

# Review of Legislation Governing Autonomous Systems

## RESPONSE TO CALL FOR EVIDENCE

March 2026

### Overview

The Society of Maritime Industries (SMI) is the trade association for the maritime engineering, science, and technology sector, representing over 200 organisations across commercial, defence, offshore energy, and research communities. SMI's Maritime Autonomous Systems Group (MASG) Council provides a focused voice on maritime autonomous and uncrewed systems by drawing together platform developers, technology integrators, software and autonomy specialists, defence primes, SMEs, and academic institutions.

This response reflects the collective experience and priorities of MASG Council members, and is informed by two substantive papers: a regulatory piece setting out industry challenges and recommendations on the regulatory framework for Maritime Autonomous Systems (MAS) [\[Annex 1\]](#); and a study on the UK's sovereign capability in the MAS sector, which examines the industrial and strategic dimensions of the shift toward autonomous naval capability [\[Annex 2\]](#).

SMI welcomes this Call for Evidence and the Government's commitment to reviewing the legislative framework governing uncrewed and autonomous systems in defence. Reform should focus on delivering a regulatory environment that enables innovation, supports industry, and accelerates the realisation of autonomous capability across commercial and defence domains.

**(a) Do you think that the current regulatory environment governing uncrewed and autonomous systems in defence is fit to enable you to achieve the aims of your organisation, and to enable the UK to achieve the aims of the Defence Industrial Strategy described above? Why do you think this?**

SMI believes that **the current regulatory environment governing uncrewed and autonomous systems in defence is not fit for purpose**. Despite significant recent progress, the framework was not originally designed for the characteristics of software-defined, adaptive, and remotely operated systems, and this gap is constraining the UK's ability to realise the ambitions outlined in both the Strategic Defence Review (SDR) and the Defence Industrial Strategy (DIS).

### ***A prescriptive framework ill-suited to novel technology***

The existing regulatory framework is grounded in prescriptive, platform-centric rules that were developed for conventionally crewed vessels. Autonomous and uncrewed systems present fundamentally different risk profiles, operational architectures, and assurance challenges that cannot be resolved by applying existing certification requirements without adaptation. The transition to risk-

based, evidence-driven regulation – which other safety-critical sectors such as aviation, nuclear, and rail already undertook – has not yet been completed in the UK maritime domain.

MASG members consistently report that the current framework creates disproportionate certification burdens for systems where the risk to third parties and the environment is materially lower than for crewed equivalents. The application of the same requirements regardless of operating context, system capability, or risk profile is inefficient and counterproductive to the DIS goal of enabling rapid capability development.

### ***Misalignment with defence modernisation ambitions***

The SDR's ambition for a 'Hybrid Navy' (a force structure that integrates crewed and uncrewed platforms) places MAS at the heart of the UK's future naval capability. However, the current regulatory environment does not provide the clarity, agility, or proportionality required to support the rapid procurement, testing, and deployment that this transition demands. Many defence programmes still require vessels to obtain commercial certification for testing and demonstration purposes, creating additional friction and delay that is inconsistent with the pace of change envisaged in the DIS.

SMI's sovereign capability paper ([Annex 2](#)) illustrates how the UK risks weakening key industrial skills regarded as vital sovereign priorities by the DIS (e.g. autonomy software, systems integration, command and control architectures, test and evaluation). Regulatory uncertainty compounds this risk by reducing industry's confidence to invest.

### ***Summary Assessment***

SMI notes that the regulatory environment is not yet fit to enable industry to develop, test and deploy uncrewed and autonomous systems at the pace and scale required, while also failing to provide the stable framework needed to achieve the Government's ambitions outlined in the DIS. However, the direction of travel is encouraging and targeted reform, focused specifically on tackling the barriers outlined in questions below – would materially accelerate progress.

### **(b) Can you give any specific examples of instances when the regulatory system for uncrewed and autonomous systems has created an unreasonable burden in terms of time and/or cost?**

Through the work of its MASG Council, SMI has identified a set of regulatory burdens that impose disproportionate costs and delays.

#### **Mandatory commercial certification for defence testing**

Defence programmes developing uncrewed surface vessels for naval applications have been required to obtain full commercial maritime certification before conducting sea trials, even in controlled or restricted waters. This adds months to programme timelines and costs that are not commensurate with the risk profile of controlled, supervised trials. The defence context, where operational controls and supervision are significantly more intensive than commercial deployment, is not adequately reflected in the current framework.

#### **Disproportionate assurance requirements for smaller ROUVs**

The introduction of Workboat Code Edition 3 (WBC 3) introduced full workboat certification requirements to small Remotely Operated Uncrewed Vessels (ROUVs), including vessels below 7 metres operated for survey, environmental monitoring, and defence experimentation. Members report that this has made operations commercially unviable and has forced some UK companies to relocate trials activity overseas. While MGN 702 and MGN 705 represent welcome steps, the upper length

threshold of 4.5 metres under MGN 705 remains insufficient to address the full range of low-risk uncrewed vessels currently affected.

### **Software assurance and certification inconsistency**

Members developing autonomous decision-making and control systems report significant uncertainty around software assurance expectations, stemming from the absence of clear, practical guidance aligned with relevant and agreed international standards. This results in inconsistent requirements being communicated by different certifying authorities, causing late-stage rework and even re-certification – adding further substantial cost. One member reported a six-figure rework cost arising from a late-stage change in assurance expectations that had not been signalled during the development phase.

### **Slow and unpredictable access to testing pathways**

Access to safe, legal, and proportionate testing environments for novel autonomous systems remains a significant bottleneck. The absence of a fully functioning regulatory sandbox (the Maritime Regulatory Innovation Framework programme has made progress but is not yet fully implemented) means that developers must navigate ad hoc arrangements, often involving lengthy correspondence with the Maritime and Coastguard Agency (MCA), to establish the basis on which a trial can proceed. Members report instances of trials being delayed by 3 to 6 months while regulatory clarity is sought, at direct cost to programme schedules and budgets.

### **Regulatory gap for vessels between 24m and convention size**

A growing number of commercially and defence-relevant autonomous vessel programmes fall into the regulatory gap between WBC 3 (which applies up to 24m) and the IMO MASS Code (which focuses on convention-sized ships). Without a clear framework, operators and developers face case-by-case regulatory engagement with uncertain outcomes, adding cost, delay, and investor risk.

### **(c) Can you give any specific examples of ways in which the regulatory system has constrained your ability to participate or compete in the market for defence and dual-used uncrewed or autonomous systems?**

The current regulatory framework constrains UK industry's ability to compete in both domestic and international markets for defence and dual-use uncrewed and autonomous systems in a number of ways.

### **Competitive disadvantage versus overseas developers**

SMI members report that overseas competitors – particularly from Norway, the United States, and Australia – are able to conduct trials and bring products to market more quickly thanks to more proportionate and better resourced regulatory regimes. Several members have indeed chosen to conduct primary testing activities abroad, with the associated loss of UK economic and reputational benefit. This dynamic, if left unaddressed, will continue to erode the UK's position as a leading maritime autonomy jurisdiction.

Jurisdictions such as Norway and the United States that enable scaled sea time today are compounding their advantage through the accumulation of operational data, the maturation of safety cases, and production learning that reduces unit costs over time. Regulatory reform is therefore a determinant of where advanced manufacturing capability ultimately anchors: regulatory uncertainty leads to delayed facility investment, which leads to production migration, which leads to a loss of IP concentration in the UK. This is not a theoretical risk; the pattern is already evident in where MASG members are choosing to locate trials and development activity.

### **SME participation barriers**

The cost and complexity of navigating the current regulatory framework falls most heavily on SMEs, which lack the resources of larger primes to maintain dedicated regulatory affairs capabilities. The absence of clear, accessible guidance from the MCA, couple with the variable quality of information provided through certifying authorities, creates a barrier to entry that systematically disadvantages smaller innovators. This is counterproductive given that many of the most significant advances in autonomy software, sensor integration, and AI-enabled mission systems are being developed by UK SMEs.

### **Defence procurement and sovereign capability**

The uncertainty around what regulatory pathway applies to novel autonomous systems, combined with the absence of clear demand signals from government, makes it difficult for UK industry to make the investment decisions needed to develop and sustain sovereign capabilities in priorities identified by the DIS such as autonomy software, command and control architectures, vehicle integration, and test and evaluation. Without regulatory clarity, investors and boards will prioritise other markets.

### **Dual-use technology development**

The regulatory separation between commercial maritime and defence regulatory frameworks creates friction for companies developing dual-use technologies. Systems developed and certified for commercial applications often require separate validation processes when deployed in a defence context, adding cost and discouraging the development of genuinely dual-use products. This is especially relevant for autonomy software platforms, situational awareness systems, and communications architectures.

### **Export competitiveness**

UK autonomous systems developers seeking to export to allied and partner nations are increasingly asked to demonstrate regulatory pedigree and testing credentials. The absence of a robust, internationally recognised UK testing and certification pathway, comparable to those being established in Norway or the United States, weakens the export proposition of UK-developed systems. This directly undermines one of core DIS objectives of using UK defence procurement to build exportable sovereign capability.

## **(d) What legislative or practical barriers are obstacles to testing, trialling or deployment of uncrewed and autonomous systems?**

SMI has identified a number significant legislative and practical barriers to testing, trialling, and deploying uncrewed and autonomous systems.

### ***Legislative Barriers***

#### **Absence of a fit-for-purpose primary legislative framework**

The Merchant Shipping Act 1995 and associated secondary legislation were not designed for autonomous or remotely operated systems. Key concepts – including the role of the master, crew responsibilities, collision avoidance obligations, and safety management – are framed around crewed vessels and do not readily translate to autonomous operation. While the Department for Transport (DfT) is understood to be working on legislative reform, industry has very limited visibility of the scope, timeline, or specific proposals under consideration. This legislative uncertainty is itself a barrier to investment.

## **Undefined liability framework**

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 operated technologies meet robust safety and cyber-security reliability standards is also important. This is increasingly material to the insurability of autonomous systems and to long-term capital allocation decisions. Insurers require a clear liability chain before they can develop or price products, and institutional investors require insurance certainty before committing to autonomous vessel programmes at scale. The absence of a defined liability framework is therefore not simply a legal gap: it is a direct constraint on the availability of insurance products and a brake on private investment in UK maritime autonomy.

## **Sub-surface assets outside current scope**

Uncrewed underwater vehicles currently fall outside the scope of the Merchant Shipping Act 1995, meaning that the MCA lacks powers to oversee or intervene in this part of the industry. While full regulation is not immediately required, the absence of any legislative basis creates uncertainty for operators and developers and limits the regulator's ability to address genuinely dangerous operations.

## ***Practical Barriers***

### **Absence of a functioning regulatory sandbox**

The Maritime Regulatory Innovation Framework (MRIF) programme has made important progress towards a scalable sandbox model for early-stage trials, but has not yet delivered a fully operational testing pathway. Without a viable, funded, and permanent sandbox mechanism, developers must rely on ad hoc arrangements (e.g. King's Harbour Master Plymouth, MGN 664 exemptions, and categorised-waters trials) which are inconsistent, resource-intensive to navigate, and not always accessible to SMEs.

### **Fragmented testing infrastructure**

The UK's physical testing capabilities – including military ranges, research facilities, harbour environments, and assets such as Smart Sound Plymouth – are fragmented and vary widely in technical maturity. They are not yet integrated into a coherent national testing ecosystem capable of supporting the full range of uncrewed system types, autonomy levels, and assurance evidence requirements. Validated simulation environments that could complement physical testing and reduce risk to third parties are similarly underdeveloped.

### **Software assurance and cyber security gaps**

The absence of clear, practical guidance on software assurance expectations, along with the inconsistent application of existing standards by different certifying authorities, creates a significant barrier to certification readiness, particularly for AI-enabled and adaptive systems. The pace of software development far outstrips traditional certification timelines and there is no clear framework for determining when software updates trigger reassessment requirements. This creates risk for developers and delays deployment.

## **MCA capacity and capability**

The MCA is a critical enabler of autonomous systems deployment but lacks the internal expertise in autonomy, software assurance, cyber security, and complex systems engineering needed to provide clear and consistent regulatory guidance at pace. The increasing delegation of regulatory functions to Certifying Authorities and Recognised Organisations has led to inconsistency, circular queries, and in some cases unnecessary classification requirements, further increasing costs and delays.

## **Lack of assurance framework for higher autonomy**

There is no unified UK framework capable of addressing the assurance challenges associated with non-deterministic decision-making, learning-enabled systems, or operations with minimal human oversight. While work is underway through programmes such as the Maritime Autonomy Assurance Testbed (MAAT) and the Centre for Assuring Autonomy, these are not yet embedded in regulatory requirements or procurement expectations. This gap will become increasingly acute as the Hybrid Navy transition advances.

## **(e) What do you consider to be the most necessary changes required to improve outcomes for the regulatory system? Please make these suggestions as specific as possible.**

SMI recommends the following changes prioritised by urgency and potential impact.

### **1. Publish a national risk-based regulatory roadmap for MAS**

The Government (led by DfT, MCA, and MoD) should publish a clear roadmap setting out the UK's intended future model for autonomous and uncrewed maritime systems regulation. This should define roles and responsibilities across regulators, tolerable risk principles, evidence expectations for autonomous systems, and how system risk is allocated across platform, operation, and operator. Without this overarching framework, individual reforms risk being fragmented and inconsistent.

### **2. Fully implement and fund the MRIF sandbox**

The MRIF programme should be transitioned from a research concept into a fully operational, funded, and permanent regulatory capability. This requires completion of the 'pipe-cleaner' demonstration to validate the sandbox process, development of a sustainable business model enabling SME participation, and secured cross-government funding and alignment. This is the single most impactful near-term action government could take to unblock innovation.

### **3. Increase MCA transparency on legislative reform**

DfT and MCA should publish clear information on areas of primary and secondary legislation that require reform, what specific barriers those reforms are intended to address, the proposals under consideration, and indicative timelines. Industry currently has very limited visibility of this programme and cannot engage meaningfully or plan investment without it.

### **4. Issue clear, practical software assurance and cyber security guidance**

MCA should publish accessible, risk-proportionate guidance on software assurance expectations for uncrewed and autonomous systems, aligned with IEC 61508 (including the forthcoming 2025 edition addressing AI/ML) and other relevant standards. Guidance should set out clear triggers for reassessment when software is updated, and be interpreted consistently across certifying authorities. This should be developed alongside industry through the new MCA Innovation Hub.

## **5. Refine and extend exemptions for smaller uncrewed vessels**

MCA should work with industry to define the evidence required to justify extending the MGN 705 exemption beyond the current 4.5m threshold, and to provide clearer guidance on the compelling body of evidence required for self-declaration under MGN 702. The risk profile of uncrewed vessels, which address only third-party risk, not crew risk, should be the primary basis for threshold-setting.

## **6. Establish a regulatory framework for the 24m–convention size vessel gap**

The Government should initiate a structured workstream, with industry engagement, to develop a regulatory approach for autonomous and uncrewed vessels in the 24-metre convention size category. This segment is likely to be where many of the earliest commercially viable MASS deployments occur and is currently subject to significant regulatory uncertainty. SMI calls explicitly for this workstream to deliver a dedicated UK MASS Code for this vessel class, with committed milestones rather than an open-ended review process.

## **7. Invest in MCA capability and capacity**

The MCA should be resourced to develop internal expertise in autonomy, software assurance, cyber security, alternative fuels, and complex systems engineering. Consideration should be given to establishing a specialist advisory panel, drawing on industry and academic expertise, to support the MCA in interpreting and developing requirements for novel technologies. The MCA Innovation Hub, if properly resourced and empowered, could be a significant enabler.

## **8. Accelerate the autonomy assurance framework**

The Government should accelerate the development and integration of a national framework for assurance of vessels with autonomous functions, building on work by NPL, Lloyds Register, the Centre for Assuring Autonomy, and the MAAT programme. This framework should define proportionate, evidence-based pathways for assuring non-deterministic and learning-enabled systems, and should be embedded in both regulatory requirements and procurement expectations.

## **9. Alignment with international regulations**

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

## **(f) What can be done to enable the Government's strong commitment to investing in autonomy to be realised faster, more effectively and with more advantage for the UK? What more could HMG do that would help the sector grow?**

SMI welcomes the Government's strong commitment to investment in autonomy as articulated in the SDR and the DIS. To realise this commitment faster, more effectively, and with greater advantage for UK industry, SMI makes the following recommendations.

### ***Clarity on demand and sovereign priorities***

The single most impactful action government could take is to provide industry with clear, funded demand signals for uncrewed and autonomous systems. SMI's sovereign capability paper is explicit on this point: without a visible pipeline of committed procurement, investors and boards will prioritise

other markets, sovereign industrial capabilities will atrophy, and the UK will lose the competitive window that currently exists. Government should:

- Publish a funded forward pipeline for MAS procurement across both naval and dual-use applications, with short-term commitments linked to longer-term demand projections.
- Define, with specificity, which elements of the MAS supply chain are considered sovereign priorities, going beyond the DIS's current high-level framing to identify the specific capabilities (autonomy software, C2 architectures, secure communications, data exploitation, test and evaluation) where UK sovereign development and maintenance is required.
- Commit to procurement approaches that provide industry with the confidence to invest, including the use of longer-term framework agreements, co-development arrangements, and support for export.

### ***A stronger intelligent customer function***

The DIS acknowledges that partnership with industry is essential to its implementation. SMI's view is that the current government intelligent customer function – across MoD, NSO, and associated bodies – is not yet equipped to manage complex autonomous systems programmes or to sustain the kind of iterative, expert dialogue with industry that effective implementation requires. Investment in the intelligent customer function, including deeper technical expertise in autonomy, software, and systems integration, is a prerequisite for the DIS to deliver.

### ***Regulatory reform as an industrial strategy enabler***

Regulatory reform should be explicitly framed as part of the UK's industrial and economic strategy for maritime autonomy, not merely as a compliance exercise. A modern, proportionate, and internationally recognised regulatory framework is itself a competitive asset: it enables faster routes to market for UK developers, strengthens the export proposition of UK-designed systems, and signals to global investors that the UK is an attractive location for maritime autonomy development and deployment.

In this context, SMI recommends embedding the regulatory reform programme described in response to question (e) into the forthcoming Shipbuilding and Maritime Technology Action Plan, linking it explicitly to the defence modernisation and Hybrid Navy programmes.

### ***Test and evaluation infrastructure***

The UK's existing test and evaluation infrastructure (including Smart Sound Plymouth, military ranges, and academic facilities) represents a significant national asset that is not yet being fully utilised to support the development and certification of autonomous systems. The Government should invest in integrating these capabilities into a coherent national testing ecosystem, supported by validated simulation environments and a clear framework for using test evidence in regulatory and procurement contexts. This infrastructure is essential both for domestic development and for positioning the UK as a destination of choice for allied and partner nations seeking to test and validate autonomous maritime systems.

### ***Export support and international engagement***

The DIS correctly identifies export as a key driver of sovereign industrial capability. SMI urges government to take a more active role in supporting UK MAS exporters, including through targeted DBT engagement with priority export markets, support for UK industry participation in international MAS procurement competitions, and active diplomacy to shape international regulatory frameworks (particularly at the IMO) in ways that reflect UK capabilities and standards. The UK's expertise in maritime law, insurance, and regulation gives it a natural advantage in shaping the international framework for autonomous maritime systems.

### ***Skills and talent pipeline***

Realising the potential of maritime autonomy will require a sustained investment in the skills pipeline – particularly in autonomy software, AI/ML, cyber security, systems engineering, and data science. While the UK has considerable talent in these areas, it has not yet successfully attracted this talent into the maritime domain at scale. The Government should work with industry and academia to develop targeted skills pathways, including apprenticeships, conversion programmes, and research partnerships, that channel UK AI and software talent into the maritime autonomy sector.

### **Conclusion**

The UK is at an inflection point for maritime autonomy. The global MASS market is projected to reach £103bn by 2030, the SDR has placed uncrewed systems at the centre of the UK's future naval capability, and the DIS has established a clear ambition for autonomous systems as a sovereign and frontier industrial priority. The window for the UK to establish a leading position – in both commercial and defence markets – is open, but it will not remain so indefinitely.

Realising this opportunity requires a regulatory environment that matches the ambition: modern, risk-based, proportionate, and transparent. The changes SMI has identified in this response are not marginal refinements, but structural enablers without which the Government's own ambitions cannot be achieved. SMI stands ready to work closely with the Government to shape, inform, and support the reform programme needed.

## ANNEX 1

### 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<sup>1</sup> 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**

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<sup>2</sup>. 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.

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<sup>1</sup> 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'.

<sup>2</sup> [Navigating innovation a regulatory sandbox framework for UK Maritime autonomy - Connected Places Catapult](#)

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 already a recognised approach in the Naval Domain in the manner through which safety cases<sup>3</sup> 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<sup>4</sup> 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:

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<sup>3</sup> Sometimes this is referred to as an assurance/safety case.

<sup>4</sup> This compelling body of evidence shall include the requirements of insurers.

- 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.

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 functions<sup>5</sup> 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<sup>6</sup> and PRAISE<sup>7</sup> 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.

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

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<sup>5</sup> These safety functions shall include normal, reasonably foreseeable abnormal and emergency operations.

<sup>6</sup> [The Safety Assurance of autonomous systems in Complex Environments \(SACE\)](#)

<sup>7</sup> [Principles-Based Ethics Assurance \(PRAISE\)](#)

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 levels.
- 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.

## ANNEX 2

### A Paper on UK Sovereign Capability

*SMI Maritime Autonomous Systems Group Council*

#### Executive Summary

Maritime Autonomous Systems (MAS) are central to the UK's defence transformation, industrial growth, and future naval capability. As the shift toward a Hybrid Navy accelerates, MAS will shape force structure, procurement, and operational effectiveness. Clarifying sovereign priorities is critical to maintaining freedom of action in key areas such as autonomy software, integration and data exploitation, whilst still leveraging global innovation. With declining industrial capacity, unclear demand signals and evolving policy frameworks, clarification and analysis of what needs to be sovereign will help guide investment, strengthen the supply chain, and inform Government industry collaboration at a pivotal moment for UK maritime capability.

This paper contends that:

#### 1. MAS is at the heart of a transformation in naval capability

Autonomy is central to the UK's transition toward a Hybrid Navy<sup>8</sup>, enabling a shift from reliance on large, crewed platforms to smaller, more numerous systems. MAS will enhance persistence, scalability, and operational resilience across intelligence, mine countermeasures, logistics, and strike support in a complementary role to traditional crewed assets. Lessons from recent conflicts and strategic reviews reinforce the urgency of this transformation, with MAS underpinning the future naval force design. The development of a mature, sustainable industrial base capable of supporting mass production, deployment, integration, and through-life support is critical to achieving a long-term strategic advantage. The window for this competitive advantage in the UK is closing. By not embracing this shift now, there is a danger of collapse of the UK supply chain.

#### 2. Selective sovereignty is essential

A targeted, pragmatic definition of sovereignty must be made within the MAS supply chain. Platforms, vehicles, and sensors are increasingly commoditised within a global market, and careful consideration should be given to *what needs to be sovereign*. The freedom of action and quality of solutions, and focusing efforts to retain sovereignty through the autonomy stack (C2, secure communications, cyber hardening, integration and deployment expertise) will enable competitive advantages. Sovereignty should also extend to specialised effectors and exploitation expertise, particularly where global supply cannot be assured. This selective approach will allow the UK to concentrate resources on high value differentiators whilst leveraging innovation in global markets.

#### 3. Global market access remains critical

Many industrial players are global companies with a UK footprint whose supply chains are already international. A closed market will not sustain a British supply chain, opportunity for growth lies with export potential. It is critical to maintain this openness in order to access a global talent pool, technological development, and competition to drive innovation, reduce costs, and accelerate delivery. A model of "resilient independence" with trusted partners will enable the UK to move at pace whilst strengthening its industrial position.

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<sup>8</sup> <https://www.iiss.org/online-analysis/military-balance/2025/12/the-uk-royal-navys-future--hybrid-high-stakes/>

#### **4. Scale and pipeline clarity are vital**

Clear forward demand signals and funded pipelines are the primary enablers of industrial investment and growth capacity. Given that MAS is a transformational and evolving capability area, industry confidence depends on transparent planning, realistic assessment of future demand, and early procurement action. Without this clarity, investors and suppliers will prioritise markets with firmer commitments, risking atrophy of UK capabilities.

#### **5. The Government's intelligent customer function is inadequate**

Delivering sovereign MAS capability requires a strengthened and better resourced Government customer function with deeper technical expertise, agile industry collaboration, and improved procurement functions. Current structures and policy are not yet sufficient to manage complex autonomous programmes or to sustain a competitive industrial base. A more engaged, expert, and iterative partnership model with industry will be essential to implement the Defence Industrial Strategy effectively. Further, legislative changes will also likely be required to enable procurement action to be fully informed by industrial strategy

#### **6. Data exploitation is the hidden advantage**

Possibly the most decisive sovereign capability is in-mission data exploitation and post-mission analysis. However, this can only be exploited if there is a mastery of data infrastructure, analytics and AI-enabled insight, strengthening decision making and operational advantage across missions. These capabilities are already hard to deliver and poorly served by traditional acquisition models. Sustained investment, data access, and specialised expertise is needed to assure the advantage. By prioritising data dominance within MAS development, the UK can position itself as a leader in AI-enabled maritime operations and deliver enduring strategic value.

#### **Our recommendations**

Immediate action needs to be taken by both Government and industry; this starts with a clear definition of what needs to be sovereign. From industry the need is: communication on what sovereign capability already exists; better visibility of company investment and development plans; and, a dialogue on how foreign-owned and multinational companies view their place in a sovereign supply chain.

For Government the need is: a funded pipeline with short term commitment to long term demand; the establishment of an expert-led, well-resourced customer function; increased effort to address regulatory challenges; work to assure supply chain resilience; and, much more active support to the realisation of export opportunities.

#### **Introduction and focus of this paper**

1. The Society of Maritime Industries (SMI) Maritime Autonomous Systems Group (MASG) Council's mission is to "be the voice of industry" in representing SMI members by advising Government and other stakeholders on improvements to the business environment. MAS has become a broad-stroke term capturing robotic systems operating on or below the water's surface autonomously or remotely controlled. Whilst some MAS technology has been used for the past 30+ years, recent technological developments have seen the sector grow rapidly to address a wide range of applications.

2. The impact of these developments has been felt globally. UK Government and industry was initially quick to adopt but has been slower to embrace a widespread use of MAS in day-to-day operations and this, coupled with a decline in shipbuilding activity, has impacted the local supply chain available to produce *MAS en masse*.

3. Recognising this reality and responding to the ambition articulated in the recent UK Strategic Defence Review (SDR)<sup>9</sup>, the 2025 Defence Industrial Strategy<sup>10</sup> (DIS) is a significant and ambitious document in terms of setting a direction of travel, in stating priorities and high level goals. But it is not yet accompanied by sector level detail and the timetable and goals proposed do not extend to the generation of this detail. The DIS recognizes the importance of partnerships as part of a national endeavour, an explicit recognition that Government alone cannot achieve the scale of change proposed without active and ongoing consultation with industry. This document is intended to inform such a consultation, addressing the detail related to the UK MAS industry. Specifically focussing in on naval applications, the intent is to explore the topic of sovereign capability, viewing this through an industrial strategy lens and addressing a number of questions:

- Why should we be concerned with our MAS industrial capacity?
- How is MAS being applied in defence?
- What does our national supply chain look like today?
- What do we mean by sovereignty and where should we focus on maintaining and developing sovereignty in the MAS supply chain?
- What actions are required by Government and industry?

4. The next few years will be critical in the development of UK MAS industry and its associated supply chain. This paper sets out what is required, covering the full range of MAS from small, compact systems to larger naval systems.

### **Why should we be concerned with our MAS industrial capacity?**

5. The UK growth agenda<sup>11</sup> set out clearly in wider national industrial strategy<sup>12</sup> establishes the imperative to unlock economic growth and new skilled jobs through an embrace of AI enabled technologies such as MAS. Beyond growth, there is an urgency recognised in Defence in the need to move to a “Hybrid Navy,” as outlined in 1SL General Sir Gwyn Jenkin’s address at the *First Sea Lord’s Sea Power Conference* in December<sup>1</sup>. This builds on a longer standing determination by the UK and other navies to pivot more towards MAS (as outlined in the 2020 SDR), regaining mass and responding to the more recent lessons from the war in Ukraine. But, in order to satisfy this ambition, industrial capacity, and the freedom of action and resilience it affords, need to be in alignment. As such, there is particular interest in directives to (and from) the National Shipbuilding Office (NSO) as they update the National Shipbuilding Strategy (NSS) with the forthcoming Shipbuilding and Maritime Technology Action Plan (SMTP). As MAS shifts naval capability away from traditional, crewed capital ships toward smaller, more numerous, and more software-defined platforms, this directly impacts how shipbuilding and the maritime sector is organised, funded, and sustained.

### **How is MAS being applied in defence?**

6. Naval applications for MAS span force protection, warfighting, intelligence, and logistics. The objective of many Navies in creating MAS capability centres on persistence, risk reduction, scalability, and cost efficiency compared with crewed platforms. The related operating concepts seek not to

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<sup>9</sup> [UK Strategic Defence Review 2025.](#)

<sup>10</sup> [Defence Industrial Strategy 2025: Making Defence an Engine for Growth.](#)

<sup>11</sup> The growth potential of the UK MAS sector is addressed elsewhere, notably in the NSO/NPL commission report by Stehr Consulting.

<sup>12</sup> [UK National Industrial Strategy 2025.](#)

replace crewed capabilities but to enhance them by increasing efficiency and closing resource gaps. MAS is currently being used in or developed for:

- Intelligence, Surveillance & Reconnaissance (ISR)
    - Autonomous surface and sub-surface vessels provide persistent maritime domain awareness. This is particularly valuable for monitoring submarine activity, grey-zone operations, and illegal or covert maritime behaviour.
  - Anti-Submarine Warfare (ASW)
    - MAS can deploy distributed sonar networks, including USVs towing arrays and UUVs conducting search and classification. This enables wide-area ASW coverage at lower cost and risk, complicating adversary submarine operations and supporting crewed frigates and maritime patrol aircraft.
  - Mine Countermeasures (MCM)
    - One of the most mature use cases. Autonomous systems conduct mine detection, classification, and neutralisation in high-risk waters without exposing crews to the risks inherent with operating inside the mine field.
  - Force Protection, Escort, & Harbour Security
    - Autonomous patrol craft monitor naval bases, ports, and anchored vessels, detecting intrusions, divers, or small hostile craft. They support layered defence concepts and free crewed assets for higher-end missions.
  - Decoy, Deception & Attrition
    - MAS can act as expendable or low-cost platforms to confuse adversary sensors, draw fire, simulate fleet movements, or saturate enemy defences.
  - Logistics & Resupply
    - Autonomous vessels can conduct uncrewed resupply, fuel transfer, or stores delivery between ships or to austere forward locations, reducing risk to crews and enabling distributed maritime operations.
  - Strike Enablement & Targeting Support
    - While often unarmed, MAS can support strike operations through target detection, tracking, battle damage assessment, and cueing for missiles or aircraft.
  - Strike Capability
    - USVs and UUVs are actively being used as “one-way effectors” to strike enemy positions. Further developments are being made to introduce large-scale strike packages on future large USVs and UUVs.
7. Overall, MAS has significant potential to underpin a shift toward distributed, resilient naval forces, enabling navies (including our potential adversaries) to do more with the same or less people while maintaining presence and deterrence in contested maritime environments.

### **What does our national supply chain look like today?**

8. The UK’s supply chain supporting MAS encompasses a broad set of technological and operational capabilities built on its longstanding maritime and defence expertise. At its core, this includes autonomy and navigation software. These providers are enabling unmanned or remotely

operated surface and sub-surface vessels to perceive, plan, and execute missions safely in dynamic marine environments. Closely linked are simulation and assurance tools and methods for testing and validating autonomous behaviours against safety standards, such as collision avoidance and international navigation rules (e.g. COLREGs).

9. Complementing autonomy are sensor manufacturers, integration and data service providers (including geospatial and oceanographic inputs) that inform autonomous decision-making and route planning. National data providers contribute high-resolution bathymetry, tidal and current datasets that autonomous vessels need to navigate coastal and offshore waters.

10. Regulatory and standards frameworks also form an essential part of the chain. The UK industry via the MCA has developed codes of practice for MAS that support manufacturers and operators in meeting safety assurance expectations ahead of formal laws.

11. On the R&D and defence side, national research laboratories, defence innovation bodies and universities invest in concepts of operation, joint testing environments, and early prototypes for persistent autonomous undersea and surface systems as part of future naval capability development.

12. Nevertheless, *significant* gaps persist. The UK supply chain struggles with fragmented and slow regulatory approval processes, which is forcing developers to test autonomous vessels abroad. There is also a shortage of specialised skills in sector<sup>13</sup>, particularly in autonomy software, cyber security for maritime platforms, alternative energy systems, and integrated testing facilities; this is further exacerbated by a lack of clear development standards and training pathways. It is anticipated that a number of these challenges will be the focus of the forthcoming National Shipbuilding Office (NSO) authored Shipbuilding and Maritime Technology Action Plan (SMTAP) and a separate SMI MASG paper on the topic of regulation.

13. Lastly, the relative absence<sup>14</sup> of well-established mass production and high-volume manufacturing capacity for autonomous marine hardware constrains scaling, especially when compared with more established defence manufacturing sectors. This limits the UK's ability to transition from prototypes and trials to sustained commercial output at scale.

## **What do we mean by sovereignty and where should we focus on maintaining and developing sovereignty in the MAS supply chain?**

14. The DIS does not define sovereignty, but its intent regarding autonomous systems and next generation maritime capabilities as sovereign capabilities (pages 10 to 11) is clear:

*'This Government is committed to investing in and onshoring the necessary industrial capabilities we need for our sovereign national security and those we should foster and support to boost the UK economy. UK-based businesses are at the heart of this strategy.'*

*'Across the range of capabilities the UK requires for warfighting, this Strategy outlines our national security industrial priorities, where varied levels of autonomy in the UK is required: ....; our supply chain priorities.....; and our frontier industries: .... **next generation land and maritime capabilities, quantum technologies, drones and autonomous systems**..... We will establish, maintain and*

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<sup>13</sup> The UK as a whole possess considerable skills in AI/ML development as well as development of safety critical software and human computer interfaces, there are however located in other sectors principally games development and creative industries, healthcare and fintech

<sup>14</sup> Notwithstanding recent UK investments by a number of companies such as Helsing and Kraken.

*sustain the necessary elements of these subsectors by investing through our new segmented commercial approach to the market, and interventions.....'*

15. The UK MAS sector delivers both autonomous systems and next generation capabilities and is therefore both 'frontier' and 'sovereign'<sup>15</sup>. But in practice, more detail is required to make this meaningful, not everything can or should be considered sovereign. This paper sets out an industry view of that detail, noting that, while the MAS supply chain can inform a pragmatic definition of sovereignty, the authority to define legal, operational, and technological sovereignty ultimately sits outside our remit.

16. UK MAS is part of a global industry<sup>16</sup> where there is vibrant competition, driving innovation and suppressing costs; the source of much of this innovation has been a very large and growing offshore and ocean science sector. Whilst military applications are far from new, only relatively recently has there been significant global growth in naval programmes, further driving industry investment. Retaining access to this global market is key<sup>17</sup> if the UK is to move at pace and to secure advantage, furthermore, many of the UK industrial actors are global companies, albeit with significant and valuable UK footprints; their internal supply chains are already global. By targeting what we see as sovereign, we can retain this wider access, whilst also signalling strongly to industry where UK sovereign capability must be developed and maintained. This signalling, combined with a pipeline of potential forward 'sovereign' business will give industry the confidence to invest, encouraging active UK collaboration, both across industry and with Government. Managed well, this process can also sustain a level of competition for sovereign aspects at a national level.

17. This approach alone is only part of a DIS implementation. Stating an intent to stage robust competitions for those aspects not considered sovereign does not remove an expectation that UK businesses should be at the fore in meeting such needs. Similarly, the DIS places a significant responsibility on Government to develop UK exporters to meet similar needs around the world. And UK sovereign capabilities should provide compelling components as part of this UK export offer, albeit under appropriate governance. This paper does not address these aspects beyond noting that they will require a closer level of engagement and transparency on future plans (by both Government and industry) than seen to date.

## **So, what in MAS should be sovereign?**

18. Building on the approach outlined above, a key premise of this paper is that UK advantage will come from leveraging a huge global market in vehicles and payloads, holding only those things that are key to UK freedom of action and qualitative edge as sovereign.

19. Whilst it is always tempting to start with the robots, the reality is that uncrewed underwater vehicles<sup>18</sup> (UUVs) and uncrewed surface vehicle/vessels (USVs), the vehicles, are in places

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<sup>15</sup> This judgement was recently confirmed in a Parliamentary Question addressing the supply chains for autonomous systems, including MAS. <https://questions-statements.parliament.uk/written-questions/detail/2026-01-13/HL13564>

<sup>16</sup> This paper notes that industry is term which spans a wide range of entities, from SMEs to multinationals; it is a broad and amorphous group. SMI represents a significant subset of MAS industry and seeks to represent its members' views, but across the sector there will be a range of perspectives. Furthermore, industrial policy must address a range of factors beyond just ensuring the maintenance of sovereign aspects.

<sup>17</sup> Notwithstanding this focus on COTS and MOTS, there will be aspects of MAS capabilities that will not be well served by the market and which will require Government investment – this is likely to be the case where naval use cases diverge significantly from commercial applications; at a high level, these are addressed in this paper.

<sup>18</sup> Also referred to variously as autonomous underwater vehicles and unmanned underwater vehicles.

approaching a commodity; *if* one is able to integrate them with current systems and sensors, there is an abundance of choice. Assurance of supply and of the supply chain matters, but currently it is not constraining;<sup>19</sup> so, the starting point of this paper is that vehicles are not sovereign, but this is a judgement that will vary across vehicle sizes and which needs to be regularly reviewed. A key factor will be the degree to which there is a genuine global market of proven solutions in place; where this is not yet truly the case (extra-large diameter UUVs might be a good example), a case for sovereignty could be made.<sup>20</sup> Furthermore, any judgement needs to address future capacity needs and the importance attached to being able to scale rapidly in times of tension or war; this requires a careful examination of the resilience and capacity of supply-chains in any potential conflicts. For smaller systems in particular, lessons from Ukraine point to the need to sustain very high volumes and to adapt designs continuously to counter very rapid threat evolution. Of its own, this does not mean that manufacture of any such systems has to be onshore - albeit it does need to be assured from a trusted source, but as a minimum, it will require UK delivery of some elements of assembly and engineering. So, whereas other areas offer clear choices regarding sovereignty, vehicle manufacture and assembly is a difficult area, requiring careful analysis and regular review.

20. Beyond the vehicles, what enables real capability and the shift to greater mass is a mix of trusted autonomy, proven integration at vehicle and system level and robustness to countermeasures. So, whilst vehicle supply itself might not be routinely sovereign, the following aspects should be:

- **Vehicle and mission autonomy software**, including collaborative autonomy.
- **Vehicle support and integration.**
- **Secure navigation and communication.**
- **Cyber hardening** – and ensuring there are no built-in cyber vulnerabilities.
- **Command and control (C2)** – the ability to integrate across systems and internationally. This requires Government, supported by industry to be able to define (or at least manage) and assure the architectures and standards so that heterogeneous MAS can be adopted, configured, and integrated into mission packages. The choice of platforms, sensors, or effectors that are attached to the architecture then becomes largely irrelevant - unless they are highly specialised or exquisite<sup>21</sup>. An increased focus on C2 architectures and standards would position the UK to define interoperability frameworks for allied MAS operations - as we have done for ASW and other pan-NATO capabilities. This provides strategic influence and ensures UK systems remain central to coalition operations as part of NATO and AUKUS (Pillar 2), aligning with the DIS emphasis on partnerships as part of national endeavour ("NATO first and first in NATO").
- **Test and evaluation** – the ability to analyse and assure end to end performance at system and system of system level.

21. Turning to MAS sensors and payloads, this paper would contend there is no obvious reason to select this as a general area for protection<sup>22</sup>, it is a global market place where commercial solutions for civil applications have wide military utility; however, there are some areas where the market cannot

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<sup>19</sup> Noting that in some areas, particularly batteries, there is a cross sector need (well beyond MAS) to develop supply chain diversity, removing a dependency on China.

<sup>20</sup> Noting that as vehicle size grows (for USVs this includes emerging plans in the US and UK for >50m), so the platforms themselves will increasingly tend to be drawn into the well-established discussion on shipbuilding pipeline.

<sup>21</sup> At which point many of the advantages of MAS over crewed platforms are lost.

<sup>22</sup> As MAS expands to address wider use cases, with a potential need for higher end sensors, so this judgement will need to be reviewed.

be assured or cannot be relied on to develop and sustain the required capabilities, this is specifically true in the world of effectors:

- Expertise in **shaped charge and warhead design**, together with understanding of damage mechanisms.
- Design and manufacturer of **deep-water effectors**.
- **Influence sweep** (for mine countermeasures (MCM)) design and manufacture.
- **Exploitation expertise** (for MCM and seabed warfare).

22. Beyond effectors, in ensuring a robust and effective sensing capability, there are sovereign aspects associated in ensuring that delivered systems genuinely deliver the required outcomes:

- Expertise in **evaluation, assurance and optimisation of advanced sensors**.
- Assured access to **data infrastructure** such as cloud services and storage.
- **Data exploitation expertise & post-mission analysis**. These are significant differentiators for the UK and offer real scope for operational advantage through data dominance; investment creates an asymmetry that is difficult for adversaries to replicate and positions the UK as a leader in AI-enabled maritime operations. As the single most important area of focus, it deserves a special focus, particularly as it is challenging to deliver in the traditional acquisition model.

23. Finally, fielding and sustaining credible capabilities is about much more than just delivering working and effective equipment. Resilience and the means to deploy, sustain and regenerate are key, making **support and mounting arrangements** as sovereign as any of the underpinning technologies. Whilst it is logical to consider this on a programme-by-programme basis, there are also significant synergies from taking a UK wide enterprise perspective, particularly with infrastructure<sup>23</sup>. This could be building on or extending the existing operating hubs and centres, albeit noting that naval bases are heavily optimised for complex ships and submarines, not MAS. Beyond infrastructure, learning from experience over recent programmes has also underlined the importance of retaining a significant margin in system numbers to allow for maintenance, repair, upgrade and attrition. Scale brings many other benefits to both customer and industry, enabling efficiencies and cost reduction as well as a clear line of sight down the supply chain, facilitating planning and targeted action to address vulnerabilities. This can be accounted for in acquisition planning.

### **How British does something have to be to qualify as sovereign?**

24. There are no easy answers to this question; as previously touched on, the market is international and so is industry. In practice, the answer will hinge on what it takes to secure UK freedom of action, this will be a mix of: workforce expertise and capacity; specialist facilities; and, access to (and in places, control of) intellectual property. Some imprecision is inevitable, but not addressing this question, area by area will leave industry unsure on what is required, removing a level playing field and discouraging investment. To be clear though, this paper contends that, subject to the provisos set out, foreign-owned companies should be able to be part of a UK sovereign construct.

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<sup>23</sup> Recognising that this enterprise perspective also needs to touch on resilience and redundancy, avoiding single points of failure or creating new vulnerabilities.

## What actions are required by Government and industry?

25. As a start point in this conversation it is important to acknowledge that all options carry risk and cost. Doing nothing means sovereign capabilities are not assured and industry will make choices based on other considerations (which includes responding to the sovereign demands of other nations); Government cannot direct industry to maintain capacity if it is not funded and funded capabilities that are not utilised properly are likely to become unfit and inefficient. Equally, taking action and managing sovereign capabilities requires an overhead to ensure they are fit and ready to meet a challenging world (as set out in the recent SDR), it demands sufficient throughput and activity, even when other factors may not require ongoing procurement action.

26. Building on this observation, the key to success is in establishing a clear-eyed view of likely future demand, including what it might take to meet likely war and transition to war scenarios (and likely notice periods to respond to a shift to a war footing). This, combined with an analysis of 'what is sovereign' allows a judgement of what must be held at near or immediate readiness, and what industrial capacity is required. This in turn informs procurement action<sup>24</sup> and pipeline planning, noting that there is a likelihood that further legislative change will be required to enable UK authorities to exclude non-UK suppliers in any competitive procurement. Further, in doing this work, as was noted earlier, there is a balance to be struck. Pragmatism is required, and, in places, there will be a need to accept 'resilient interdependence'<sup>25</sup> over full autonomy. This means being open to collaboration with trusted international partners as part of an overall strategy and pipeline plan.

27. Overall, such an approach is far from new, it has informed stockpile management and previous generations of defence industrial strategy (noting that recent years have seen many nations, including the UK adopt a more laissez-faire stance). But, as MOD seeks to implement the DIS, a key difference to consider is the degree to which MAS is new and transformational – there is little in the way of a steady state programme and there is much about the current programme which is likely to change<sup>26</sup>. This means forward planning is difficult and in some areas there may be a need to plan and establish *ab initio* sovereign capabilities, not just to sustain and protect what exists already. Getting this right is likely to be an iterative activity. The need for 'new build' can in part be met through industry investment, but only if industry is confident on the return; investors are already lined up to capitalise on growing defence budgets across Europe, but they have a choice as to where to invest and are wary of getting caught out by a 'say-do' gap. Doing the analysis and clearly communicating intent is important, but translating this into a funded pipeline (with short term action) will ensure industry moves quickly to be ready.

28. Done well this pipeline approach can be constructed to ensure MOD choice and some competitive leverage, at least in most areas. But it cannot be done by half measures, otherwise key areas risk atrophy or will not develop, or stale monopolies will emerge. Excepting those areas where the market demand is high, partnerships with industry, including collaboration across industry partners will naturally tend to closed-shops and lock-in unless MOD manages matters. Keeping throughput, including supporting export (and actively working partnerships in NATO and AUKUS to achieve this) can help sustain vibrancy and reduce pressure on UK budgets, but the inescapable observation is that this requires a level of engagement and action. This is a significant step up for UK procurement authorities, requiring an enduring, expert and well-resourced intelligent customer function (including

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<sup>24</sup> Noting that, to be complete, this must span all procurement pathways, including contractor owned and/or operated solutions and indirect demand from Government service providers.

<sup>25</sup> [https://www.weforum.org/stories/2026/01/race-for-tech-sovereignty-is-a-balancing-act/?utm\\_source=linkedin&utm\\_medium=social](https://www.weforum.org/stories/2026/01/race-for-tech-sovereignty-is-a-balancing-act/?utm_source=linkedin&utm_medium=social)

<sup>26</sup> A shift to bigger vehicles, increased autonomy, more collaboration across systems and an expanding range of applications.

in the NSO and National Armaments Director Group (NADG)); this function is not yet in place. Further, it may require use of levers hitherto used rarely or not at all, thereby ensuring industry and investors make profits in line with expectations (otherwise investment will flow elsewhere); as an example, single source regulations currently limit industry profit and discourage industry investment.

29. Looking beyond developing the pipeline, the customer function and a more active collaboration with industry, success also requires a careful review of supply chain resilience and addressing the significant gaps identified in this paper, it is hoped that the latter is an area where the SMTAP will secure real progress.

### **Next steps**

30. This paper is intended to generate debate and inform a dialogue in industry and with Government. The ultimate goal is to help shape more detailed implementation plans. We would therefore welcome comment and input and would be happy to support focused workshops or meetings on the areas covered.