Coastguard Agency (MCA) has published Workboat Code Edition 3 (WB3), which came into effect on the 13th of December 2023.

These Regulations include Annex 2, which allows for 'Remotely Operated Unmanned Vessels' (ROUVs) to be certified under the Workboat Code, subject to compliance with all the requirements in the Annex. These requirements cover both the vessel itself, and the ROC (or RCC), including communications, control, emergency alarms and alerts between the two. The Annex also covers watchkeeping requirements and practice.

The MCA has decided that they will delegate survey and certification against WB3 and Annex 2 to those Certifying Authorities that can demonstrate competence to undertake the work. At the moment, it is expected that Lloyd's Register (LR), BV and DNV Certifying Authorities are going through that process. MECAL (whose history started with the IMarEST) is similarly going through that process, in which MASS SIG members are closely involved with.

For UK operators, designers, and builders, it should mean that certification through WB3 can provide a more efficient route than that previously in place, through MCA assessment against MGN664 (M+F).

Hydrographic Regulations

The most exciting development in MASS from a hydrographic perspective is the building anticipation surrounding the potential arrival of the S-100 capable Electronic Chart Display and Information System (ECDIS).

Here is just one aspect associated with the arrival of S-100 Electronic Navigational Charts (ENCs).

Most mariners familiar with sea-going ECDIS will recognise some of the limitations when trying to set up a safety contour. Essentially, a safety contour is a line displayed on the ECDIS showing the limit of safe water, the other side of the line away from the ship, there will not be enough water for the ship to travel without grounding.

This safety contour is a vital feature of ECDIS.

The only limitation associated with safety contours is that most current ENC cells allow safety contours at only a few depths, usually 2 m, 5 m, 10 m, 20 m, 30 m and 50 m, imagine a cross-section of a channel or river with a dry bank on either side. The cross-section would take a loose V-form. The depth contours would run parallel to the sides of the channel. The imaginary channel bounded by the two 10 m contours would be narrower than a similar channel bounded by the 5 m contours. It is these imaginary channels that would be indicated as safe water on the ECDIS display.

If the ship requires 10 m of water to be safe, then the 10 m contours would be fine. If, however, the ship only needed 6 m of water to be safe, as a 6 m contour currently cannot be displayed, the ECDIS would default to the nearest safety contour which would be 10 m. This would preclude a much wider channel which would be safe to navigate in.

The exciting development is that for some time, work has been undertaken by the International Hydrographic Office (IHO) to create far more detailed ENCs that can allow more precise depth contours. The marine electronics manufacturers representatives from Committee International Radio Maritime (CIRM) have been working with the IHO to enable the display of these far more detailed (S-100) ENCs on ECDIS.



We are not there yet and even when we do get there, there will still be many ENC's that will still have to be displayed in the older format but we are rapidly approaching a point whereby both the old and the new standard ENC's can be displayed on ECDIS machines. A concept referred to as dual-fuelling.

The massive advantage for autonomous ships is that once these new ENC's are available, the lateral extent of waterways will be much greater. This will allow more sea-room for autonomous and conventional shipping to safely use the same seaways.

Software and Control Systems

There is currently a lot of high profile in the maritime space on both “Military Drones” and “Autonomous Platforms”. The former, with news coming from the Ukraine / Russia conflict, heralds the power and reach of relatively low cost (compared to the target vessels) of such devices, and their use by a country that really lacks an offensive naval capability, to dominate the Black Sea. Remotely operated or piloted vehicles, and their software (and counter software) are high profile, and industry is growing its recruitment in such technologies, just as we are looking at MASS and AI, alongside the Human Element SIG, (such as the recently published HUMANE work). For my own part, I will be taking on the task of the IPMS (Integrated Platform Management System) for the MoDs new “Fleet Solid Support” platforms, which will be complex software in itself (building on a solid base from Navantia).

The blurring of lines between Autonomous, Remote Controlled, and Highly Automated, still continues, with many programmes having half-way houses between the domains, while the technology matures. Working with Lloyds Register recently on both human element, and “Alarms and Warnings” has provided insight into some of the problems that still affect mariners, and which will not be reduced by the onset of ever-more-complex systems, unless it is properly handled. Work carried out to explore this under Asger Schliemann Haug has provided more much-needed data from modern mariners, to try and bring this to the forefront of our thinking.

The software world in maritime is less regulated than for aerospace, (and therefore less costly upfront), but work is being done to look at whether safety and overall cost of ownership might benefit from more rigorous software standards, such that on-board systems can be trusted with safety-affecting duties while also remain more resilient. All of this drives interesting careers and jobs in that space away from the more traditional steel, GRP and electrical trades.

Ethics and Safety of AI

Do we need a responsible scaling policy?

At the AI Safety Summit held in the UK in November, 2023, Dario Amodei, CEO of a generative AI start-up called [Anthropic](#) presented a new company [Responsible Scaling Policy \(RSP\)](#). The goal of the RSP is to manage risks from increasingly capable AI systems. It takes a long-term view and focuses on mitigating catastrophic risks where AI could cause large-scale harm. In this brief update, I explain what Anthropic's RSP entails, and discuss some implications the maritime sector may wish to consider.

What is a responsible scaling policy?

Anthropic's RSP defines [four AI Safety Levels](#), which have been drawn from existing biosafety approaches to handle dangerous biological materials. As AI Safety risks increase, due to increased misuse potential or autonomy, higher AI Safety Levels are required to impose stricter safety and security standards. This means that AI Safety Levels are intended to pause the scaling of AI capabilities if they outpace safety standards. In order to resume deployment, effective safety measures need to be developed. This may incentivise attending to both AI development and safety standards simultaneously.

What does it mean for the maritime sector?

A common refrain in the maritime sector is that 'every ship is unique' – meaning that each ship, even within the same fleet may deploy AI differently, or combining or embedding AI tools differently into aspects such as cameras and sensors, navigation, collision detection, or other. AI in the maritime sector therefore has greater diversity and complexity, such that it is hard to imagine catastrophic risk in terms of a single AI system as with Anthropic's Claude Large Language Model. In this case, how might we envision catastrophic risk appropriately, and what would large-scale harm encompass? Moreover, should risks posed to job security, or environmental degradation be included? For me, although it may be some time before we see fully autonomous vessels scale within the maritime sector, [the \(mis\)use of recreational watercraft parts to deploy explosive sea drones](#) signals that we may need to think about safety 'at scale' and what an RSP may entail.



Thank you

Thank you to the following MASS SIG experts for their input into this quarterly report:

- Ann Pletschke – Overview
- Gordon Meadow – People, Skills and Workforce Assurance
- Jonathan Earthy – Human Factors
- Erik Tvedt – IMO Regulatory Progress
- Alan Cartwright – Other Policy Updates
- Neil Salter – Hydrographic Regulations and Foreword
- Bob Doncom – Software and Control Systems
- Caitlin Bentley – Ethics and Safety of Artificial Intelligence