28-29 Threadneedle Street, London EC2R 8AY
Telephone: + 44 (0) 20 7628 2555
Email: info@maritimeindustries.org
Website: maritimeindustries.org

# Unlocking the UK's Maritime Autonomy Opportunity: A Coordinated Industry Perspective on Regulatory Challenges

*SMI Maritime Autonomous Systems Group Council*

## Executive Summary

Maritime autonomy represents a once in a generation opportunity for the United Kingdom - commercially, militarily, and strategically. With a global Maritime Autonomous Surface Ships (MASS) market projected to reach £103bn by 2030, and the UK already home to world-leading innovation, research, and test facilities, the nation stands at an inflection point. Enabling sector growth through appropriate regulatory reform has far-reaching economic value. A thriving autonomy ecosystem stimulates high-performance manufacturing, AI and data-science capability, cyber-security innovation, and specialist maritime supply chains - creating high-skilled jobs and strengthening the UK's position in globally competitive technology domains. This links MASS directly to skills, security, productivity, innovation industries, and regional growth, which are key government priorities.

Realising this opportunity requires a regulatory, assurance and legislative framework that is modern, risk-based, and proportionate to emerging technologies.

The Society of Maritime Industries' Maritime Autonomous Systems Group (MASG) Council has developed this paper to present a unified industry view of the challenges and priorities facing the UK. It reflects inputs from across the commercial, defence, research, and technology communities, at a time when the government is considering future legislation and launching key strategies - including the forthcoming Shipbuilding & Maritime Technology Action Plan, the refresh of naval capability through a 'Hybrid Navy' model, and active work within Department for Transport (DfT) on modernising maritime regulation.

This summary highlights the priority areas where targeted government action would directly accelerate capability growth, attract inward investment, and position the UK as a global leader in MASS adoption.

Key Messages:

1. **The UK must modernise regulation to remain competitive:** The current framework, grounded in prescriptive rules, is not designed for adaptive, software-defined and remotely operated systems. A shift to risk-based, evidence-driven regulation is essential.
2. **Autonomous behaviours require new assurance models:** Current frameworks cannot accommodate non-deterministic decision-making, adaptive systems or Artificial Intelligence (AI) enabled behaviours. At the same time the associated national physical and virtual infrastructure to support testing and trialling remains fragmented and a co-ordinated ecosystem capable of supporting emerging validation and assurance requirements is required. Without dedicated regulatory development, and national infrastructure programme the UK risks falling behind international competitors.
3. **Early-stage testing is too slow, costly, and inconsistent:** Small and Medium Enterprises (SMEs), academic institutions and innovators face disproportionate barriers to conducting controlled, safe trials - slowing product development and reducing UK competitiveness.
4. **Software assurance and cyber security are emerging as critical bottlenecks:** Lack of clear, practical requirements in UK domestic requirements is contributing to inconsistent certification outcomes, supply-chain confusion, and significant rework costs.

5. **Proportionate regulation for smaller uncrewed vessels is critical:** Marine Guidance Note (MGN) 702 and 705 are constructive steps but require further refinement and/or additional mechanisms to avoid stifling one of the most innovation rich segments of the market.
6. **The regulatory gap for 24m to convention-sized vessels must be addressed:** This segment presents significant risks and major opportunities for early MASS adoption, and greater engagement is needed to clarify government plans for how this area will be taken forward.
7. **Legislation must evolve and the process must be transparent and coordinated:** DfT's ongoing regulatory reform activity should be aligned with sector needs, with industry actively engaged early in shaping updates. This includes legislation of sub-surface assets. This is critical to avoid unintended impacts on existing commercial operations.
8. **The MCA must be resourced and empowered to lead:** Increasing regulatory complexity cannot be met through current capacity or reliance on delegated authorities alone. Investment in digital, cyber, autonomy, systems engineering and assurance expertise is essential.
9. **Regulatory reform is also an economic and industrial strategy opportunity:** Modernising regulation will unlock wider UK growth across high-value sectors (including advanced manufacturing, AI, cyber, digital systems, and specialised maritime supply chains) enabling workforce development and strengthening the UK's position in globally competitive, future-facing industries.

Priority Actions:

The MASG Council recommends that government departments (including DfT, MCA, MoD, NSO, DMR, DSIT and DESNZ) prioritise the following:

1. **Link MASS regulatory priorities to upcoming government strategies:** Ensure the forthcoming Shipbuilding & Maritime Technology Action Plan, defence modernisation programmes (including Hybrid Navy concepts), and wider industrial strategy embed clear commitments to these regulatory enablers and reflect them in MCA and cross-government departmental workplans.
2. **Implement a national, risk-based maritime regulatory roadmap:** Define the UK's future model for autonomous and digitally enabled maritime systems, including:
    a. Roles and responsibilities across government and regulators;
    b. Tolerable risk principles and accountability;
    c. Proportional evidence expectations for autonomous systems;
    d. The allocation and management of system risk across platform and operations.
3. **Fully implement and scale the Maritime Regulatory Innovation Framework (MRIF):** Deliver a funded, permanent trials authorities capable of enabling safe, early-stage testing, including:
    a. Completion and validation of the sandbox model;
    b. A viable business model;
    c. Cross-government alignment and long-term funding.
4. **Establish a UK framework for autonomy assurance:** Accelerate national work on the Maritime Autonomy Assurance Testbed (MAAT) and related methodologies and integrate them into a coherent regulatory approach for vessels with autonomous functions. This would be supported by an integrated approach to physical ranges, validated simulation, environmental data providers and digital infrastructure into a unified national facility supporting both commercial and defence requirements.
5. **Expand MCA capability and capacity:** Invest in internal skills across autonomy, cyber, alternative fuels, systems engineering, risk-based regulation and software assurance, and establish new mechanisms to access specialist expertise from outside government. Reinforce MCA leadership in regulatory development and interpretation.

6. **Strengthen and clarify software assurance and cyber-security requirements:** Deliver clear, practical guidance proportionate to levels of risk to third-parties and environment protection aligned with relevant and agreed international standards; support ecosystem capability-building and ensure consistent interpretation across Certifying Authorities (CAs)/Recognised Organisations (ROs). The guidance will establish the compelling body of evidence required to demonstrate the safety functions including in normal, reasonably foreseeable abnormal and emergency operations across the System of Systems required to operate remote and vessels with autonomous functions.
7. **Increase transparency on DfT's legislative intentions and required changes** Industry currently has limited visibility of the areas where DfT believes legislative change is needed, the barriers these changes are intended to address, the specific proposals under consideration, and the expected impact on operators, developers, and regulators. Clear communication of the legislative programme (including scope, rationale, anticipated outcomes, stakeholder engagement points, and indicative timelines) is essential to ensure industry is properly engaged and that reforms deliver the intended impact.
8. **Establish a clear plan for vessels between 24m and convention size:** Work with industry to evaluate the risks and opportunities in this category and set out how government intends to address the current regulatory gap.
9. **Refine and expand exemptions for smaller ROUVs and Mini-MASS:** Provide clearer expectations for MGN 702 self-declaration, and work with industry to define evidence for extending MGN 705 or achieving proportionality for vessels between 4.5m and ~7m.

## Introduction: Why Maritime Autonomy Matters for the UK

Maritime Autonomy represents a transformative opportunity for the UK, promising to reshape the nation's economic, environmental, and security landscape. The UK Maritime sector currently contributes £13bn to the economy and supports over 111,000 jobs across 6,800 companies. Autonomous technologies (particularly Maritime Autonomous Surface Ships (MASS) and Uncrewed Surface Vessels (USVs)) are rapidly advancing, offering greater efficiencies, enhanced safety, reduced emissions, and the ability to operate in hazardous or remote environments. These innovations underpin the UK's ambitions in offshore renewables, defence, shipping, aquaculture, and port operations, with the government targeting 50 GW of offshore wind by 2030 and doubling investment in Autonomous Maritime systems for national security.

Beyond economic growth, autonomy enables, safer working practices, advanced monitoring of critical subsea infrastructure, supports climate and environmental research, and creates high-value jobs - particularly in coastal regions where productivity lags behind inland areas. The UK's leadership in global innovation, world-class facilities, and robust industry-academia partnerships position it, if supported correctly through effective legislation that enables growth, to capture a significant share of the projected £103bn global Maritime Autonomy market by 2030.

The purpose of this white paper to set out what the Society of Maritime Industries (SMI) Maritime Autonomous Systems Group (MASG) Council sees as the challenges from a regulatory perspective to stimulate, maximise and support this growing market.

## The Problem Statement: Navigating Regulatory and Assurance Complexity

Autonomous technologies require assurance through risk-based models which offer the adaptability required for innovation but introduce greater uncertainty and require enhanced technical expertise to evidence the safety[1] of these vessels. This represents a step change to the current approaches of certification achieved against compliance with numerical standards.

It is important to acknowledge that regulatory and assurance challenges are multifaceted and nuanced. The transition from prescriptive to risk-based regulation also means that iterative development, essential for safe and reliable autonomous systems, can be hampered by processes that require re-approval without clear triggers. Reassessment should be driven by safety-relevant changes - such as impacts on safety functions, operating limits, or remote-supervision assumptions - yet in practice even minor updates can trigger disproportionate assurance burdens, increasing costs and discouraging investment.

The UK must ensure its regulatory environment is sufficiently agile and proportionate to support innovation, maintain competitiveness, and enable the full potential of maritime autonomy to be realised safely.

## Key Regulatory Areas and Industry Needs

The following represents a synopsis of the challenges that SMI members consider require further consideration and it proposes targeted activity to enable greater adoption of MASS safely. This would attract further investment into the UK maritime sector and enable the benefits to maritime operations that MASS enable.

1. **Enabling Safe, Early-Stage Testing and Demonstration of MASS**

[1] There has been a lot of debate on what we mean by 'safe' within the context of autonomy. The term normally links to 'the satisfaction of the administration'.

Across vessels using Remotely Operated and Autonomous Operation of Key Functions, access to safe, early-stage testing remains one of the most significant barriers facing UK innovators. Although the UK's regulatory environment is rightly grounded in safety, current pathways are largely geared towards full certification and mature systems. This creates substantial friction for rapid, iterative development - particularly for Small and Medium Enterprises (SMEs), research organisations, and operators working with novel, prototype vessels. This challenge applies equally to defence programmes, many of which still require vessels to obtain commercial certification for testing and demonstration, further underscoring the need for proportionate and flexible pathways

To address this, the sector has invested considerable effort into developing more proportionate, pragmatic, and risk-managed approaches that enable safe real-world trials without imposing the full assurance burden associated with commercial deployment. A range of models already exists or are emerging, each offering distinct advantages and limitations.

These include the use of localised regulatory models such as King's Harbour Master (KHM) Plymouth (uncategorised waters), categorised-waters testing, the risk-based Marine Guidance Note (MGN) 664 approach, and the Maritime Regulatory Innovation Framework (MRIF) derived sandbox model. These options are explored in greater detail in a Connected Places Catapult (CPC) whitepaper[2]. There is also work underway in Defence to improve industry's ability to test and trial vessels, in line with Recommendation 39 of the Strategic Defence Review (SDR). However, it is noted that the outcome of this work is unlikely to deliver the necessary impact across all applications. Additionally, supporting competitive access to properly validated simulation to provide evidence in support of test and trials whilst also reducing the risk to third-parties and environmental protection during product development.

The Department for Science, Innovation and Technology (DSIT) funded MRIF programme which includes the Maritime and Coastguard Agency (MCA) as a core partner, has made substantial progress towards a scalable, repeatable sandbox model that reduces the assurance burden while maintaining necessary safety requirements. The approach - built collaboratively with industry - has demonstrated high potential to unlock innovation and support SMEs by creating a structured pathway for early-stage trials. Although the initial ambition of completing a full "pipe-cleaner" demonstration vessel within the life of the programme has not yet been realised, the work remains highly promising. To avoid losing momentum, SMI see that the follow-on activity is key to the provision of this strategic enabling capability for national competitiveness; this should include:

- Finalising, refining, and validating the sandbox process, including delivery of a full pipe-cleaner to build confidence and operational clarity.
- Developing a clear business model for how a future trials authority could sustainably commercialise operational mitigations, enabling an ecosystem where SMEs can realistically participate.
- Securing funding and cross-government alignment to transition the MRIF model from a successful research concept into a fully implemented regulatory capability.

## 2. Support Industry in Transitioning to Risk-Based Certification Approaches and Developing Practical Guidance

MGN 664, Certification Process for Vessels Using Innovative Technology, represents a major step in the UK's move toward a flexible, risk-based certification model for Maritime Autonomy. The MASG Council recognises the importance of this structured, principles-based approach, which provides the adaptability needed to enable innovation while maintaining appropriate safety standards. This is

[2] Navigating innovation a regulatory sandbox framework for UK Maritime autonomy - Connected Places Catapult

already a recognised approach in the Naval Domain in the manner through which safety cases[3] demonstrate the safety of respective vessels through a blend of quantitative and qualitative evidence to the satisfaction of the Defence Maritime Regulator (DMR) that the vessel is safe to be operated.

However, the transition to risk-based regulation is significant, requiring new skills, capabilities, and cultural shifts across both commercial marine and regulatory bodies. The guidance to industry should clarify the roles of MCA and Certifying Authorities (CAs)/Recognised Organisations (ROs) in safety and environmental risk management.

The addition of further clarity to MGN 664 to provide consistency in the required compelling body of evidence[4] which is scalable in nature across and delivered through process, methodologies, aligned to recognised good practice from other sectors which is proportional to the risks to third-party and environmental protection; this would reduce uncertainty and costs for those seeking to adopt or development MASS. This would materially reduce duplication of effort, accelerate learning across the sector, and help ensure consistency in how risk-based principles are implemented. Importantly, as seen in other leading nations, risk-based certification benefits from an element of co-creation between regulators and innovators. This does not compromise the essential separation between regulatory oversight and applicant responsibility; rather, it ensures shared understanding, reduces ambiguity, and builds regulatory confidence in emerging technologies.

The MASG Council welcomes the recent announcement of a new MCA Innovation Hub and emphasises the importance of this function being designed to:

- Bridge early engagement between innovators and the regulator,
- Provide clarity on regulatory pathways, and
- Develop a framework of practical application of risk-based certification methods, including those underpinning MGN 664 and supporting guidance to enable consistent application proportionate to the identified risk to third-parties and environmental protection.

As the sector evolves, the UK's success in maritime autonomy will depend on its ability to embed risk-based regulation in a way that is practical, proportionate, and accessible to organisations of all sizes. Strengthened guidance and structured engagement will be essential to achieving this.

### 3. Raise Awareness of Software Assurance and Cyber Security Requirements, Including Crossover Implications for Conventionally Crewed Vessels

Software assurance and cyber security represent one of the most challenging and under-developed areas within the UK's maritime autonomy ecosystem. As vessels (both crewed and uncrewed) become increasingly software-defined, the risks associated with poorly understood or inconsistently applied assurance practices continue to grow. Industry consistently reports that this is an area where there is an inconsistency in regulator expectations flowed down through CAs in the absence of a coherent framework is already constraining innovation, certification, and market access.

A significant step-change is required in how both software assurance and cyber security are approached in the commercial maritime sector. Current guidance stated in Workboat Code Edition 3 (WBC Ed 3) remains high-level, fragmented, and variably interpreted across CAs, technology developers, shipyards, system integrators, and operators.

[3] Sometimes this is referred to as an assurance/safety case.
[4] This compelling body of evidence shall include the requirements of insurers.

In the absence of clear, accessible expectations, organisations risk developing innovative technologies that later become costly (or in some cases impossible) to assure once standards and expectations mature and become embedded in regulation. Certification bodies expect structured, lifecycle-based assurance approaches aligned with standards. However, many organisations (especially SMEs) lack the awareness, capability, or supply-chain to select, justify and implement an appropriate set of standards as part of a coherent assurance argument.

While several widely used frameworks exist for high-integrity and complex systems, they have well-recognised limitations when applied to AI/ML-enabled autonomy. Standards bodies across multiple sectors (including maritime, automotive and industrial) are actively developing adaptations and extensions (e.g. emerging 'data-driven systems' approaches) to clarify how unintended behaviours in AI/ML-enabled systems should be managed. In practice, any chosen set of standards must be justified, traceable to system-level safety objectives and hazards, and agreed with relevant stakeholders as part of the overall assurance case, rather than assumed or prescribed.

Cyber security, meanwhile, is rapidly converging with software assurance. IMO Resolution MSC.428(98), IACS Unified Requirements E26 and E27, and evolving Class-led cyber frameworks reflect a growing recognition that cyber risk is a safety risk. Systems cannot be considered "safe" unless they are also cyber-resilient. This crossover has major implications for both uncrewed and conventionally crewed vessels: increasingly, crewed vessels carry the same digital architectures, remote-access systems, programmable electronic systems and integrated bridge technologies found on autonomous platforms. As a result, cyber-security expectations are now extending beyond autonomy programmes to the wider commercial fleet. Several key challenges continue to inhibit progress:

- Lack of clarity on expectations: Guidance such as WBC Ed 3 and Marine Information Note (MIN) 698 references relevant standards but provides limited practical steer, resulting in inconsistent interpretation between CAs, Class, operators and technology developers.
- Capability and capacity gaps: Both industry and regulators report a shortage of software assurance expertise, causing delays and uncertainty.
- Pace of software evolution: Software develops far faster than traditional certification timelines, creating uncertainty around when reassessment, re-validation, or regulatory input is required.
- Fragmented responsibility: Supply chains often lack clear assurance deliverables, leading to misalignment and late-stage rework.
- Cross-domain inconsistency: Defence, commercial, offshore energy and research sectors all interpret requirements differently, creating unnecessary divergence.

The MASG Council believes there is a pressing need to:

- Develop clear, accessible guidance on software assurance expectations including practical routes for proportionate adoption aligned with the risk to third-parties and environmental protection.
- Provide early-stage, structured engagement mechanisms (through the forthcoming MCA Innovation Hub) to support applicants and reduce ambiguity.
- Promote an integrated approach to safety and cyber security assurance, ensuring alignment across standards, supply chains, and operational practices.
- Increase awareness of the need for robust configuration and change-management processes, to identify when the software changes trigger reassessment or regulatory engagement.
- Build capability across the ecosystem by sharing best practice from other sectors (aviation, nuclear, automotive and rail) where risk-based software assurance is well established.

Ultimately, software assurance and cyber security should be seen not as compliance burdens but as strategic enablers that protect safety, underpin certification readiness, strengthen international competitiveness, and enable scalable deployment of autonomous and digitally intensive maritime systems. The MASG Council stands ready to support industry and regulators in building a clearer, more proportionate, and future-proof assurance landscape.

### 4. Champion Robust Assurance Frameworks for Vessels Remotely Operated and Autonomous Operation of Key Functions

To date, much of the UK's regulatory and industry discussion has focused on the step-change required to assure complex systems such as remote operations and semi-autonomous behaviour. While this shift is significant (requiring new approaches to software assurance, cyber security, and risk-based certification) it does not address the next major challenge: the assurance of vessels with autonomous functions where human involvement becomes reduced or is removed entirely. Higher degrees of autonomy involve systems making context-dependent decisions, adapting behaviours based on environmental inputs, and operating with limited or no real-time human oversight. These capabilities introduce fundamentally different risk profiles, and the assurance challenges they present cannot be solved by extending existing frameworks designed for crewed or remotely operated vessels. They require new regulatory thinking, new evidence models, and new forms of oversight. At present, there is no unified UK framework capable of addressing:

- Non-deterministic decision-making, where system behaviour cannot be fully predicted in advance.
- Learning-enabled or adaptive functions, which evolve over time and may behave differently in new contexts.
- Human–autonomy interaction models, where responsibilities shift dynamically between the system and remote operators.
- Validation and verification at scale, where traditional test-based approaches become infeasible due to the near-infinite variety of operational scenarios.
- Assurance of autonomy stacks, which integrate sensing, decision-making, perception, control, and software safety functions5 into a complex whole.

While initial steps are being taken - most notably through work by the Lloyds Register (LR) and National Physical Laboratory (NPL) with the Maritime Autonomy Assurance Testbed (MAAT) programme and partners such as the UK Hydrographic Office, Plymouth Marine Laboratory (PML), Met Office, University of Plymouth and the University of York's Centre for Assuring Autonomy's who have developed amongst other things SACE[6] and PRAISE[7] frameworks.

The MAAT programme, supported by the National Shipbuilding Office (NSO), is following a structured, proportional and evidence-based approach to deliver a coherent assurance framework for MASS, across operational lifetime. The objective is to ensure compliance can be assessed against concrete evidence, which includes answering a specific, bounded claim rather than an unqualified assertion; generating traceable evidence back to structured requirements; and enabling organisations to navigate and select the right methods, environments and tools for Test and Evaluation for each case. This approach acknowledges there are significant unanswered questions to be addressed, not least on regulatory interpretation, interoperability and legal responsibility.

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[5] These safety functions shall include normal, reasonably foreseeable abnormal and emergency operations.

[6] The Safety Assurance of autonomous systems in Complex Environments (SACE)

[7] Principles-Based Ethics Assurance (PRAISE)

The MASG Council believes the UK must accelerate activity in this space if it is to maintain global competitiveness and prepare for the increase in adoption of this level of technology in response to commercial crewing challenges and the non-mandatory phase of the International Maritime Organization (IMO) MASS Code. Countries such as Norway, Singapore, Japan, and the United States are already exploring structured assurance approaches for higher autonomy, often linking them directly to national innovation strategies. There is a clear opportunity for the UK to establish itself as a leader by:

- Developing a national framework for assurance of higher autonomy, grounded in safety engineering, AI assurance, and evidence-based performance assessment.
- Defining proportionate, scalable evidence pathways that evolve from deterministic to probabilistic and behavioural-based assurance models.
- Strengthening cross-government coordination, ensuring defence, commercial, academic, and standards-body efforts are aligned rather than duplicative.
- Embedding autonomy-specific validation and verification principles, including synthetic environments, scenario-based testing, and real-world performance monitoring.
- Integrating work on cyber security, software assurance, and data integrity to create a coherent approach to assuring autonomous behaviour.

Higher autonomy will not be unlocked through incremental change alone. It requires purpose-built frameworks, grounded in rigorous science, transparent evidence requirements, and regulatory confidence. The MASG Council stands ready to champion this agenda, convene expertise across the ecosystem, and support efforts such as MAAT and the Centre for Assuring Autonomy that are beginning to lay the foundations for what will become one of the most important assurance challenges of the next decade.

### 5. Promote Validated Testing Capabilities to Underpin Assurance Frameworks

Robust assurance frameworks rely not only on sound principles and clear regulatory pathways, but also on access to credible, well-instrumented, and operationally relevant physical testing environments, linked to validated simulation test environments. As the maritime autonomy sector matures (particularly with increasing expectations around software assurance and cyber resilience) the need for representative, real-world testing becomes increasingly acute. While simulators, digital twins, and synthetic environments will play a growing and complementary role in future assurance models, physical testing remains foundational. It provides the empirical evidence, behavioural validation, data quality, and operational insight required to support risk-based certification, inform safety arguments, and build regulator and stakeholder confidence. Without appropriate physical test capabilities, even the best-designed frameworks will be difficult to implement in practice.

At present, the UK benefits from pockets of excellence - military ranges, research facilities, controlled harbour environments, and emerging test assets including Smart Sound Plymouth. However, these capabilities are fragmented, vary widely in technical maturity, and are not yet integrated into a coherent national testing ecosystem. As a result, industry often struggles to access facilities that can:

- Accommodate a range of vessel sizes and autonomy technologies.
- Support controlled, risk-managed trials of novel behaviours.
- Provide high-quality data capture for assurance evidence.
- Safely test edge cases, degraded modes, and failure behaviours.
- Validate autonomy stacks in complex multi-agent scenarios.
- Conduct cyber-physical stress testing and resilience trials.

The MASG Council sees a clear strategic opportunity to strengthen the UK's leadership in maritime autonomy by investing in, coordinating, and promoting physical testing capabilities that directly support the emerging assurance landscape. These capabilities are essential for:

- Risk-based certification, where empirically grounded evidence is needed to justify novel or adaptive behaviours.
- Software assurance, enabling validation of system behaviour under realistic operational conditions.
- Cyber-security resilience, including testing of communications, interfaces, and fail-safe mechanisms under real-world stressors.
- Vessels with autonomous functions, which require complex scenario testing beyond what is feasible through simulation alone.
- Defence-commercial interoperability, ensuring dual-use technologies are tested in environments relevant to both domains.

Several emerging initiatives - including work by NPL under MAAT, ongoing efforts linked to the MRIF programme, provide important building blocks. However, a more explicit, coordinated national approach is required. The MASG Council strongly encourages government and regulators to develop and resource a national, integrated testing capability (complemented by regulatory sandboxes such as MRIF), ensuring industry has access to the physical and virtual environments needed to generate robust assurance evidence.

## 6. Proportionate Assurance Requirements for Smaller Remotely Operated Uncrewed Vessels (ROUVs)

There has been a notable and welcome increase in MCA engagement on the regulatory treatment of smaller Remotely Operated Uncrewed Vessels (ROUVs) and "Mini-MASS". This segment of the market - characterised by vessels typically below ~7 metres in length - underpins a large proportion of UK innovation, particularly across offshore survey, environmental monitoring, academia, defence experimentation, and early-stage autonomy development. With the introduction of WBC Ed 3, members raised concerns that applying full workboat requirements to these smaller, uncrewed systems created disproportionate assurance burdens. This has had a significant commercial impact on many UK companies, constraining operations and disincentivising domestic development. The subsequent publication of MGN 702 and MGN 705 represents meaningful progress, and the MASG Council strongly welcomes this direction of travel.

MGN 702 - General Exemption for MASS under 2.5m LOA is a positive and welcome step in the disapplication of certain MCA-specific requirements, whilst placing the responsibility on the operator to identify and comply with broader obligations under primary legislation - most notably SOLAS and COLREGs. We acknowledge that the MCA cannot disapply these international instruments due to the definition of "vessel" within UK law. The smallest vessels typically have extremely limited onboard energy, payload, and processing capacity, making continuous connectivity and full situational awareness impracticable under current expectations for remotely operated vessels.
The MASG Council would therefore welcome further MCA guidance to:

- Clearly define the aspects and requirements that operators should consider when applying MGN 702; and
- Clarify the liabilities and risks associated with self-declaration where these wider requirements cannot reasonably be met.

Such clarity would materially support both operators and innovators in assessing viability and compliance pathways.

MGN 705 - General Exemption for ROUVs between 2.5m and 4.5m LOA has been strongly welcomed by industry and has already enabled some vessels to operate in UK waters where this was previously not possible. However, members believe that the exemption does not go far enough. There is broad sentiment that the upper length limit should be increased, as many vessels that fall just outside the current threshold present similarly low risk and therefore face disproportionate assurance obligations. This point was raised extensively during the consultation phase.

While we recognise that thresholds must be set, the current limit appears primarily driven by consistency with the crewed vessel regime - where requirements protect both crew and third-parties - rather than the fundamentally different risk profile of uncrewed vessels, which address only third-party risk. At the MASRWG Conference 2025, the MCA indicated that further changes would require additional evidence. The MASG Council would welcome clarity on:

- What specific evidence is required to justify an increased threshold or alternative approaches; and,
- How industry can best support the MCA in obtaining this evidence.

At the same time, industry recognises that an extension of MGN 705 may not be possible in the short term due to certification obligations applied to crewed vessels. In this scenario, members strongly support the development of a reduced and more proportionate set of technical requirements for the next vessel band (approximately 4.5 to ~7m LOA), reflecting the materially lower risk profile. Such an approach would provide clarity, remove unnecessary burdens, and ensure a smoother transition between exemption and certification regimes.

A collaborative evidence-gathering and policy-development approach would create a clear pathway for refining MGN 705 and/or establishing a proportionate technical regime for uncrewed vessels in the next size category.

### 7. Engage on Risks and Opportunities for Vessels Over 24m but Below Convention-Sized Ships

Vessels above 24 metres but below convention size represent a rapidly growing and strategically important segment of the UK maritime market - particularly for offshore energy support, research, aquaculture, survey, defence, and emerging autonomous operations. However, this category currently sits in a regulatory gap, with the Workboat Code applying only up to 24m and the draft IMO MASS Code only focussing on convention-sized cargo vessels, leaving a substantial class of larger workboats and mid-sized vessels without a clear and future-ready regulatory framework. The MASG Council proposes that the gap presents material risks as well as significant strategic opportunities:

Key risks include:

- Regulatory uncertainty: Operators face ambiguity around applicable standards, particularly as vessels in this size range begin to integrate novel technologies such as autonomous systems, alternative fuels, and advanced digital control.
- Fragmented oversight: Without a dedicated framework, vessels may be assessed via exemptions, equivalence, or case-by-case arrangements - creating inconsistency, delay, and cost.
- Misalignment with emerging autonomy pathways: As autonomy scales beyond small USVs, many of the earliest commercially viable MASS deployments may fall within this mid-size category. A lack of clarity could slow adoption, investment, and safety assurance.

Key opportunities include:

- Testbed for next-generation regulation: This vessel category offers an ideal space to test and demonstrate modernised regulatory approaches, including goal-based frameworks, evidence of suitability of proposed Acceptable Means of Compliance (AMCs), and structured alternatives linked to new assurance methodologies.
- A platform for scalable autonomy: Many early high-value autonomy applications - offshore inspection, subsea support, environmental monitoring, logistics - will involve vessels in this size range. Clear regulatory expectations would unlock commercial pathways for UK innovators.
- Alignment with decarbonisation: Larger workboats are among the first adopters of alternative fuels and hybrid propulsion. A modernised regulatory approach for this fleet could accelerate safe deployment and position the UK as a leader in clean maritime technology.
- Industrial and export advantage: The UK has significant design, build, and operational expertise in this vessel segment. A clear regulatory framework would strengthen the competitiveness of UK yards, integrators, and operators internationally.

Given the importance of this vessel class to both commercial and defence sectors, the MASG Council is seeking greater engagement and clarity from government on:

- How this regulatory gap will be addressed;
- What work is planned or underway to evaluate the risks and opportunities in this category;
- How industry can support evidence generation and option development; and,
- Indicative timelines or milestones for developing a future-ready framework.

A coordinated and transparent approach in this area will help ensure the UK does not miss a time-critical opportunity to modernise regulation, de-risk innovation, and position the UK as a global leader in both autonomy and clean maritime technology.

## 8. Future Regulation of Sub-Surface Maritime Assets

There is ongoing discussion about potential changes to primary legislation that would bring sub-surface assets within the scope of the Merchant Shipping Act - an area not previously covered. This would ultimately provide regulators with the powers to oversee and intervene in this part of the industry, particularly within the commercial domain. While such legislative changes alone would not immediately result in full regulation, they would enable regulators to halt operations deemed dangerously unsafe, and could pave the way for future regulations that might significantly impact and disrupt established practices. The SMI MASG Council is keen to ensure that the interests of both its members and the wider industry are effectively represented in the assurance and regulatory treatment of sub-surface assets. We would welcome a defined plan for how changes to primary legislation and subsequent regulation will be developed and how our members and wider industry can support the development of effective regulation in this area.

## 9. Fit For Purpose Regulations

Enabling the safe and scalable deployment of MASS will ultimately require updates to the UK's legislative framework and greater clarity on how the international liability and safety obligations apply to remotely operated and autonomous systems.

While the Department for Transport (DfT) is actively progressing legislative reform beyond the former Future Transport Bill scope, aimed at addressing areas of regulation that are outdated, a hinder to

innovation, or not designed with new technologies and business models in mind. Industry currently has limited visibility of:

- Which areas of primary or secondary legislation DfT believes must change;
- What specific barriers these changes aim to resolve;
- What proposals are under consideration; and
- What the expected impacts on operators, innovators, regulators, and insurers will be.

This lack of clarity limits industry's ability not only to plan and invest with confidence but also to support government effectively in shaping reforms. Without early visibility of the issues DfT seeks to resolve, the changes being considered, and the outcomes they aim to achieve, there is a risk that legislative updates may not deliver the impact or enablement that industry requires. Structured engagement on legislative priorities (including the rationale for proposed changes and indicative timelines), is essential to ensure industry can contribute meaningfully and that reforms achieve their intended effect. Cross-government coordination, recognising the importance of autonomy to safety, innovation, industrial strategy, and defence is also key.

The UK is a leading jurisdiction for maritime law and a global centre for marine insurance. Clarity is needed on how existing conventions, UK flag state requirements and safety management obligations will apply where navigational decision making is undertaken by software or shore-based operators rather than an onboard crew. This includes understanding how rules on collision avoidance, crew responsibilities and safety management translate when autonomy replaces traditional crewing models.

A clear allocation of responsibility between vessel owners, operators, technology developers and remote operation centres will help avoid unquantifiable exposure and coverage disputes. Access to reliable operational data, transparency around system behaviour, and assurance that autonomous and remotely controlled technologies meet robust safety and cyber security reliability standards, is also important.

Given the global nature of shipping, alignment with international regulatory developments, particularly at IMO, will help provide an internationally coherent regulatory framework which would not only support insurability but also help attract investment, and accelerate the safe deployment of autonomous maritime technologies.

Updating the UK legislative framework as a critical enabler for giving the MCA the powers and flexibility necessary to support MASS and maintain the UK's competitiveness in maritime autonomy whilst also providing evidence in support of the development of the wider international framework.

**10. Increased Regulator Investment**

The MCA are a critical pillar to the success of adoption and growth of MASS within the UK shipping sector. The unintended risks associated with not prioritising the expansion of the MCA may unintentionally block or delay progress due to limited capacity, or alternatively may permit developments without fully understanding the implications, undermining safety and regulatory confidence. The increasing reliance on delegated functions (primarily through CAs and ROs) has led to unintended consequences. Members frequently report that queries relating to WBC Ed 3 are redirected to a CA without meaningful guidance from the MCA, even where the question concerns regulatory intent, interpretation, or policy coherence. This has contributed to a growing disconnect between the regulator and industry, reinforcing perceptions of inconsistency and lack of accountability. Delegation is valuable, but it cannot substitute for clear regulatory leadership. The experience of many operators demonstrates that the current model can:

- Create circular or unresolvable queries;
- Introduce inconsistency in interpretation between different CAs;

- Reduce transparency regarding policy intent; and,
- Increase costs where classification is mandated unnecessarily.

In some cases, vessels have been required to undergo full classification (where CAs are also ROs) even when this was not previously necessary resulting in disproportionately higher costs than equivalent processes for crewed vessels. This places UK operators at a competitive disadvantage and runs counter to the principle of proportionate regulation.

We would welcome the MCA having increased access to the right expertise to generate and regulate the evolving needs of shipping. This expertise would include software assurance, cyber security, autonomy, alternative fuels, complex systems engineering, and new assurance methodologies.

Additionally, as previously stated in this paper autonomous technologies require assurance through risk-based models which offer the adaptability required for innovation but introduce greater uncertainty and require enhanced technical expertise to demonstrate and evidence the safety of these vessels. This represents a step change to the current approaches of certification achieved against compliance with numerical standards. The transition to risk-based regulation is significant, requiring new skills, capabilities, and cultural shifts across both commercial marine and regulatory bodies.

Key to this transition is having a clear vision of what a risk based regulatory system looks like, and where risk is held and managed within each part of the system.

Risk based regulation is a deliberate move away from platform centric prescriptive rules, to a broader system approach where risk is identified, categorised and managed across the entire spectrum of the system, including not only the platform, but also how the system is operated / controlled in any given use case. This enables risk associated with immature / novel technology to be managed and mitigated through stronger operational controls and overarching safety management systems, which in turn can be adjusted as confidence and evidence grows in system performance.

A move to a risk-based assurance system in the maritime sector will require a change of approach across all aspects of the enterprise. At the regulatory level there is increased emphasis on setting parameters for tolerable risk and establishing and assuring process for assessing and managing risk in a consistent and repeatable manner. This framework can then be used by system designers / operators from the outset to establish risk envelopes in which their system can be used throughout its lifecycle. In the early stages of test and development these will be heavily constrained by operational controls, which are then adjusted as the performance evidence and confidence grows. This will require the maritime industry to develop more robust safety management systems which are capable of managing the changing nature of the risk as the technology matures. Key throughout is having absolute clarity on who is accountable for risk and who is managing it.

Beyond the operators and the regulatory authorities, other parts of the maritime industry will need to adapt to a risk based regulatory system; CAs and ROs will no longer be able to rely solely on prescriptive platform-based rule sets, but instead assess the totality of the system. Finally marine insurance companies will also need to re-assess how they look at vessels and system.

The transition from the current regulatory system to a more flexible risk based system will not be trivial, and the journey and desired target model need to be clearly identified and supported across the industry to ensure that any changes to legislation, additional investment in regulatory authorities or test and trials facilities, supports the overarching vision, which to date has not yet been defined.

To address these issues, the MASG Council believes it is essential that:

- A road map describing a risk based regulatory system for novel technology is established which clearly identifies how a new regulatory model would work and how each element of the maritime community will need to change to enable the transition;
- The MCA maintains clear ownership of regulatory intent and interpretation;
- Industry has access to consistent, authoritative guidance when navigating emerging requirements;
- Delegation is supported by oversight mechanisms that ensure proportionate, predictable outcomes; and
- Resourcing decisions are aligned with the increasing complexity of autonomy, digitalisation, and decarbonisation.

A well-resourced, capable MCA (supported by clear accountability, effective delegation, and strong engagement with industry) will be critical to enabling safe innovation, supporting UK competitiveness, and ensuring the growing maritime autonomy sector can thrive.

## The Path Forward: Recommendations and Call to Action

The challenges outlined in this paper span legislation, regulation, standards development, assurance methodologies, and regulator capability. Collectively, they represent the key enablers required for the UK to unlock the full commercial, defence and economic potential of Maritime Autonomy. The purpose of this paper - to present a coordinated industry perspective on the regulatory priorities that will stimulate and sustain UK leadership - is reflected directly in the Priority Actions set out above.

To translate these priorities into impact, the MASG Council calls for a coordinated programme of work across government, with clear ownership, timelines, and engagement routes. This programme should align legislative reforms, regulatory development, testing infrastructure, and cross-government industrial strategy, ensuring consistency between the MCA, DfT, MoD, NSO, DMR, DSIT, DESNZ and wider stakeholders.

The MASG Council recommends that next steps include:

- Establishing a structured cross-government workplan that aligns directly with the Priority Actions, identifying leads, milestones and mechanisms for industry contribution.
- Creating an early engagement framework where government can test proposals, share emerging thinking, and invite targeted evidence from industry, academia and defence stakeholders.
- Setting out the legislative and regulatory changes under consideration, how they will address known barriers, and where industry input is most needed.
- Progressing technical work on standards and assurance, including the development of risk-based certification models, autonomy assurance frameworks, and proportionate expectations for software and cyber security.
- Embedding these regulatory enablers into national strategies, including the Shipbuilding & Maritime Technology Action Plan, defence modernisation initiatives such as Hybrid Navy, and wider innovation and industrial strategy.
- Ensuring regulator capability keeps pace with the complexity of autonomy, through investment in skills, new access routes to specialist expertise, and clarity of regulatory intent and interpretation.

Taken together, these steps will provide the clarity, consistency and confidence required to accelerate safe innovation, attract inward investment, and secure the UK's competitive position in the global MASS market. The MASG Council stands ready to work closely with government to shape, inform and support this programme, ensuring that regulatory reform delivers the impact required across commercial, defence and wider strategic sectors.

## Contact Details

Emma Johnson – Director of Maritime Autonomous Systems Group

Society of Maritime Industries

Emma.johnson@maritimeindustries.org

07771 603354