Quantifying the UK Maritime Autonomy Opportunity

For the NPL and NSO

11th May 2026

COMMERCIAL IN CONFIDENCE

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Document Summary

This report provides an evidence-based assessment of the scale, structure, and economic potential of the UK Maritime Autonomy market across commercial and defence applications. It establishes a clear market definition and segmentation, quantifies current and future economic impacts, and identifies the strategic opportunities and enablers required to support informed policy, investment, and industry decision-making.

Document Information

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The statements, conclusions and recommendations found within the report are not those of the commissioning parties. However, this document will be used by the National Shipbuilding Office as evidence to inform policy for the upcoming Shipbuilding & Maritime Technology Action Plan, which looks to address the challenges faced by the UK maritime autonomy sector. The Action Plan will be released in late 2026. National Physical Laboratory, acting on behalf of the Maritime Autonomy Assurance Testbed (MAAT) programme, will use the evidence in the document to inform the prioritisation of the application of future MAAT outputs, to meet industry and end-user needs.

Contents

1 Introduction & Study Objectives

1.1 Purpose of the Study

This study has been commissioned by the National Physical Laboratory (NPL) (as part of the Maritime Autonomy Assurance Testbed (MAAT) programme), in partnership with the National Shipbuilding Office (NSO), to provide a robust, evidence-based assessment of the scale, structure, and economic significance of the UK Maritime Autonomy market. Its primary purpose is to quantify the current and future UK economic opportunity associated with Maritime Autonomy, and to present that opportunity in a form that is credible, accessible, and actionable for government, industry, and investors.

The study responds to a clear and growing need for a shared, authoritative evidence base that can support effective decision-making across policy, funding, and industrial strategy. While Maritime Autonomy has been widely recognised as a strategically important and high-growth area (across commercial, defence, and dual-use applications), there has to date been no single, agreed view of the size of the market, its constituent segments, or its potential contribution to UK economic growth. This work seeks to address that gap.

The specific objectives of the study are to:

- Define and clearly bound the Maritime Autonomy market, establishing a consistent set of definitions, assumptions, and segmentation that can be used across government and industry;
- Quantify the current and future economic contribution of the UK Maritime Autonomy market, including direct, indirect, and induced impacts;
- Identify the principal drivers of growth, areas of opportunity, and constraints affecting market development;
- Assess the UK's competitive position, strengths, and gaps, including regional capability and supply-chain considerations;
- Benchmark the UK's position against international comparators to inform export potential and strategic prioritisation;
- Provide evidence-based insights and recommendations to support policy development, public investment decisions, and private-sector engagement.

The study is being delivered by **Stehr Consulting Ltd**, supported by **WPI Economics**, combining deep domain expertise in Maritime Autonomy, regulation, and systems assurance with established economic modelling and impact-assessment capability. This integrated approach is intended to ensure that the analysis is both technically grounded in the realities of Maritime Autonomy development and deployment and methodologically sound from an economic and policy perspective.

Importantly, the outputs of this study are designed to serve multiple user groups (the end users), each with distinct but complementary needs:

- **Government departments and public bodies** (including NSO, NPL, and wider policy stakeholders) are expected to use the findings to inform policy formulation, prioritisation of interventions, and the design of funding and support mechanisms - particularly in relation to the MAAT programme and wider industrial and defence strategy objectives;
- **Industry stakeholders**, including technology developers, operators, and supply-chain organisations, may use the report to better understand market structure, growth trajectories,

and areas of emerging opportunity, supporting strategic planning, collaboration, and engagement with government;
- **Investors and financial institutions** may draw on the quantified market evidence, scenarios, and comparative analysis to inform investment decisions, due diligence, and assessments of risk and potential return within the Maritime Autonomy market;
- **Regional bodies and clusters** may use the analysis to understand regional strengths and gaps, supporting place-based investment, skills planning, and capability development.

Feedback from industry engagement undertaken alongside this work has reinforced the importance of presenting the findings in a way that balances analytical rigour with clarity and usability. As a result, the study not only emphasises quantitative outputs but also transparent assumptions, clearly articulated segmentation, and structured narratives that enable different audiences to extract insight relevant to their specific decision-making contexts.

In this way, the study is intended to function as a strategic reference document for government and as a practical evidence base for industry and investors - supporting a more coordinated, informed, and confident approach to the development of the UK Maritime Autonomy market.

1.2 Scope & Boundaries

This study has been designed to provide an independent, objective, and evidence-based assessment of the UK Maritime Autonomy market. While commissioned and funded by the NPL and the NSO, the analysis and conclusions presented in this report are not intended to advocate for any specific programme, organisation, or funding mechanism. Rather, the study aims to establish a neutral and credible baseline that can be used by a wide range of stakeholders to inform decision-making.

1.2.1 Scope of the Study

Consistent with the Request for Quotation (RFQ) and the approach set out in the project proposal, the scope of the study encompasses the following core dimensions:

- **Commercial and Defence Applications** - The analysis explicitly covers both commercial and defence Maritime Autonomy markets. These are treated as distinct but interconnected domains, recognising that many technologies, suppliers, skills, and assurance challenges span both markets, while also acknowledging differences in drivers, operating environments, and adoption pathways;
- **Surface and Subsurface Domains** - The study considers Maritime Autonomy across surface and subsurface systems, including vessels, vehicles, and supporting infrastructure. This reflects the breadth of current and emerging applications across shipping, offshore energy, ports, survey, and defence missions;
- **Autonomy Spectrum** - The scope reflects the full range of autonomy in practice - not just as a binary shift between remote operations and autonomy, but as a continuum spanning decision-support and advanced automation, through remote and supervised modes, to autonomous behaviours.[1] This approach recognises that value creation and market activity occur across all stages of autonomy maturity, not solely at the autonomous end-state;

[1] This was further refined and narrowed during the Maritime Autonomy definition work - primarily focusing on cases involving reduced onboard crewing.

- **UK Domestic and Export Markets** - The study addresses both the UK domestic market and the UK's position within global and export markets. This includes consideration of international competitiveness, comparative advantage, and the extent to which UK capability is positioned to capture future export opportunities.

In addition, the study explicitly includes the development of a clear market definition and segmentation framework as part of its scope. Given the breadth and variability of how Maritime Autonomy is currently described and categorised, the analysis deliberately refines and articulates what is meant by Maritime Autonomy and the Maritime Autonomy market for this work. This ensures that subsequent quantification and comparison are grounded in a shared and transparent understanding of scope.

The work has been undertaken within a defined 12-week delivery period, with outputs comprising a Technical Report (this document) and an Executive Summary. Therefore, the analysis reflects a considered balance between depth, breadth, and practical deliverability, aligned with the agreed scope and objectives.

1.2.2 Bounding Assumptions and Prioritisation

Given the complexity and evolving nature of the Maritime Autonomy market, this study applies a clear set of bounding assumptions and prioritisation choices to focus the analysis on areas of greatest policy and practical relevance. These decisions have been made deliberately and transparently, enabling the report to provide a robust, decision-ready evidence base rather than exhaustive coverage.

In particular:

- The study focuses on market definition, segmentation, and economic quantification across a variety of levels. Economic quantification is conducted using up-to-date company data, whilst the future outlook is derived using aggregated quantitative and qualitative analysis;
- Where quantitative data is limited or uncertain, qualitative assessment and triangulation are used to provide insight and context;
- The analysis prioritises areas of greatest relevance to near and medium term decision making, recognising that some longer term or more speculative aspects of Maritime Autonomy development are less amenable to accurate quantification at this stage.

These choices reflect the commissioned approach, which recognised that while more detailed segmentation or modelling could add value, such work would be more appropriately undertaken through subsequent, focused analysis.

1.2.3 Point-in-Time Assessment and Future Development

This report should be understood as a point-in-time assessment of a rapidly evolving market. The Maritime Autonomy market is characterised by fast-moving technological development, shifting regulatory frameworks, and changing landscapes of public and private investment.

The study is intended to act as a starting point and reference baseline, rather than a definitive or final statement of market size or opportunity. Where appropriate, the report highlights areas where further data collection, deeper analysis, or expanded scope would add value. Recommendations arising from the analysis are captured contextually throughout the report in clearly signposted call-out boxes, ensuring that insights are directly linked to the evidence and discussion within each relevant chapter/section.

The authors would expect that, to remain relevant and useful, the evidence base established through this work should be reviewed, refreshed, and maintained over time, enabling stakeholders to track market evolution, measure progress, and adapt policy and investment decisions accordingly.

Recommendations:

- Future work should examine how Maritime Autonomy may reshape the broader Maritime sector, including potential substitution of crewed operations, shifts in demand for services, changes to operational expenditure profiles, and impacts on defence procurement, workforce dynamics, and supporting industries. A whole-sector perspective would help policymakers and industry understand both the opportunity and the broader consequences of increased autonomy adoption.
- Given the necessarily bounded scope of this initial study, there is value in undertaking follow-on work that explores additional analytical dimensions in greater depth. This could include activities such as supply-focused quantification and deeper demand segmentation quantification.
- Conduct regular updates and maintain a living, up-to-date evidence base, using this report as a baseline.

1.3 Methodology Overview

This study has been delivered using a structured, multi-layered methodology designed to combine quantitative economic analysis with qualitative insight derived from deep domain expertise in Maritime Autonomy.

While the detailed methodology, data sources, assumptions, and analytical techniques are set out in full in the Annexes in this report, this section provides an overview of the overall approach and how the different analytical components have been integrated.

Full details of the economic modelling approach, including company-level dataset construction, attribution for multi-activity companies, and the estimation of direct, indirect and induced impacts, are set out in Annex A. Assumptions, data sources and methodological limitations are documented there to ensure transparency and reproducibility.

The qualitative frameworks underpinning the future look, including use-case led growth estimation, scenario development, Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis and international benchmarking, are elaborated in Annex B, Annex C and Annex E.

1.3.1 Overall Approach

The methodology is structured around four interrelated workstreams:

- Market definition and segmentation;
- Economic quantification, including both current market and future growth assessment;
- Qualitative market assessment, UK capability, and regional analysis;
- International benchmarking and comparative insight.

These workstreams have been delivered iteratively rather than sequentially, allowing early findings (particularly on market definition, segmentation, and qualitative insights) to inform subsequent economic modelling and interpretation.

1.3.2 Market Definition and Segmentation

Given the absence of a single, consistently applied definition across policy, industry, and academia, the study does not rely solely on existing classifications. Instead, one of the fundamental activities was to develop a clear, transparent, and fit-for-purpose definition of Maritime Autonomy and the Maritime Autonomy market for this study

This approach combines:

- A review of existing regulatory, policy, and industry definitions;
- A structured analysis of Maritime Autonomy across platforms, domains, and value-chain activities;
- Expert judgement informed by direct experience of Maritime Autonomy development, assurance, and deployment.

This process results in a market framework and segmentation that supports meaningful economic analysis while remaining practical and intelligible for decision makers. The agreed definitions and segmentation underpin all subsequent analysis in the report.

1.3.3 Qualitative Analysis and Expert Insight

In parallel with formal data collection, the study incorporates a structured qualitative assessment grounded in the project team's internal knowledge and technical expertise. This includes insight from Stehr Consulting's core team and specialist associates with senior experience across defence, commercial maritime operations, autonomy integration, and systems assurance.

This qualitative analysis has been used to:

- Interpret market structure, maturity, and dynamics where quantitative data are limited or inconsistent;
- Assess strategic drivers, constraints, and interdependencies across the Maritime Autonomy market;
- Inform judgments on relative capability, readiness, and competitiveness;
- Provide context and guidance for the economic modelling scenarios and outputs.

Rather than relying on a single analytical framework, the study applies a combination of quantitative analysis and structured qualitative judgement, selected to reflect the characteristics of a complex, emerging and cross-sector market.

1.3.4 Evidence Gathering and Data Review

The study draws on a combination of desk-based research, targeted stakeholder input, and expert interpretation, including:

- Review of published literature, market studies, policy documents, and official statistics;
- Use of publicly available datasets and industry sources where appropriate;
- Input from commercial, defence, regulatory, and investment perspectives.

Given variability in data availability across different segments of the Maritime Autonomy market, a structured data review and triangulation approach has been applied. Where data gaps exist, these are explicitly acknowledged, and qualitative insight is used to inform assumptions rather than to imply false precision.

1.3.5 Economic Quantification and Modelling

Economic quantification in new and emerging markets presents inherent challenges. This is particularly true for Maritime Autonomy, where the activity is dominated by Small and Medium Enterprises (SME) rather than larger firms typically captured through conventional economic datasets.

At the outset, this study focused on building a robust current state market assessment using The Data City's platform and Real-Time Industrial Classifications (RTICs) to market activity. However, it became clear that this approach alone could not provide an accurate picture of the market. A significant number of SMEs were either mis-categorised or not captured at all, and many were not required to report revenue. As a result, the economic quantification approach was strengthened with extensive qualitative input to validate company inclusion and estimate the proportion of each organisation's activity attributable to Maritime Autonomy. This ensured that the modelled current economic footprint (including direct, indirect, and induced impacts) was representative of the market.

Even with these refinements, the current market size was only one part of the analysis. Understanding the future opportunity is arguably of even greater value. Given the emerging nature of the market and the limited availability of consistent time-series data, quantitative analysis alone cannot reliably infer future growth potential. Instead, a 'multi-ingredient', evidence-based approach was developed, combining qualitative and quantitative elements to derive plausible market growth trajectories. This incorporates expected drivers of adoption, policy direction, regulatory developments, operational demand, technological evolution, and insights gathered through stakeholder engagement. Significant attention was placed on future operational demand for autonomous systems, which formed the foundation for establishing growth potential.

These qualitative insights can then be combined with relevant quantitative evidence, including historical trends in Maritime Autonomy and projected trends in adjacent markets, to parameterise a set of quantitative scenarios for modelling.

It is also important to note that quantitative export estimates could not be produced using the available datasets, as The Data City does not include trade or export information. All export-related insights referenced in this study are therefore arrived at qualitatively, drawing on interviews, international benchmarking and market intelligence, and are covered in the relevant qualitative sections of the report rather than in the economic model outputs.

Recommendations:

- Develop a formalised scenario modelling framework and expand access to longitudinal datasets to strengthen quantification over time.
- Re-quantify the market after several years of growth once the market dynamics have settled and data-set availability is improved.

1.3.6 UK Capability, Regional Analysis, and International Benchmarking

Building on the market framework and economic analysis, the methodology includes:

- An assessment of the UK's position in Maritime Autonomy, drawing on evidence from market activity, application focus, and comparative strengths and constraints;
- A high-level international benchmarking exercise focused on comparator nations with established or emerging leadership in Maritime Autonomy.

These elements are intended to provide strategic context and insight - informing interpretation of the quantified economic findings and supporting an assessment of relative strengths, gaps and constraints in UK capability - rather than delivering exhaustive organisation-level or country-by-country mapping.

1.3.7 Transparency and Limitations

The methodology has been designed with a strong emphasis on transparency. Key assumptions, data limitations, and methodological choices are documented and explained in Annexes A and C, enabling readers to understand how conclusions have been reached and where uncertainty remains. The methodology is deliberately transparent and auditable, enabling readers to understand how evidence has been translated into findings and to use this work confidently as a baseline for future refinement and extension.

The methodology has been designed with a strong emphasis on transparency. Annexes A and C provide a comprehensive and in-depth exposition of the economic modelling framework and the detailed methodologies applied throughout the study, including data construction, analytical techniques, and the sequencing of the analysis. These annexes enable readers to interrogate how evidence has been translated into quantitative and qualitative outputs, how methodological choices have been applied, and how these choices influence the resulting findings.

Key assumptions, data limitations, and areas of uncertainty are explicitly documented in Annex F. This annex sets out the assumptions underpinning the analysis, the known constraints of the available data, and the implications these have for interpretation of the results. Where appropriate, the report also identifies areas where further analysis, improved data availability, or future updates would add value and strengthen the robustness of subsequent iterations of this work.

2 Defining Maritime Autonomy

2.1 Chapter Overview

This chapter establishes the definition of Maritime Autonomy used throughout the study. The way Maritime Autonomy is defined directly determines market scope, segmentation, and the credibility of the economic results that follow.

This chapter sets the working definition of Maritime Autonomy used throughout the study. Market size, segmentation and growth estimates are highly sensitive to scope, so establishing this definition is essential to the credibility of the analysis that follows.

- Maritime Autonomy is defined around reduced onboard crewing and changed operating models, not around the novelty of technology.
- The definition treats autonomy as a system-of-systems, spanning vessels, people, shore-based operations and enabling infrastructure.
- Scope deliberately includes commercial, defence and dual-use maritime activity to reflect how capability, supply chains and investment operate in practice.
- Activities are excluded where automation or digitalisation improves performance but does not materially affect crewing or operations.
- Aerial systems are out of scope except where they are integral to vessel operations.
- This definition sets the market boundary used for segmentation, company inclusion and revenue attribution.
- Furthermore, this chapter explains why headline figures in this report may not align with other published autonomy market estimates that apply broader or narrower definitions.
- The definition is fit-for-purpose for this study: transparent, bounded, and intended as a baseline rather than a permanent standard.

2.2 Why Definition Matters

A clear and shared definition of Maritime Autonomy is fundamental to the analysis presented in this report. It underpins how the market is quantified, how economic impacts are assessed, and how insights can be interpreted and applied by different users. Without this clarity, there is a significant risk that estimates of market size, growth potential, or competitiveness are misinterpreted or compared inconsistently.

In practice, Maritime Autonomy is frequently defined either at a very high level or in ways that reflect the perspective of a particular discipline, sector, or stakeholder group. In some cases, definitions focus narrowly on uncrewed vessels; in others, they emphasise specific technologies, regulatory constructs, or future end-states of autonomy. While each of these perspectives may be valid within a given context, taken in isolation, they are often unhelpful for the purposes of economic analysis and policy decision-making.

Therefore, this study treats the definition of Maritime Autonomy not as a given, but as a necessary and deliberate first analytical step, a core component of this work.

2.3 Approach to Defining Maritime Autonomy

The definition used in this study has been developed through an iterative process, using a draft internal technical note to facilitate structured consideration and engagement, and testing the concept through multiple analytical lenses. These lenses included, but were not limited to:

- **Platform and domain** (surface, subsurface, and supporting infrastructure);
- **Autonomy function and maturity** (from decision support and remote operation through to autonomous capability);
- **Application and mission context** (commercial, defence, and dual-use activities);
- **Value-chain and ecosystem perspective** (spanning technology, integration, operations, services, assurance, and governance).

This multi-lens approach was intentionally expansive at the outset. It allowed the project team to explore the full breadth of activities, capabilities, and organisations that might reasonably be considered part of the Maritime Autonomy market, and to understand where existing definitions either oversimplified or obscured important distinctions.

2.4 Refining and Bounding the Definition

Building on this initial expansive view, the definition was refined and bounded through a structured scoping process, including internal alignment within the project team and collaborative scoping discussions with NPL and NSO. These discussions were critical in testing the emerging definition against the objectives of the study, the practical needs of end users of the report, and the constraints of time, budget, and data availability.

Through this process, the definition was shaped to ensure that it:

- Focuses on operational Maritime activity, rather than broader Marine or environmental domains unless directly relevant to Maritime industry or defence missions;
- Captures autonomy as a socio-technical capability, encompassing not only platforms and software, but also human-machine interaction, operational concepts, supporting infrastructure and doctrine;
- Applies across both commercial and defence contexts, recognising there are differences in drivers and operating environments, while maintaining a common analytical frame;
- Remains sufficiently bounded to support meaningful market segmentation and economic quantification within the scope of this study.

This definition is not intended to be universal or permanent (though it may inform future work), but rather one that is fit-for-purpose for this study and transparent in its assumptions and boundaries. While this section sets out what is meant by Maritime Autonomy in conceptual terms, the definition of the Maritime Autonomy market (including how it is structured, segmented, and quantified) is addressed in more detail in the subsequent market Segmentation Framework section. Together, these two sections establish the foundation for the economic analysis that follows and provides readers with the clarity required to interpret the results appropriately.

Recommendation:

Consider convening NPL/NSO, regulators, statistical bodies and industry to test whether this study's definition should evolve into a shared framework for future measurement.

Definition of Maritime Autonomy (for the purposes of this study)

"Maritime Autonomy, for the purposes of this study, refers to the capability of maritime platforms and associated operational systems to perform activities with reduced onboard human presence. This reduction is enabled through autonomous or remotely supervised technologies applied to tasks traditionally carried out by the crew e.g. vessel navigation, engineering, mission execution, and vessel management. The focus is not on removing humans entirely, but on how autonomy enables alternative operating models and lean-crewed vessel operations.

The definition considers a spectrum of human involvement, from decision support and remote supervision through to highly autonomous operation, provided there is a credible link to reduced crewing or enabling different operating models. Automation or digitalisation that improves performance or safety without materially affecting crew requirements fall outside of scope.

Maritime Autonomy is a system-of-systems concept combining technology, people, and operating models. It encompasses both shipboard functions and shore-based roles that directly replace or support onboard activities, including the use of Remote Operation Centres (ROCs) and shore-based control or pilotage. The definition applies to surface and sub-surface platforms supported by associated infrastructure. Aerial systems are excluded, except where vessel-based launch and recovery are integral to the autonomous vessel's operation.

Functionally, Maritime Autonomy may be applied to navigation and vessel control, machinery and engineering management, mission or payload execution, and shore-based oversight. The definition focuses on what functions are delivered autonomously or remotely, rather than prescribing the specific technologies used to support them.

The term 'Maritime', when used within the term 'Maritime Autonomy', is used deliberately to emphasise operational maritime activity across commercial, industrial, research, and defence contexts where autonomy contributes to reduced-crewing or alternative service models.

Autonomy that is purely exploratory or academic, with no operational or service context, is excluded, as are tethered or highly specialised robotic systems that do not meaningfully support reduced-crewing maritime operations."

3 Market Segmentation Framework

3.1 Chapter Overview

This chapter sets out how the Maritime Autonomy market is structured for analysis. Maritime Autonomy is not viewed as a single industry but an ecosystem spanning multiple sectors; a clear segmentation framework is required to avoid over-aggregation and to support credible quantification.

- The market is segmented to reflect where autonomy is applied and where value is created, rather than around technologies or organisational types alone.
- A demand-led segmentation is adopted as the primary framework, structured around sectors, applications and use cases where Maritime Autonomy is deployed.
- This approach aligns most closely with policy, investor and end-user decision-making, and provides a more robust basis for economic modelling given data limitations.
- A supply-led perspective (organisations, capabilities and value-chain roles) is acknowledged but used as a supporting lens rather than the primary analytical structure.
- Five demand segments are defined, spanning commercial shipping, ports and public maritime services, defence and security, offshore energy and industrial operations, and research and environmental science.
- These segments form the basis for company classification, revenue attribution and future growth modelling used in later chapters.
- The framework is intentionally fit-for-purpose and bounded, recognising that further refinement (e.g. by autonomy maturity or technology sub-segment) would add value but sits beyond the scope of this study.

3.2 Purpose of Market Segmentation

Market segmentation is a critical step in translating the conceptual definition of Maritime Autonomy into a framework that supports meaningful economic analysis. It provides the structure through which market activity can be organised, quantified, and compared, and enables users of this report to understand where value is created, by whom, and how different parts of the ecosystem interact.

It is important to note that Maritime Autonomy does not constitute a single, discrete industry. Rather, it is an ecosystem spanning platforms, technologies, services, infrastructure, assurance, and finance, and applied across a wide range of commercial and defence use cases. Segmentation is therefore essential to avoid over-aggregation and to ensure that differences in maturity, scale, growth potential, and economic impact are not obscured.

3.3 Segmentation Approaches Considered

Several potential approaches for segmenting the Maritime Autonomy market were considered at the outset of this study, including:

- **Domain-based segmentation** (e.g. surface, subsurface);
- **Autonomy-based segmentation** (e.g. decision support, remote operation, supervised autonomy, autonomous operation);
- **Application-based segmentation** (e.g. defence missions, offshore energy, shipping, ports).

Each of these lenses offers useful insight, but each also presents limitations when used in isolation - particularly in the context of economic quantification, where data availability and consistency vary significantly across segments.

During early project development, these segmentation lenses helped characterise the diversity of activity across Maritime Autonomy. However, for the purposes of economic quantification they proved insufficient as primary organising structures. As a result, the study refined its segmentation framework during scoping discussions with NPL and NSO, focusing instead on the distinction between demand-led and supply-led perspectives. This created a more coherent analytical foundation while still capturing the breadth of the market.

3.4 Demand-Led and Supply-Led Perspectives

Building on this refinement, the study distinguished between demand-led (structured around sectors, applications, and use cases) and supply-led (focusing on organisation types, capabilities, and value-chain roles) segmentation. This distinction shapes both how the market is understood and how economic activity is measured.

A demand-led segmentation groups the market by the real operational needs, rather than the technology that underpins it. Under this perspective, the market is structured around sectors and use cases such as commercial shipping, defence and security, offshore energy and Maritime infrastructure, and ports. It aligns closely with policy and end-user decision-making and is well suited to understanding adoption drivers and value creation.

A supply-led segmentation instead focuses on how capability is delivered to market - including platforms, technologies, services, infrastructure, and assurance. This lens is valuable for understanding industrial capability, supply-chain structure, and where economic value accrues across the ecosystem.

The study acknowledges that both perspectives are valid and complementary. Undertaking full parallel analyses would have introduced additional scope and analytical complexity beyond the focus of this initial study. A single primary segmentation approach was therefore adopted to maintain clarity and analytical robustness.

3.5 Segmentation Approach Adopted for this Study

Following internal alignment and collaborative scoping discussions with NPL and NSO, the study adopts a primarily demand-led segmentation, structured around applications and use cases, as the core analytical approach for economic quantification.

This approach was selected because it:

- Best aligns with the objectives of the study and the needs of its end users, particularly policymakers and investors;
- Enables clearer linkage between market activity, economic impact, and real-world operational outcomes;
- Is more robust to data limitations than alternative approaches when estimating market size and growth.

At the same time, the study explicitly recognises the importance of the supply-led ecosystem perspective, discussed within Section 3.7.

3.6 Demand-Led Market Segmentation (Primary Framework)

Under the demand-led framework, the Maritime Autonomy market is segmented by sector and application, reflecting where autonomous and remotely operated Maritime capabilities are currently deployed or are expected to be adopted.

These demand segments were considered as:

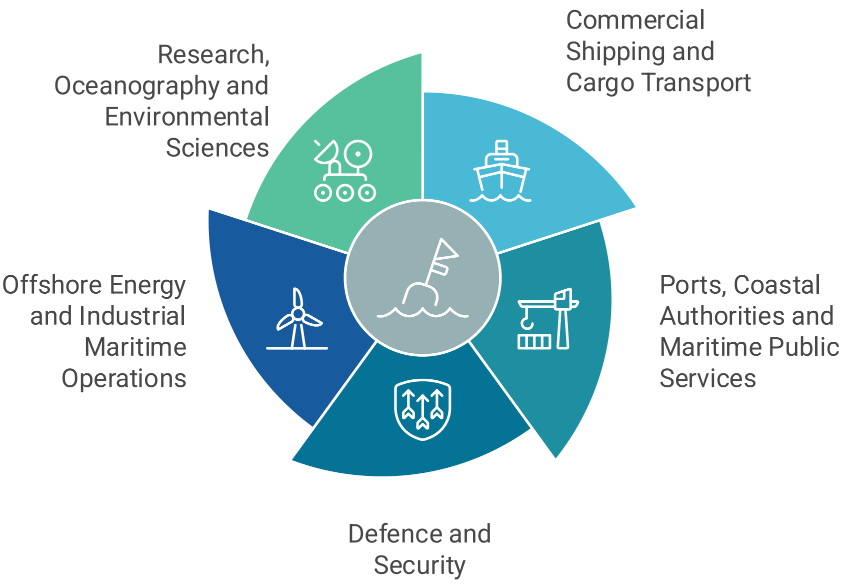

Figure 1 - Demand Segmentation of Maritime Autonomy

- **Commercial Shipping and Cargo Transport** - Deep-sea shipping, short-sea and feeder services, coastal and inland waterway operations;
- **Ports, Coastal Authorities and Maritime Public Services** - Remote and automated harbour operations, pilotage, vessel traffic services, search and rescue support, and regulatory or compliance monitoring;
- **Defence and Security** - Intelligence, Surveillance and Reconnaissance (ISR), Mine Counter Measures (MCM), Anti-Submarine Warfare (ASW), Electronic Warfare (EW), force protection, logistics, and operations in contested environments;
- **Offshore Energy and Industrial Maritime Operations** - Offshore Energy pre-construction, operations and decommissioning activities, and infrastructure operations including dredging and maritime construction, and aquaculture and related maritime industries;
- **Research, Oceanography and Environmental Science** - Research platforms, persistent ocean monitoring, and climate and environmental data collection, where directly linked to maritime operational activity.

These segments form the primary basis for future market predictions, economic impact assessment, and growth analysis within this study.

Given the wide range of autonomy-related aspects in scope (including decision support, remote operation, supervised autonomy, and higher levels of autonomy), the market and opportunity quantification was undertaken at an aggregate level rather than differentiated by specific operational type. The underlying adoption drivers and maturity pathways vary significantly across segments and represent areas for more detailed consideration in future work.

3.6.1 Demand Segment Use Cases

Through workshops hosted by Stehr Consulting, industry experts gathered to define the use cases falling under Maritime Autonomy. The following emerged: 5 demand segments, 26 application areas and 76 use cases, which are all described in Figure 2. Whilst non-exhaustive, these use cases best describe most applications within Maritime Autonomy (as defined within this study).

Recommendations:

- As understanding of the market grows, review defined use cases and maintain an ‘application longlist’ to support further approaches for quantifying market size.
- Future work should develop segment-specific reliance on autonomy-based differentiation to support maturity tracking and policy targeting.

3.7 Supply-Led Market Segmentation (Supporting Framework)

To complement the demand-led segmentation, the study also articulates the supply-led segmentation structure for Maritime Autonomy, recognising that value is created across a wide range of interconnected elements. These include, for example:

- Platforms and System Integration (surface and subsurface);
- Operators and Managed Service Providers;
- Engineering, Naval Architecture and Integration Services;
- Autonomy Technologies and Subsystems (software, hardware, sensors, communications, propulsion);
- Infrastructure and Shore Systems (Remote Operation Centres (ROCs), connectivity, test and trial infrastructure);
- Data, Artificial Intelligence (AI) and Analytics;[2]
- Operations, Logistics and Support Services;
- Regulatory, Standards, Assurance and Certification;
- Finance, Insurance, Legal and Investment Services.

For the most part, these supply segments are defined to enable future work, and as such are fully defined in Annex C. It is likely that the supply chain that underpins this supply-led structure is captured to some extent in the indirect Gross Value Add (GVA) quantification, given that it draws on input-output supply chain data. It should be noted that this framework has not yet been validated or tested and should therefore be reviewed and further considered before being used to structure any subsequent analysis. At this stage, it is provided for indicative purposes and to share early thinking.

[2] Some enabling technologies underpinning Maritime Autonomy (e.g. AI models, compute hardware, satellite communications) sit largely outside the Maritime supply chain and are not segmented separately within this study, but their influence is acknowledged.

Recommendations:

- Further validate supply segmentation with key stakeholders prior to any modelling or application of it to economic quantification.
- Apply the supply-led framework in a follow-on study, including value-capture analysis and supply-chain risk/sovereignty mapping.

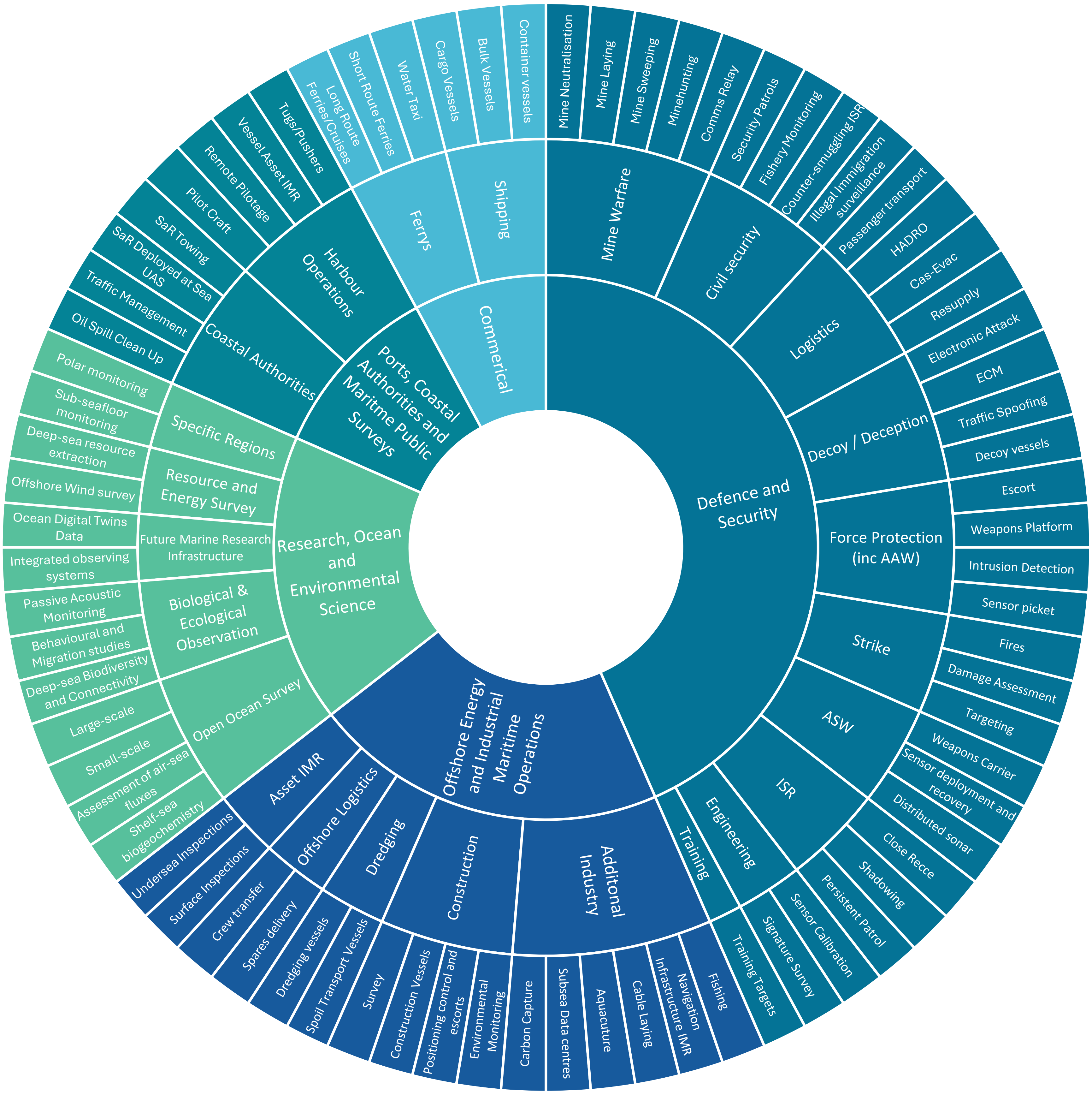

Figure 2 - Demand Segmentation and Use Cases

Some Titles shortened to fit in graphic.
IMR: Inspection, Maintenance and Repair; SaR: Search and Rescue; ECM: Electronic Counter Measures

3.8 Scope, Limitations and Future Refinement

The segmentation adopted in this study reflects a deliberate balance between analytical accuracy and practical deliverability. Emphasis was placed on clarity and usability to ensure the analysis provides robust, decision-relevant insights.

The segmentation is therefore intended as a foundational structure, suitable for the purposes of this initial economic assessment. As the market evolves, and as more detailed data becomes available, there may be value in further refining or extending the segmentation - particularly to explore specific technologies, reliance on autonomy, or supply-chain aspects in greater depth. Where relevant, opportunities for future work are highlighted later in the report.

Recommendation:

Refine segmentation as data maturity improves - particularly technology sub-segments, reliance on autonomy, and assurance services.

4 Quantifying the Market Size & Economic Opportunity

4.1 Chapter Overview

This chapter quantifies the current size and future growth potential of the UK Maritime Autonomy market, providing the economic evidence base for policy, investment and strategic decision-making.

- Using a bottom-up, company-level approach, the UK Maritime Autonomy market is estimated to have generated £625m in annual turnover in 2023, supporting ~2,000 direct jobs and £215m in direct GVA.
- When indirect and induced effects are included, the total economic footprint rises to £469m GVA and ~5,300 jobs, demonstrating that value creation extends well beyond core autonomy companies.
- The market is characterised by a large SME base, with smaller companies accounting for a material share of activity despite individually modest turnover.
- Historical analysis indicates rapid early-stage growth, with GVA increasing at approximately 30%+ per annum between 2019 and 2023, reflecting an emerging but accelerating market.
- Forward projections suggest strong but variable growth, highly sensitive to policy, regulation and investment conditions:
- Under the central growth case, the UK Maritime Autonomy market could reach £3.7bn GVA by 2040 and £8.3bn GVA by 2050.
- Under more favourable conditions, upside scenarios indicate materially higher outcomes; under constrained conditions, growth is significantly dampened.
- Growth is expected to be driven primarily by defence adoption, offshore energy, commercial shipping applications and public-sector maritime services, with different segments maturing at different rates.
- All projections are scenario-based ranges, not forecasts, reflecting data limitations, market immaturity and the evolving regulatory and investment landscape.

This chapter demonstrates that Maritime Autonomy is already an economically material UK market, with substantial long-term upside, but one whose trajectory depends strongly on near term strategic choices.

4.2 Literature Review

The market for Maritime Autonomy is on an accelerating growth trajectory. While exact estimates vary (depending on definitions and segments included), all sources agree on substantial expansion in the 2020s and 2030s:

- A widely cited industry analysis by Allied Market Research [1] projected that the global autonomous and smart ships market could reach £103 billion by 2030. This figure, which includes a broad range of marine autonomy applications, suggests a significant rise in demand across almost all marine industries;
- More conservative analyses still show strong growth. For example, the market research platform MarketsandMarkets [2] focused on autonomous ship technology and forecasted a rise from an estimated around US$5-6 billion in 2020 to US$13.8 billion by 2030 (around £10 billion), a Compound Annual Growth Rate (CAGR) of about 12.5% (2020-2030). Similarly, Fortune Business Insights [3] estimated the global autonomous ships market at US$5.61 billion in 2023 and expected this to roughly double to US$12.25 billion by 2032 (a 9% CAGR in the late 2020s).

These forecasts, though lower than Allied's scenario, still imply rapid adoption of unmanned vessels and related technology worldwide.

The table below summarises key market size forecasts from different organisations:

Table 1 Market Forecasts from Different Organisations

Source (Year)	Scope of Analysis	Current/Base Value	Forecast & Horizon	Growth Rate
Fortune Business Insights (2025) [4]	Global autonomous ships market (commercial + defence)	~$5.6 B (2023)	$12.3 B by 2032	~9.1% CAGR (2025–2032)
MarketsandMarkets (2021) [2]	Global autonomous ships market (hardware/software)	~$5 B (2020 est.)	$13.8 B by 2030	~12.5% CAGR (2020–2030)
Allied Market Research (2019) [1]	Global "marine autonomy" demand (broad)	– (n/a)	£103 B by 2030	High-growth scenario (disruptive adoption)
DIT HPO Factsheet (2021) [5]	UK share of global marine autonomy	– (nascent)	~£10 B by 2030 (implied)	~10% of the global market [6]

As shown above, even the most conservative forecast sees the Maritime Autonomy market growing by two to three times in the next decade, while more optimistic analyses see an order of magnitude boom by 2030. The range in estimates reflects different definitions - narrower studies often count only the market for new autonomous ship systems or platforms sold, whereas broader studies include the value of operations and services enabled by autonomy across the Maritime industry (hence the £103 B estimate when one assumes widespread adoption across shipping, offshore energy, aquaculture, etc.). Regardless of methodology, the trend is clear: Maritime Autonomy is a high-growth market globally, expected to become a multi-billion (even hundred billion) pound market in the coming decades.

Due to the variety of predictions and the historical lack of a concise and well-accepted definition, no existing estimates for the growth of the UK Maritime Autonomy Market are found, requiring this bespoke research, whilst also reducing the viability of any direct comparisons to historical studies.

4.3 Baseline Market Size

The first step in estimating the overall economic opportunity for the Maritime Autonomy market in the UK was to define the current market size. As will be described in 4.3.1, this assessment focuses on quantifying the value of activities currently undertaken by UK companies operating within Maritime Autonomy, using a combination of data from The Data City and expert qualitative insight. This section describes the approach used, as well as the value of the current market.

4.3.1 Detailed Methodology

A thorough assessment of the UK Maritime Autonomy market requires a transparent, multifaceted methodology considering the absence of consistent official statistics and the fragmented nature of existing commercial estimates. At present, there are no up-to-date official UK Government estimates or datasets providing a market size for Maritime Autonomy. Existing global estimates vary widely in scope, definitions and methodology, and typically do not provide sufficient transparency on the underlying sources used to derive UK-level estimates, if available. While the global figures presented in Section 4.2 provide useful directional context, they are insufficient for UK-specific quantification due to inconsistent definitions, inclusion boundaries, and data provenance.

This section summarises the evidence base and analytical approach used to estimate the size of the UK Maritime Autonomy market. The analysis draws primarily on UK company-level datasets, supplemented by expert input and publicly available financial information. Given the emerging nature of the market and the prevalence of companies operating across multiple markets, a structured attribution and proportioning approach was applied to isolate Maritime Autonomy related activity. Further methodological detail is provided in Annex A, as well as the full assumptions, limitations and recommendations around this methodology.

4.3.1.1 Company-Level Dataset Construction

Work began by generating a dataset of companies potentially active in Maritime Autonomy, through a combination of:

- The project team's domain knowledge of UK commercial, defence and dual-use operators;
- The Data City platform, which uses machine learning and web-scraping methods to analyse company websites and other online sources to classify companies into sector taxonomies.

This generated a longlist, which identified just over 710 UK Marine and Maritime companies with activities relating to autonomy, robotics, vessel platforms, control systems, sensors, subsea technologies and enabling digital systems. This longlist was then refined to ensure alignment with the study's formal definition of Maritime Autonomy. Not all companies in the longlist dataset operate within the scope of autonomy-enabled reduced crewing Maritime operations (a crucial aspect of the study's Maritime Autonomy definition): many focus on robotics or digital technologies without a direct link to Maritime operations. As such, manual cleaning and expert validation of the longlist dataset were undertaken to exclude:

- Companies without clear Maritime Autonomy relevance;
- Niche robotics companies with no reduced-crewing or Maritime operational connection;
- Marine environment only robotics with no operational Maritime context;
- Organisations whose main operations are outside the UK.

As a result of this review process, around 400 companies were removed from the initial list, as they were found not to meet the inclusion criteria for the Maritime Autonomy market. This left a consolidated company list of 308 businesses judged to be involved in Maritime Autonomy activity in the UK.

4.3.1.2 Estimating Economic Contribution for Companies with Missing Financial Information

A proportion of identified companies did not have reported financial data. To estimate their economic contribution, a multi-step approach was adopted:

- Identification of relevant companies: Stehr Consulting reviewed the company longlist, classifying approximately 43% of companies as Maritime Autonomy related. This proportion was then applied to the subset of companies with missing financials to estimate the number of relevant companies;

- Assumption on company size: companies with no reported financial data were assumed to be small or micro entities, likely falling below statutory reporting thresholds defined by Companies House. Turnover below £10 million was used as a practical threshold to identify small companies;
- Turnover estimation: for these small companies, turnover distributions derived from existing data for unlisted UK companies were applied to 'fill in' missing turnover for these companies (see Annex A for details);
- Derivation of GVA and employment: ratios of GVA to turnover and employment to turnover observed for companies with reported financial data were applied to these turnover estimates to estimate the economic contribution of these small, unreported companies.

This approach allows inclusion of smaller and emerging companies in the market size estimates, ensuring a more comprehensive and representative view of the UK Maritime Autonomy market.

4.3.1.3 Attribution for Multi-Activity Companies

The consolidated company list includes those with exclusive involvement in Maritime Autonomy and those for whom Maritime Autonomy activity is one of several company focuses. To avoid overstating the size of the Maritime Autonomy market, for multi-activity organisations, only the share of turnover, employment and activity estimated to be attributable specifically to Maritime Autonomy is included. This ensures that the estimates reflect the proportion of the company's activity genuinely related to Maritime Autonomy rather than their total business operations. These adjustments were made using a structured approach, which varied according to the size of the company, reflecting that adjustments to larger companies' share would have a larger bearing on our market size estimates than those to smaller companies. As such, large companies were reviewed individually to determine an appropriate attribution, while representative samples were used for medium and smaller companies[4]. Turnover and employment data were obtained directly as reported. Company-level GVA was calculated from reported wages and operating profits, with adjustments for depreciation and amortisation. The structured approach is set out in detail in Annex A.

4.3.1.4 Direct, Indirect and Induced Impacts

Economic contribution is assessed using three impact channels:

- **Direct Impacts:** Derived from company-level financial data capturing the core economic footprint of organisations whose primary activities relate to Maritime Autonomous systems - including platforms, subsystems, autonomy software, integration services, and operational support. Direct impacts encompass turnover, employment, and GVA;
- **Indirect Impacts:** Economic activity generated through the supply chain, including engineering (for example, designing and developing systems and software to be used in the Maritime Autonomy market), manufacturing, electronics, digital, and professional services that support the development, deployment or operation of Maritime Autonomy;
- **Induced Impacts:** Wider economic activity supported by the expenditure of wages earned by employees in both the direct and indirect components of the market.

[4] Small, Medium and Large firms are defined in detail based on turnover in Annex A, with boundaries of £10 million, and £100 million.

All indirect and induced impacts are estimated, avoiding double-counting, and the final economic contribution reflects a thorough, transparent approach.

4.3.1.5 External Cross-Checks and Market Intelligence

To ensure the completeness, accuracy and credibility of the consolidated company list, the study incorporates a structured process of multi-source validation drawing on organisations with deep visibility across the UK's Maritime, subsea, autonomy and ocean-technology ecosystems. This process goes well beyond internal desktop review and represents a deliberate effort to triangulate the dataset with independent expert networks.

In addition to The Data City's longlist and Stehr Consulting's internal market knowledge, external intelligence has been gathered from the following bodies:

- Society of Maritime Industries (SMI);
- National Oceanography Centre (NOC) Innovation Hub;
- Plymouth Marine Laboratory (PML);
- Future Autonomous at Sea Technologies (FAST) Cluster.

This approach ensures the dataset reflects the breadth and depth of the UK's Maritime Autonomy market, recognises the dual-use nature of many technologies, and provides a repeatable and updatable basis for future updates to the market defined within this study.

4.3.2 Baseline Current Market Size

4.3.2.1 Direct Impacts

Based on the latest available company data, the UK Maritime Autonomy market is estimated to have generated £625 million in annual turnover in 2023. This year was selected as it provides the most recent and complete set of reported financial information across the identified company population.

Of this, £556 million (89%) came from companies with reported financial information, while the remaining £69 million was derived from estimated turnover for smaller companies with partial or missing financial data - who, by virtue of not having reported financial information, are assumed to be below £10 million in turnover (more detail on this is set out in Annex A).

Across the UK Maritime Autonomy Market, a large number of SMEs contribute to a large portion of the total turnover. Beyond the 11% of turnover assumed to come from the smallest companies, there are 55% (51 companies) that are SMEs with reported financial data with annual turnover below £50 million. While individually small, these companies collectively contributed £144 million (26%) in annual turnover, highlighting the importance of smaller companies in the UK Maritime Autonomy market. Companies with turnover between £50 million and £100 million contributed £86 million (15.5%), while those with turnover between £100 million and £1 billion contributed £173 million (31.1%). Large companies with turnover above £1 billion contributed £152 million (27.4%), reflecting the relatively small proportions of Maritime Autonomy activity within these large, diversified companies.

Maritime Autonomy related activity is estimated to generate £215 million in direct GVA and support approximately 1,980 direct jobs across companies operating in the UK in 2023.

Direct economic footprint of the Maritime Autonomy market in the UK (2023)

Turnover	Gross Value Added	Employment
£625 million	£215 million	1,980

These figures represent the direct economic footprint of companies that have commercial activity that fits within the Maritime Autonomy definition, including:

- Development and manufacture of autonomous or remotely operated surface or subsea vessels;
- Autonomy software, navigation, sensing, and control systems;
- System integration, operations, data services, and mission execution;
- ROCs and associated shore-side digital infrastructure.

4.3.2.2 Indirect and Induced Impacts

When supply chain and induced activity are included, Maritime Autonomy's economic footprint expands substantially. Indirect impacts arise from upstream activity supporting Maritime Autonomy companies, including engineering, electronics, subsea systems, testing, assurance and certification services. Induced impacts capture the wider economic effect of wages spent by employees.

On this basis, the market's contribution is estimated at £102 million in indirect GVA and £152 million in induced GVA, resulting in a total GVA of £469 million in 2023. Employment impacts include 1,580 indirect jobs and 1,720 induced jobs, bringing the total employment supported across the Maritime Autonomy market and wider market participants and supporting activities to 5,280 jobs in 2023. These figures demonstrate that the market's economic significance extends beyond the companies directly engaged in Maritime Autonomy.

4.3.2.3 Regional Economic Contribution

To give an indication of where revenue is generated and where the GVA is generally applied regionally, for each company with recorded revenue, the registered postcode and summed GVA were used to generate a regional heatmap, shown in Figure 3 - Total GVA Heatmap by Registered address of reporting compani3.

Further details of the exact activities and regional hotspots are provided in 5.1.1. However, hotspots around existing Maritime infrastructure (Solent, Plymouth, Aberdeen, etc.) demonstrate that new Maritime Autonomy development is remaining around traditional Maritime hotspots. Simultaneously, the opportunity autonomy offers to the wider maritime sector is evident, with additional hotspots outside conventional maritime locations, including in London and the home counties, where there is additional investment and technical capability.

Recommendations:

- Tag companies collated in a quantification study with supply-led segmentation tags, to provide an economic breakdown by supply segmentation.
- Map smaller organisations and their contributions based on approximate revenue and GVA.

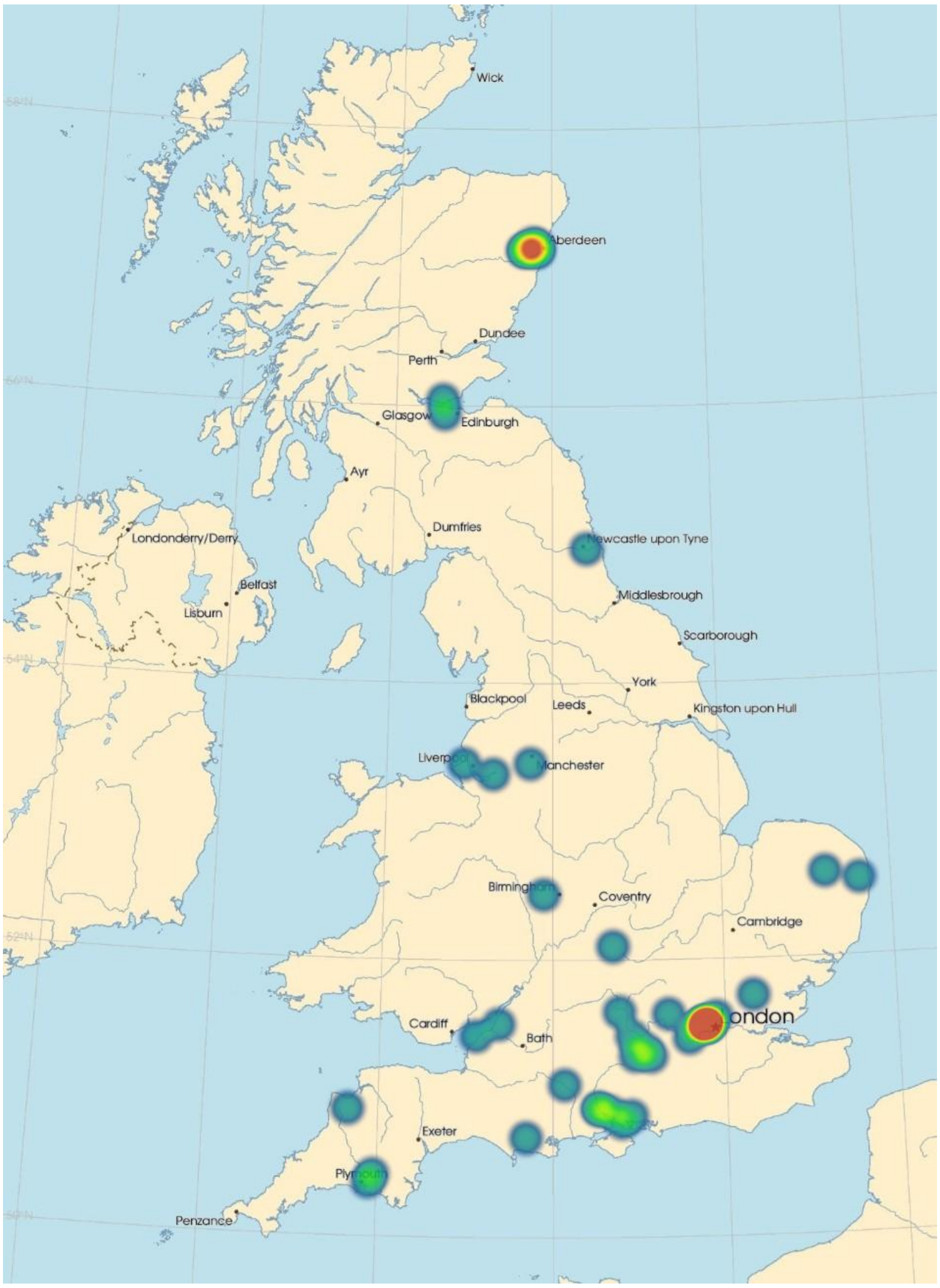

Figure 3 - Total GVA Heatmap by Registered address of reporting companies

4.4 Projecting Market Growth

Current projections for Maritime Autonomy are inconsistent, caused in part by a lack of a consistent definition, but also by the challenges in determining the adoption rate across each unique sector in which it may play a part.

A variety of constituent parts are therefore required to build a stronger understanding of how Maritime Autonomy could grow. These are synthesised into a collated projection for the market, built around three projections, representing baseline, accelerated and conservative growth potentials. Each of these scenarios is developed using a combination of these constituent parts and is not representative of any one specific set of triggers and outcomes, instead demonstrating a range of what may occur.

For consistency, three time horizons are used throughout:

- Short term (0-5 years);
- Medium term (5-15 years);
- Long term (15-25 years).

This section lays out the constituent parts to be synthesised; these are summarised below:

- **Past Trends:** Historical trends in the Maritime Autonomy market derived from data gathered from The Data City, as defined in 4.3.1, considering both the current year and company reports from 2019;
- **Comparative Markets:** Consideration of similar markets, with markets selected based on comparative maturity, technical complexity and similar societal or regulatory barriers to growth;
- **Application Specific Modelling:** A demand and autonomy use case-driven growth scenario set, considering the applications Maritime Autonomy may undertake, the growth of the representative markets, and the increase in adoption from Maritime Autonomy;
- **Qualitative Modelling:** A set of qualitative scenarios, describing specific triggers and the potential outcomes, both in terms of qualitative changes to the market and potential economic shifts. For a subset of these, the impact on application-specific adoption rate and on the wider market was also considered to indicate the shifts to market growth.

Through the consideration of each constituent part above, three growth trajectories were developed, presented in 4.4.4, indicating the potential growth rate and economic value of the Maritime Autonomy market.

4.4.1 Historical Trends

Historical analysis indicates that the Maritime Autonomy market has experienced rapid expansion in recent years, with annual growth rates of approximately 34% in GVA, 25% in turnover and 23% in employment between 2019 and 2023, according to our analysis. In the US, autonomous ships (a subsector of maritime autonomy) showed an annual growth of around 22% between 2021 and 2025, when the market was at a similar maturity [3]. By 2025, the remotely operated segment made up the largest driver of the US market size, and the military and law enforcement ships segment led the market by type.

4.4.2 Comparative Benchmarking

Benchmarking with adjacent autonomous technology markets (e.g. Uncrewed Aerial Systems (UAS) and Driverless Cars) suggests that emerging technology markets often experience strong early growth followed by a period of sustained expansion, typically within the range of 10%-20% annual growth during their scaling phases (Further detail is provided in Annex C).

4.4.3 Application Specific Modelling

Comparative benchmarking and historical trend analysis provide helpful context but are insufficient on their own for projecting an emerging, rapidly evolving market. The rate of adoption and thus growth is dependent on regulatory, economic, and benefit-led investment, which only qualitative insight can begin to determine.

To gain a greater understanding of the potential opportunity, a method of applying a combination of existing and more readily available quantitative data (such as the value of existing sectors that Maritime Autonomy will play a part within, in the future), as well as qualitative based understanding around the adoption of autonomy in these sectors and specific applications over time, is required.

A bottom-up use-case aggregation approach was applied to the defined demand segments and use cases defined in 0, providing insight into the potential growth within the Maritime Autonomy market. This approach considered a selection of the use cases for Maritime Autonomy, applying a combination of expert judgment with existing hard data and independent estimations for future growth in related sectors, to enable aggregation of specific application predictions of growth that were then applied across the market.

Recommendations:

- Once the market is more developed, re-assess qualitative ranges against observed data and refine parameters iteratively, and reapply the modelling approach with a more detailed understanding.
- Revisit the use cases in greater detail to strengthen the depth of analysis, drawing on existing Maritime market growth studies where appropriate (including those currently behind paywalls).

4.4.3.1 Growth Projections

Through application of the bottom-up approach, the expected growth according to each defined time horizon for a selection of use cases was found and is presented in The process applied for each use case, to provide these estimations, is detailed in Annex B alongside the references used to support the analysis.

Table 2. The year 2025 was selected as the baseline year, as this has the potential for the most up-to-date data. The selection of use cases investigated was decided by first defining which areas were of higher priority to investigate, either because of the potential for growth by Maritime Autonomy, or due to the scale of the market they represent.

Unfortunately, data availability for market and autonomy applications was also key, so some of the defined segments in 0 were not assessed to avoid relying solely on baseless assumptions. The remaining use cases cover a wide range of market sizes and Maritime Autonomy adoption rates and are believed to cover the market sufficiently to enable the outputs to be applied to the whole market.

The process applied for each use case, to provide these estimations, is detailed in Annex B alongside the references used to support the analysis.

Table 2 Estimated growth of Maritime Autonomy revenue for select use cases[5]

		Annual revenue/Expenditure £m, in nominal terms			
Analysis Title	**Use Cases**	**2025**	**2030**	**2040**	**2050**
Commercial Shipping					
Freight Shipping	All Freight Shipping	17.4	307.7	903.2	4,196.1
Passenger Vessels	All Passenger Transport	-	5.1	476.2	1,514.8
Defence and Security					
Defence	All Defence-specific Use Cases	300.0	650.0	1,300	1800
Maritime Border Security	Illegal Immigration and Counter Smuggling ISR, Security Patrols	-	1.2	6.1	15.9
Offshore Energy and Industrial Maritime Operations					
Offshore Wind Undersea Inspection	Offshore Wind Undersea Inspection	0.2	2.1	20.6	36.0
Offshore Spares	Offshore Spares Delivery	-	19.0	212.0	379.9
Fishing	Fishing	-	6.7	42.6	170.4
Aquaculture	Aquaculture	0.1	0.7	9.1	51.0
Ports, Coastal Authorities and Maritime Public Bodies					
Tugboat Operations	Tugboat Operations	-	16.5	94.6	217.6
Remote Pilotage	Remote Pilotage	-	0.5	15.1	167
Research, Oceanography and Environmental Science					
Research	All Research Applications	0.9	2.8	18.0	58.7
	Total (£m per annum):	**320**	**1,000**	**3,100**	**8,600**

[5] Dashes in this table represent areas where no perceived value from Maritime Autonomy is provided, effectively no current evidence of this application having been fulfilled in any capacity.

4.4.3.1.1 Aggregation of Growth Predictions

The most valuable output from this bottom-up approach is the potential for growth across the market. Summing for each horizon considered provided the following annualised CAGR:

- Short term - 0-5 Years: **26%**
- Medium term - 5-15 Years: **12%**
- Long term - 15-25 Years: **11%**

Note, the short-term projection is based on the estimation of £320 million in 2025, which is evidently not fully representative, demonstrating the limited selection of use cases. It remains useful to determine how the growth of the use cases considered might occur. In the following section, these predictions are used as a baseline to compare the outcomes of the scenarios against.

4.4.3.2 Alternative Growth Scenarios

Developed through qualitative workshops and insights from experts, and building on the detailed understanding of the market provided through the UK SWOT analysis (Section 6.3) five scenarios were developed to provide a qualitative insight into how certain triggers, both outside and inside UK Government control, may impact the growth of the market.

Proposed Scenarios:

A. Coordinated policy support unlocks accelerated export growth;
B. Defence-led accelerated growth amid geopolitical pressures;
C. Public scepticism and high-profile incidents slow adoption;
D. Regulatory caution drives testing abroad and a gradual domestic decline;
E. Capital constraints trigger foreign acquisition and value leakage.

Each scenario is described over the next few pages, in terms of triggers, dynamics and economic outcomes they may lead to.

The first three of these scenarios were further considered in terms of the impact this would have on the growth of each segment of the market. This selection aims to describe the range of economic impact possible, considering accelerated, recessive, and a potential market restructure. This will then give an indication of the potential upper and lower bounds in terms of market growth potential. The application of the scenarios aims to be illustrative of the potential ranges in growth expected from Maritime Autonomy and is not to be taken as forecasts for what is expected.

Throughout these scenarios, estimations for the growth over the defined time horizons are estimated.

Recommendation:

Refine and review scenarios and conduct full economic impact analysis to develop further understanding of outcomes from various triggers.

4.4.3.2.1 Scenario A: Coordinated Policy Support Unlocks Accelerated Export-Led Growth

The UK accelerates growth through clearer cross-government collaboration, stronger defence procurement signals, and leadership in international MASS standards, reducing regulatory friction and unlocking private investment. Defence creates a predictable source of demand, enabling UK companies to scale and export platforms, autonomy software and assurance services, embedding Maritime Autonomy across the supply chain and sustaining long-term growth.

Economic Impact: Improved market growth; revenue shared deeper into the supply chain sooner, stronger strategic position for export and skills growth.

Modelling Approach: This scenario represents various UK bodies providing coordinated policy and regulatory support around Maritime Autonomy. In practice, this could enable accelerated growth of both technology and direct adoption. To represent this, the adoption rate for Maritime Autonomy considered in each use case was moved forward by 1-5 years. Markets were assumed to grow as previously defined, just earlier. The impact of this can be seen in Table 3.

Table 3 Impact of Scenario A on growth compared to baseline

Scenario	Short-term growth (0-5 years)	Medium-term growth (5-15 years)	Long-term growth (15-25 years)	Comparative Market Value (to baseline) 2050
Baseline	26%	12%	11%	-
A	39.9%	9.2%	10.6%	32%

4.4.3.2.2 Scenario B: Defence-Led Acceleration Amid Geopolitical Pressure

Due to heightened geopolitical tensions and increased defence spending, demand for uncrewed and hybrid naval systems grows. International collaboration and sustained defence innovation funding accelerate technology maturity and reinforce UK capability and credibility. Defence demand supports rapid Technology Readiness Level (TRL) progression, with some indirect benefits into adjacent commercial and offshore energy markets. However, constrained public finances restrict civil adoption, resulting in an imbalanced outcome where defence-centric growth is strong but broader commercial and research markets develop more slowly, potentially leading to an overall similar market size.

Economic Impact: Defence market booms, with increased growth, but reduced growth in civil sectors, even where dual-use technology itself improves adoption. This reflects a market shift rather than a direct growth or reduction of the whole.

Modelling Approach: Several assumptions around each of the use cases were made:

- Defence market grows 20% faster, with a corresponding value increase from autonomy;
- Civil Security grows 10% faster, with a similar but lesser need for this market to grow;
- Dual-use technologies lead to commercial shipping adoption growing faster, but shipping overall growth is reduced, leading to only 1% additional growth;
- Reduced funding and interest in offshore capabilities lead to a 5% market reduction; meanwhile, fishing and aquaculture growth is constant;
- Political uncertainty leads to a 10% reduction to port related autonomy growth;
- International passenger travel reduces by 10% due to increased perceived risk, alongside a 20% reduction in Maritime Autonomy adoption as a lack of investment leads to difficulty in traversing regulatory barriers;
- Research investment is reduced due to a national investment shift, reducing market size by 20%, even whilst adoption maintains its trajectory.

The impact of these assumptions on growth can be seen in Table 4

Table 4 Impact of Scenario B on growth compared to baseline

Scenario	Short-term growth (0-5 years)	Medium-term growth (5-15 years)	Long-term growth (15-25 years)	Comparative Market Value (to baseline) 2050
Baseline	26%	12%	11%	-
B	29.0%	11.2%	10.3%	3%

4.4.3.2.3 Scenario C: Public Scepticism and High-Profile Incidents Slow Adoption

Market growth stalls after a high-profile incident undermines public and insurer confidence. Tighter regulation, higher insurance costs and paused trials deter investment, while approvals become harder to secure. Defence and surveying persist, but broader commercial adoption slows, constraining skills development and driving talent and capability overseas.

Economic Impact: Growth stalls and is delayed; after a period of recovery, growth may begin again, but at a reduced rate initially. This may be experienced internationally depending on the scale of the impact, in which case the UK is not inherently in a worse position. The value of the market potentially is reduced even in the long-term and beyond.

Modelling Approach: A high-profile incident occurs, alongside existing scepticism, providing a barrier to growth for several Maritime Autonomy applications for a period of potentially 10 years as the industry recovers trust; after which growth can continue either as expected, or at a reduced rate, depending on how public facing it is.

- Defence investment and growth are maintained, the Hybrid Navy concept is less likely to be impacted by such an incident, Civil Security is slowed by 20% for the next 10 years as the regulatory environment provides temporary friction;
- Passenger Transport, Fishing, and Port operation autonomy market growth is delayed by ~10 years, after which adoption is half as fast;
- Research applications reduced by 10% initially, with a couple of per cent reduction over a longer time scale;
- Offshore Wind sees 50% reduction in the rate of adoption in any large autonomous vessel (spares delivery, crew transfer vessels, etc.), but only 5% for inspection activities.

Making these assumptions, Scenario C can be modelled, giving the growth in Table 5.

Table 5 Impact of Scenario C on growth compared to baseline

Scenario	Short-term growth (0-5 years)	Medium-term growth (5-15 years)	Long-term growth (15-25 years)	Comparative Market Value (to baseline) 2050
Baseline	26%	12%	11%	-
C	16.1%	11.6%	8.6%	-46%

4.4.3.2.4 Scenario D: Regulatory Caution Drives Testing Abroad and Gradual Domestic Decline

Slower legislative reform and sustained regulatory caution stall progress. Companies shift testing and early deployment overseas, domestic infrastructure and skills are underused, and SMEs struggle to grow. While regulatory credibility remains, commercial leadership and export momentum erode, increasing import dependence and leaving the UK in a reactive market position.

Economic Impact: Increased import requirement and minimised UK strength with lower revenue and potentially declining sovereign gross value add.

4.4.3.2.5 Scenario E: Capital Constraints Trigger Foreign Acquisition and Value Leakage

Persistent finance gaps and weak procurement signals undermine investor confidence and constrain growth. Better-funded international competitors outpace UK SMEs, driving downsizing, overseas acquisition, and the loss of Intellectual Property (IP) and talent. Despite strong early-stage research, ownership of growing companies erodes, weakening sovereign capability, industrial resilience and long-term competitiveness, and leaving the UK market growing slowly and internationally disadvantaged.

Economic Impact: Lower growth in the UK, international competition grows rapidly, leaving the UK's position weak. Supply market and trials infrastructure are affected as well, restricting growth across the UK with links into Maritime Autonomy.

Recommendation:

With a larger use case set, review these scenarios in more detail, considering further the impact of variables on more nuanced and varied use cases.

4.4.4 Collated Market Projections

Projecting future growth in the Maritime Autonomy market is challenging due to the complexity of all the interlocking segments, which span multiple unique markets, from commercial shipping, defence and offshore wind to research and environmental monitoring. Moreover, the market is still at an early stage of development; technologies and commercial applications are rapidly evolving, and the regulatory and policy frameworks are still being established. While detailed use-case analyses, including scenario modelling, have been carried out, the future market-size projections below draw on a combination of methods to produce credible estimates. Historical growth trends provide a baseline for how the market has evolved, the use-case analyses inform plausible segment-specific trajectories, and insights from adjacent markets, such as drones and autonomous vehicles, offer additional context for technology adoption and commercial expansion. Combining these factors allows us to generate three growth trajectories that are grounded in evidence, structured analysis, and comparable market analogues.

Table 6: Summary of the different GVA growth trajectories modelled, CAGR

Growth projections	Short-term growth (0-5 years)	Medium-term growth (5-15 years)	Long-term growth (15-25 years)
Conservative	15%	10%	5%
Central	25%	14%	8%
High	34%	18%	12%

These growth rates have been calibrated based on a variety of qualitative and quantitative evidence sources, as summarised above and detailed in Annex C.

Employment growth is assumed to follow the same relative profiles as for market output growth but at a lower rate. This reflects the slower rate of historical employment growth relative to output growth, both in the maritime autonomy sector and the wider economy. To arrive at an equivalent set of employment growth trajectories we apply the historical elasticity of employment to real GVA growth (inflation-adjusted) calculated using Maritime Autonomy market data for 2020-2022. Over this period, employment growth averaged approximately 0.68 of GVA growth.

Table 7: Summary of annual employment projections used in different growth trajectories, CAGR

Growth cases	Short-term growth (0-5 years)	Medium-term growth (5-15 years)	Long-term growth (15-25 years)
Conservative	8%	5%	2%
Central	15%	8%	4%
High	21%	11%	7%

The central case reflects the baseline growth trajectory derived from the combination of historical trends, adjacent segments benchmarking and qualitative market evidence.

The conservative and high-growth cases are developed by adjusting growth rates around this central trajectory to reflect different assumptions about:

- The pace of technological development;
- Regulatory and policy support;
- Investment levels and private-sector adoption;
- The speed of commercial deployment across maritime industries.

Under the conservative case, growth moderates earlier as adoption progresses more gradually and regulatory or investment barriers slow market expansion. Under the high-growth case, stronger technological advancements, policy support and commercial demand lead to more rapid scaling during the early adoption phase.

Applying these growth trajectories to the current market baseline suggests that the Maritime Autonomy market in the UK could reach:

- Central case – £10.7 billion in turnover, £3.7 billion in GVA and 11,200 in jobs by 2040 in nominal terms; £24.0 billion in turnover, £8.3 billion in GVA and 17,010 jobs by 2050 in the central case, which represents a realistic trajectory under moderate adoption, technological maturity, and supportive regulation.
- High-growth case - assume that technology adoption accelerates, and market and regulatory conditions are highly favourable, demand grows rapidly and no major bottlenecks or barriers impede progress. Under these conditions, the market could fully unlock its potential, realising up to £25.4 billion in turnover, £8.7 billion in GVA and 20,830 jobs by 2040, and expanding to £77.0 billion in turnover, £26.5 billion in GVA and 39,200 jobs by 2050. This growth trajectory highlights the market's substantial economic upside, reflecting the transformative impact of maritime autonomous technologies on trade, operational efficiency and new market opportunities.

- Conservative case - conversely, slower adoption or persistent barriers could result in a more constrained outcome, with turnover and GVA reaching £4.3 billion and £1.5 billion respectively by 2040, and £7.0 billion and £2.4 billion in turnover and GVA by 2050.

This range illustrates both the risks and the potential opportunity cost of delayed development. Figure 6 shows the Projected GVA for the Maritime Autonomy market in the UK under the different growth trajectories.

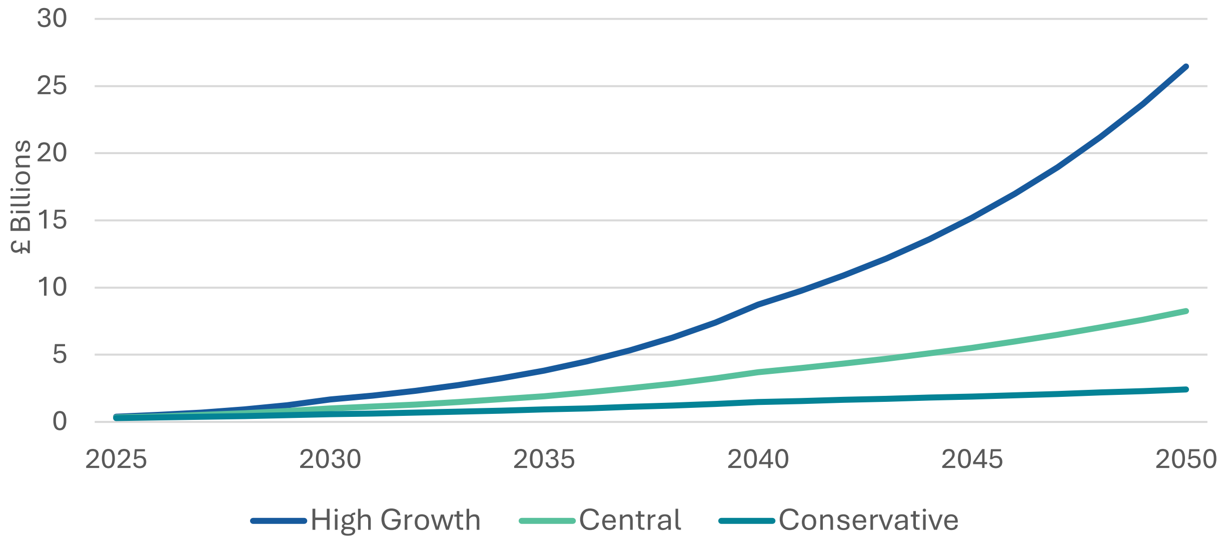

Figure 5 - Projected GVA under the different growth trajectories (nominal prices).

Recommendations:

- Develop a formal scenario library with parameter sensitivities (e.g. defence spend bands, assurance pathway maturity, offshore build-out pace).
- Upon the release of the Defence Investment Plan (DIP) and future maritime regulatory initiative, re-investigate the forward look completed here.

5 Cross-Cutting Drivers, Risks and Enablers of Growth

5.1 Chapter Overview

This chapter sets out the key drivers, enablers and system conditions that will shape how the UK Maritime Autonomy market develops, and where the greatest opportunities exist to accelerate growth and value capture.

- Demand for Maritime Autonomy is being driven by structural, long-term needs across defence modernisation, offshore energy operations, critical national infrastructure protection and persistent maritime awareness.
- Defence provides a powerful early anchor market, accelerating technology maturity, building operational credibility and creating exportable reference cases.
- Offshore energy, subsea infrastructure and public maritime services offer repeatable, scalable demand, where autonomy delivers clear safety, cost and workforce resilience benefits as operations move further offshore.
- Regulatory clarity, proportionate assurance pathways and access to real-world testing environments act as high-leverage enablers, unlocking private investment, accelerating adoption and improving export readiness.
- Where these enablers are aligned, the UK is well positioned to convert strong technical capability into domestic deployment and international market share.
- Capital availability remains uneven but is increasingly attracted where demand signals, assurance maturity and service-based operating models reduce risk and improve revenue visibility.
- International competition is intensifying, reinforcing the importance of early domestic adoption as a means of securing learning curves, reference customers and long-term value retention.
- Sovereign advantage increasingly sits in autonomy software, remote operations, assurance, system integration and in some cases, vessel build opportunities, areas where the UK already demonstrates strong capability and global credibility.
- Public trust, insurance confidence and safety performance will shape the pace of visible commercial adoption, making assurance and transparency enablers of scale, not barriers.
- Overall, the UK's growth trajectory is highly responsive to coordination across policy, regulation, procurement and finance, with relatively small interventions capable of delivering disproportionate market impact.

5.2 Demand Drivers

Across offshore renewables, energy security concerns remain a long-term demand source despite near-term volatility. Offshore wind has experienced delays and cancellations, particularly in the US, driven by inflationary pressures, policy reversals and supply-chain constraints. This has softened near-term survey and inspection activity that traditionally underpins USV and Autonomous Underwater Vehicle (AUV) demand. However, European political momentum around energy independence is re-emerging as a counterweight. Commitments such as the Hamburg Declaration signal a return to scale over the medium to long term [7], with sustained seabed survey, cable inspection and environmental monitoring requirements. While vessel availability, manufacturing capacity and grid build-out remain constraining factors, the underlying workload profile remains structurally supportive of autonomous operations.

In oil and gas, particularly within the UK Continental Shelf, the dominant driver is not growth but obligation. Rising decommissioning activity, driven by ageing assets and regulatory pressure to accelerate well plug and abandonment, supports inspection, survey and monitoring demand. However, the character of this work differs from many current autonomy system concepts. Much of the value is tied to heavy construction, intervention and tax-linked cost recovery, limiting the extent to which autonomy directly displaces crewed operations. That said, demographic pressures in the offshore workforce and safety considerations are emerging as indirect demand drivers. Autonomy increasingly features not only as a cost lever, but as part of a broader workforce and skills narrative, including its potential role in attracting and retaining a different group of talent.

Security and Critical National Infrastructure concerns represent a distinct and growing demand area. Heightened awareness of vulnerabilities in subsea cables, pipelines and offshore assets has reframed Maritime Autonomy as an enabling layer for persistent awareness rather than episodic intervention. The scale of undersea infrastructure challenges conventional defence concepts: thousands of kilometres of assets cannot credibly be “defended” through continuous vessel presence alone. This shifts the approach towards low-cost, distributed sensing and Maritime domain awareness, with autonomy embedded as part of a wider system-of-systems. Demand is therefore likely to increase, in a variety of forms that emphasise sensor deployment, maintenance and data integration.

Defence policy provides the clearest near-term acceleration signal [8]. The Royal Navy’s “Hybrid Navy” programme, with uncrewed systems deployed wherever possible, positions autonomy as a core operational capability rather than an addition [9]. In parallel, defence industrial policy is expected to increasingly treat autonomy as both a sovereign capability concern and a dual-use growth area, reinforcing defence’s role as a core customer capable of de-risking earlier-stage solutions and accelerating technology readiness.

5.3 Enablers and Constraints

Governance and regulation emerge as decisive enablers or inhibitors across all scenarios. Where coordinated policy support improves, through clearer ownership across departments and more predictable procurement pipelines, regulatory friction will reduce, and investor confidence will improve. Through this, the UK’s role as a hub of assurance, testing and certification will be reinforced. Persistent regulatory caution, even when grounded in high safety standards, risks displacing the testing, early deployment and value creation overseas. In this case, the capability may remain strong, but economic capture and scaling weaken.

Technology readiness is advancing unevenly. In commercial markets, most operations remain remotely controlled, with autonomy constrained by legal, assurance and insurance frameworks. Defence is moving faster, using mission context and risk tolerance to justify more ambitious autonomy concepts. Operationally, practical constraints such as technological integration, launch and recovery systems, and wider operation environment considerations (e.g. weather and sea state) continue to define the commercial interest. Narrow, single-purpose platforms struggle to maintain utilisation, while overly flexible designs risk cost and complexity creep. As a result, operating models, logistics, and the maturity of spot charter markets are as influential as vehicle performance itself.

Within the current regulatory environment, trials and testing, and correspondingly demonstration, are challenges to complete, both in overcoming regulatory hurdles and the financial burden of developing high TRL systems to trial lower readiness systems. As such, demonstrations are also reduced, which constrains operator buy-in and subsequent purchase of systems. This effect can compound, either stopping development dead or, at least, increasing the financial and time costs to reach final production and delivery of vessels.

Sovereignty considerations are evolving, but they are not shifting away from platforms. Vessel build capability remains a critical element of UK sovereignty, particularly in the context of supply-chain resilience, industrial skills retention, and the sustainment of larger and more complex platforms required for operations in demanding environments such as the North Atlantic. While elements of the smaller vessel market may exhibit characteristics of commoditisation, this does not remove the strategic importance of maintaining domestic build, integration, and sustainment capability across key classes of vessels.

Alongside this enduring platform requirement, the cognitive and information layers - mission logic, autonomy software, data architectures, cyber resilience, command and control, and upgrade pathways - are emerging as distinct and increasingly decisive sovereignty considerations. These layers represent different industrial dynamics, development cycles, and risk profiles to hull build alone, and require parallel attention. Therefore, ensuring sovereignty spans both physical platforms and the autonomy systems they host. This layered approach creates opportunities for UK value capture even where elements of platform manufacture are sourced internationally, but it also increases the importance of managing intellectual property, assurance, and long-term control across the full system lifecycle.

5.4 Systemic Risks

Several risks cut across the market and sectors it spans. Capital constraints remain a persistent vulnerability, particularly for scale-up companies facing long procurement timelines and uncertain demand signals. In this environment, foreign acquisition becomes a rational survival strategy, but one that risks long-term value leakage, erosion of sovereign capability and reduced industrial resilience.

Public trust and the social licence represent another non-linear risk. A high-profile accident or cyber incident could trigger regulatory retrenchment, higher insurance costs and delayed adoption, particularly for visible commercial applications. While defence and niche survey use cases may remain resilient due to their unique capability advantages, broader market growth could slow materially, with skills and talent migrating to more permissive jurisdictions.

The question of sovereignty remains, and without a clear plan to build sovereign capability within Maritime Autonomy, there is a risk for industry to prioritise other nations with clearer intentions and support. This could have a two-fold impact: UK positioning weakened, with a simultaneous risk to integrating and deploying sovereign systems, either due to lack of availability of systems outright, or with limited control over the assurance of the systems. Either way, the UK will need to manage sovereignty as a core tenet of future planning to enable ongoing strength within the market.

Finally, geopolitical pressure creates both opportunity and imbalance. Defence-led acceleration can rapidly raise technology readiness and export credibility, but risks reducing available investment for civil markets if public finances tighten and regulatory reform lags. The result may be uneven growth, concentrated in defence-aligned companies and applications.

5.5 The Future Growth of Maritime Autonomy in Defence

With naval operations and investment representing a large component of the future Maritime Autonomy market, describing how Defence may grow - through insight built around the future capabilities expected and the cost to deliver these - is deemed a useful context builder and has been included here.

5.5.1 Hybrid Navy

The First Sea Lord and the Royal Navy (RN) have announced a strategic pivot away from traditional complex warships and towards a 'Hybrid Navy'. Following a mantra of 'uncrewed where possible; crewed where necessary', they intend to build a Force that combines traditional crewed warships with large numbers of autonomous and remotely operated systems, all connected by digital networks and AI. By doing so, the RN can, it is argued, regain combat mass and advantage against peer adversaries (especially Russia) despite limited ship numbers and workforce.

This means that a significant proportion of the RN budget for both readiness and investment will be dedicated to Maritime Autonomy in the coming years. There are four key programmes (covered in the next sections) in this initiative.

The Royal Navy's Hybrid Navy agenda also has the potential to act as a pathfinder for allied naval hybridisation, particularly across European fleets facing similar workforce constraints and a shared North Atlantic operating context. If the RN is seen to translate concepts into deployable, interoperable capability - supported by rapid experimentation, open architectures and assurance - this can create strong export pull-through for UK industry, not only in platforms but in the enabling layers (integration, test & evaluation, assurance, command-and-control and digital infrastructure). This aligns with the RN's stated intent to engage industry around interoperable systems and rapid experimentation, and to help build an export-oriented industrial base.

5.5.2 Minehunting

The RN's Minehunting Capability (MHC) programme is well established and now into its 'Block 2' procurement. The MHC programme is replacing the RN's mine countermeasures vessels with Uncrewed Service Vessels (USVs) and Uncrewed Underwater Vessels (UUVs), supported by lean-crewed support ships, dedicated to the deployment, operation and support of these Maritime Autonomy systems. The programme is expected to spend ~£2bn over the next 10 years. The technology used is also anticipated to be readily adaptable for other roles that involve large-scale underwater survey such as seabed warfare and hydrography. Given these wider use cases, the MHC spend is likely to be a conservative estimate, which also does not consider export opportunities for this Maritime Autonomy use case. Export opportunities are likely to be significant, given the prolific use of mines in the Black Sea and elsewhere in conflicts. Even if current conflicts were to cease soon, the work of clearing such mines will take years and will require significant investment. Opportunities to increase the efficiency and effectiveness of such work are likely to mean greater adoption of Maritime Autonomy in mine countermeasures activities in the coming years. Such existing and proven use cases are forecast to double in the next 3-5 years.

The other three Hybrid Navy initiatives are more conceptual, and their funding is subject to the resolution of the Defence Investment Plan (DIP). Nonetheless, the intended direction of travel is clear, and inferences can be made from the existing known equipment programme as to likely levels of investment needed.

5.5.3 Atlantic Bastion

This is the RN's concept for building a persistent surveillance network across the North Atlantic. It combines submarines, Maritime patrol aircraft, ships, seabed sensors, satellites, and autonomous vehicles to detect and track hostile submarines and vessels. The aim is to create a wide "web" of sensors that can identify threats (particularly Russian submarines) much earlier than traditional patrol methods.

The concept relies heavily on uncrewed systems such as underwater drones and autonomous surface vessels to extend the reach of traditional assets like the Boeing P-8 Poseidon and the Type 26 frigate. By networking all these sensors together, the RN hopes to maintain near-continuous awareness of activity in the Atlantic approaches to the UK.

The concept is being tested by the Atlantic Net project, where the RN seeks to buy underwater ISR as a service from commercial providers using commercially operated capabilities, with an initial capability provided by the end of 2026. The funding for Atlantic Net and Atlantic Bastion is yet to be determined, but to meet the ambitious scale and timelines will require £1-2bn over the coming decade.

5.5.4 Atlantic Shield

This programme is intended to provide maritime integrated air and missile defence for the North Atlantic area, and for UK and NATO maritime task groups. It is the re-conceptualisation of the Future Air Dominance System (FADS) programme that was centred around the Type 83 destroyer.

Given the intention to move away from complex warships, the new programme is designed to adopt a system-of-systems approach where sensors, command and control capability, and weapons systems will be disaggregated across more numerous and cheaper vessels. The intention is that the sensor and weapons vessels will be uncrewed ships.

As such, this programme can be conceived as comprising a significant proportion of Maritime Autonomy technologies, perhaps 25-30% of the overall programme. The likely overall cost of the programme has been estimated at ~£15bn. This gives rise to an estimate of £3.5-4bn for the Maritime Autonomy elements.

5.5.5 Atlantic Strike

This concept provides the means to strike adversaries at range and ‘hold them at risk’. It will include long-range missiles, hypersonics, one-way effectors and uncrewed air vehicles integrated into carrier strike groups. Given the nature of this concept, little of it will be classified as Maritime Autonomy, even though USVs such as those of Atlantic Shield may well host some of the weapons. It can be considered that such platforms are accounted for in the Atlantic Shield cost/budget calculations.

5.5.6 Summary

Overall, it can be surmised that the UK Maritime Defence element of the Maritime Autonomy market in the coming decade could aggregate to c£7bn if all the RN’s requirements are to be met. This estimate includes predominantly acquisition costs and does not account, in general, for in-service support, e.g. maintenance and logistics.

Also to be considered is the volume of increased data services that will be required to transmit, store, process and analyse the data associated with the hybrid navy, which will be orders of magnitude greater than that currently managed by the Royal Navy.

5.6 Underlying AI Technology

While this study focuses on Maritime-specific drivers of autonomy adoption, it is important to recognise that many of the most significant enabling technologies (particularly large-scale AI models, advanced perception systems, and high-performance computing hardware) are developed outside the Maritime sector, primarily by large international technology companies. These global advancements are likely to influence Maritime Autonomy capability far more rapidly than sector-specific innovation alone. Their evolution may affect the pace, feasibility, and nature of adoption across multiple use cases, and could materially alter UK competitiveness given the currently limited domestic role in developing frontier-level AI or compute infrastructure.

The scenarios and forecasts in this study, therefore, do not attempt to predict the broader trajectory of general AI development (including potential emergence of Artificial General Intelligence or self-improving AI systems), or its influence, but it is recognised that these trends could accelerate capability and reshape future market dynamics.

Recommendation:

Future work should examine how advancements in core enabling technologies (particularly frontier AI models, high-performance computing, and AI-enabled connectivity systems (e.g. satellite constellations)) could alter Maritime Autonomy trajectories. This should include an assessment of the UK's position within the global AI and compute ecosystem, potential dependencies on non-UK providers, and implications for resilience, competitiveness, and capability development across Maritime sectors.

5.7 Export, Import and International Competition

The global market for Maritime Autonomy is expanding rapidly, driven by accelerating defence modernisation programmes, large-scale offshore wind deployment, growth in subsea infrastructure, and the digitalisation of commercial shipping. Asia-Pacific currently leads in adoption and industrialisation, with Europe and North America also emerging as major markets. Against this backdrop, the UK faces both significant export opportunities and intensifying competitive pressures.

5.7.1 Global Market Outlook

International demand for Maritime Autonomy is expected to grow sharply to 2030 as navies expand uncrewed capabilities, offshore wind scales to multi-gigawatt deployments, and shipping companies adopt autonomy-enabled operational efficiency technologies. Based on global growth trajectories, the UK is well-positioned to capture approximately 10% of the global Maritime Autonomy market by 2030 [6], equivalent to a potential £8-12 billion annual opportunity, provided that investment, regulation and commercial adoption continue to develop favourably.

5.7.2 Import Competition and International Entrants

The competitive landscape is becoming more challenging. UK operators increasingly face import competition from well-funded international companies - notably Ukrainian and US companies - which are entering UK waters and wider European markets with strong venture-backed financing and large-scale operational experience. This competition is particularly visible in survey, inspection and persistent uncrewed monitoring.

Meanwhile, state-backed investments in autonomy in China, Japan, Norway and France continue to accelerate, with each nation deploying strategic programmes to support domestic industry, develop test infrastructure and scale export-ready systems.

UK companies face the risk that, without regulatory clarity and competitive test range access, these international organisations could continue to establish early dominance within the UK in high-value commercial segments, including offshore energy and maritime security.

Moreover, the threat of new entrants of foreign uncrewed platforms into UK domestic markets (operating in UK waters) represents a growing form of competition. If overseas companies establish operational dominance in the UK offshore energy and survey markets, UK suppliers risk losing essential home-market reference cases, learning cycles and economies of scale. This has direct implications for sovereign capability: without a healthy domestic customer base, the UK's ability to sustain independent autonomy development, maintain control of critical technologies and build export-ready systems will erode.

5.7.3 UK Export Position and Defence Competitiveness

Recent UK defence export performance suggests a strong foundation on which Maritime Autonomy could be built. The UK secured £13.2 billion in defence export orders in 2024, reflecting a 10.4% growth on the previous year, with Europe emerging as the UK's largest export market for defence capability. This broader export strength is reinforced by longer-term trends: UK defence exports averaged £9.3 billion annually between 2020 and 2024, with Europe representing 38.4% of total export orders over that period [10].

These indicators suggest an international appetite for high-quality UK-developed defence technology - an advantage that the UK Maritime Autonomy market can leverage if supported by comparable procurement signals and export-readiness programmes.

5.7.4 UK Export Strengths in Maritime Autonomy

Despite intensifying competition, the UK retains strong export potential in high-value, high-assurance applications where it already possesses deep capability:

- Autonomous MCM systems, building on the Royal Navy's leadership in uncrewed MCM deployments;
- Hybrid naval platforms, mission systems and autonomy-enabled support vessels - particularly where these support allied European fleet hybridisation and North Atlantic operating requirements;
- Subsea robotics and inspection technologies, a long-standing UK speciality;
- Autonomy and AI decision-support software, including navigation, perception and mission-management systems;
- ROC architectures, digital control rooms and integrated assurance services.

These export-oriented applications are expected to comprise an increasingly material share of the UK's Maritime Autonomy economic opportunity over the next decade.

5.7.5 Hybrid Navy as an Export Engine

The RN's Hybrid Navy agenda can also act as a reference customer and validation pathway for European fleet hybridisation. In practical terms, this can convert domestic capability development into export traction by:

- Providing credible reference cases (operational deployments, sustainment models, safety/assurance artefacts) that de-risk allied adoption;
- Demonstrating interoperability and open architectures, enabling allies to plug into mission systems and C2 patterns with reduced integration risk;
- Establishing repeatable test, evaluation and certification approaches, which can be exported as services alongside products; and,
- Packaging capability as "systems + services" (ROC architectures, mission management, cyber hardening, training and operational support), rather than relying solely on platform sales.

5.7.6 Strategic Challenges and UK Policy Context

To remain internationally competitive, the UK must address several structural risks:

- Regulatory clarity and validation speed: Operators and foreign investors increasingly benchmark nations by how quickly systems can be tested, assured and commercially deployed;
- Availability of test ranges/sandboxes and infrastructure: Nations such as Norway, Singapore and Japan are using well-defined testbeds to attract foreign companies; the UK must ensure Smart Sound Plymouth (amongst other National Centre for Maritime Autonomy facilities), Solent waters, British Underwater Test and Evaluation Centre (BUTEC) and emerging ranges offer globally competitive access;
- Capital intensity and foreign funding dynamics: International competitors (particularly in the US, Asia-Pacific and Eastern Europe) benefit from far larger venture capital scale, sovereign investment funds or defence-led acceleration programmes than those historically available in the UK.

These competitive and regulatory pressures also have important implications for sovereignty. Where the regulatory ecosystem is overly cautious or slow to enable testing, assurance, and deployment, domestic Maritime Autonomy development risks falling behind international competitors. Over time, this can result in UK operators and government becoming increasingly dependent on foreign-developed systems, expertise, and infrastructure, eroding sovereign capability by default rather than by strategic choice.

In this context, clarity is needed not to inform regulators directly, but to guide wider policy and industrial strategy on which elements of Maritime Autonomy the UK should actively retain and grow domestically. This includes identifying those capabilities where sustained domestic development is critical to long-term sovereign freedom of action.

These might include[6]:

- Sovereign command-and-control and ROC infrastructure;
- Sovereign autonomy software and mission-system integration expertise;

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[6] This is not intended to define or prescribe a formal sovereignty position, but to illustrate the types of capability areas that are commonly cited in wider policy and industry discussions.

- Sovereign test, evaluation and assurance frameworks; and,
- Assured ability to deploy uncrewed systems for defence, offshore energy security and marine monitoring.

While platform manufacturing could be globally distributed[7], the aspects mentioned above might be considered to underpin sovereign freedom of action and must be protected against over-reliance on foreign suppliers. Further work on defining and prioritising sovereign elements of maritime autonomy is ongoing elsewhere, including within government, and sits beyond the scope of this study. The intent here is to signal the strategic relevance of domestic capability retention, rather than to set policy.

5.7.7 Summary

The UK enters the international Maritime Autonomy market from a position of strength - supported by strong defence export performance, world-class subsea robotics capability, and emerging leadership in autonomy assurance. However, the market now faces a decisive moment: global competitors are scaling faster, investing more heavily, and increasingly entering UK operational waters with highly capable platforms.

If the UK can combine regulatory reform, test-range competitiveness, and targeted support for export-ready products, it can secure a meaningful share of the fast-growing global market. Without coordinated action, international competition - particularly from heavily funded Ukrainian, US, and state-backed Asian and European organisations - may erode the UK's ability to convert early technical leadership into long-term global market share.

Sustaining sovereign capability will be central to preserving the UK's strategic freedom of action. Export competitiveness and sovereignty are interdependent: nations that lead in domestic deployment, regulatory clarity and sovereign control of critical autonomy technologies will also lead in the global market.

In addition, the Hybrid Navy direction can generate secondary export value if RN programmes are used to demonstrate repeatable operating models, assurance approaches, and interoperable reference architectures that allied European navies can adopt. This would amplify UK export prospects in autonomy software, integration services, test & evaluation and digital infrastructure - areas already highlighted as growth opportunities linked to international programme expansion and market access.

[7] This comment is not intended to signify that Platform manufacture should be non-sovereign, instead that isolating platform and the autonomy aspects listed enables sovereignty and manufacture to be considered in parallel between the components of vessels.

Recommendations:

- Commission a dedicated export study using HMRC trade codes, company-level surveys and comparator market analysis to quantify UK export share.
- Accelerate development of consistent MASS approval routes, operational permissions and internationally recognised assurance frameworks.
- Ensure UK test ranges (including Smart Sound Plymouth, Solent waters, BUTEC and others) operate as globally competitive environments.
- Introduce dedicated export accelerators, buyer engagement programmes and early-market entry support for autonomy companies.
- Prioritise support for segments where the UK can lead globally to hold ground against US, Ukrainian and Asian competitors.
- Align MOD, DBT, DfT, NSO, MCA, DSIT and offshore energy directorates to ensure a coherent Maritime Autonomy export strategy.
- Leverage the UK's defence export performance to position Maritime Autonomy as a complementary high-technology offering in allied procurement programmes.
- Champion UK-developed assurance frameworks (e.g. MAAT) in international forums such as the IMO and NATO.
- Build an understanding of the challenges and opportunities presented by foreign investment into the UK domestic maritime autonomy market.
- Pursue bilateral and multilateral cooperation, particularly in Europe, to embed UK autonomy technologies in shared capability programmes.

5.8 Access to Finance, Capital Flows and Investment Dynamics

Access to finance (from both public and private sources) is a critical enabler of growth within the UK Maritime Autonomy market. Capital availability shapes the pace of technology development, the ability of companies to scale, the extent of export readiness, and ultimately the rate at which autonomous and remotely operated solutions can achieve widespread adoption. The structure of capital flows, and the distribution of risk across those flows, is therefore a defining feature of the UK's competitive position.

This section reviews the current UK financing landscape, identifies structural constraints, and outlines how investment patterns are expected to evolve as the market matures.

5.8.1 Current Access to Finance Landscape

The Maritime Autonomy market sits at the intersection of defence, commercial Maritime operations and emerging technology. This results in a non-standard investment profile, shaped by the following characteristics:

- Long project and procurement cycles, particularly where defence programmes dominate, with timelines often extending from several years to decades;
- High assurance requirements and a perception of regulatory complexity, creating uncertainty around development timelines, cost of certification and time-to-market;

- Dual-use potential, where opportunities span both commercial and defence markets. While this broadens commercial scope, it complicates funding pathways, as companies must navigate different procurement cultures, testing regimes and customer expectations;
- Fragmented early-stage market structure, with SMEs, start-ups and multinational primes all developing heterogeneous and often non-interoperable solutions. Many products remain at the prototype stage, with limited demonstration of validated business value, weakening investor confidence relative to more mature crewed systems.

Where companies have secured commercial traction or defence deployment, investment appetite increases substantially - underscoring the importance of demonstrators, early procurement and visible end-user adoption.

5.8.1.1 Public Investment

Public investment has been a major driver of capability development in the UK to date, flowing through a wide range of defence, innovation and regional interventions:

- Defence investment, led by MOD / DE&S acquisition pathways (notably Intelligence Surveillance and Reconnaissance (ISR), Mine Counter Measures (MCM)) and advanced development programmes), remains one of the most significant revenue channels for UK autonomy companies [8];
- Innovation grants and accelerators - UKRI, Innovate UK, Defence and Security Accelerator (DASA) and others - have supported early development, prototyping and demonstration [11]. The UK Shipping Office for Reducing Emissions (UK SHORE), which allocated £240m since 2022 and proposes a further £448m for 2026-2030, has played a substantial enabling role, even where awards do not focus exclusively on autonomy [12];
- Regional growth vehicles, including Freeports, Local Growth Funds and Local Enterprise Partnerships (LEP) linked programmes, have contributed to cluster development and infrastructure upgrades [13];
- Targeted interventions from strategic public/private bodies, such as The Crown Estate's funding into offshore wind supply chain decarbonisation, increasingly incorporate autonomous operations and uncrewed systems.

Therefore, Public investment continues to play a disproportionately important role in early-stage product development, testing and demonstration across the UK.

5.8.1.2 Private Investment

Private investment is an increasingly important component of the UK funding mix, although the market remains uneven:

- A growing cohort of UK-based early-stage funds - specialising in robotics, 'deep tech' and marine and maritime technologies - support pre-seed and seed-stage investment, enabling early prototyping;
- Strategic investment from defence primes (UK and international) is increasing, particularly for niche technologies aligned with mission-specific use-cases;
- Corporate venture activity from offshore energy companies, subsea engineering companies and global logistics operators is emerging, with potential for rapid value capture through vertical integration;

- Institutional investor participation remains limited, reflecting market immaturity, regulatory uncertainty and the lack of consistent, predictable revenue streams.

The result is a landscape where individual companies may secure substantial public grants or strategic corporate investment, yet capital availability remains inconsistent, particularly at later growth stages. This often leads to a proliferation of prototypes and early demonstrators, but fewer pathways to scale or export.

By comparison, the US Venture Capital (VC) ecosystem typically deploys larger, faster investments into autonomy and dual-use robotics, creating a relative scale disadvantage for UK SMEs unless procurement-led revenues, strategic investors and assurance-backed finance (e.g. MAAT) narrow the perceived risk gap.

5.8.2 Investment Conditions Shaping Growth Trajectories

This section does not seek to provide a comprehensive assessment of barriers to Maritime Autonomy adoption, recognising that these issues are well covered in existing literature and prior studies. Instead, it focuses on the specific investment and finance-related constraints that most directly influence the growth trajectories modelled in Section 4, shaping the pace, scale, and timing of market development across the scenarios presented.

The UK's relatively risk-averse venture environment, combined with global capital reallocation toward AI, is constraining the availability of early-growth finance for Maritime Autonomy and increasing SME vulnerability. Many UK SMEs remain dependent on primes' cash flow and short-cycle public funding, which makes scaling difficult and heightens exposure to market shocks. These financial constraints amplify perceived market risk for investors and limit the ability of smaller companies to carry autonomy capability forward between programmes.

Partnerships are central to scaling UK Maritime Autonomy, but poorly structured arrangements can create long-term vendor lock-in around autonomy software, data or ROC infrastructure, which may depress investor confidence and constrain sovereign freedom of action. An investable sovereign position, therefore, depends less on UK content and more on UK control of the 'cognitive layer' - autonomy software, mission logic, ROC operations and assurance; this aligns with industry feedback that the UK should be sovereign where it matters while remaining globally integrated where it does not.

Across industry engagement and expert assessment undertaken as part of this study, a consistent set of investment-relevant constraints emerges. These do not act as absolute blockers, but as conditioning factors that materially influence growth outcomes:

- Regulatory uncertainty - including assurance, certification and operational approvals - which inhibits confidence in timelines for commercial deployment and hence delays investment;
- Limited procurement clarity, particularly for dual-use systems, with few long-term frameworks that provide predictable demand signals required to support scale-up investment;
- Dominance of early-stage companies, many lacking collateral, customer track records or multi-year revenue, limiting access to growth capital;
- High CapEx requirements for physical hardware, testing and certification, which compare unfavourably with faster-moving, higher-return classes such as pure software or AI outside the maritime industry;
- Low familiarity among mainstream investors, who often view maritime autonomy as an emerging, unproven class with limited comparable market precedents;

- Regional imbalances in access to specialist investors, with coastal clusters relying on disparate networks for growth capital;
- UK VC risk-aversion and AI ‘crowd-out’: A comparatively risk-averse UK VC landscape, coupled with global reallocation of capital toward generic AI, reduces available funding for maritime autonomy and increases SME vulnerability;
- SME cash-flow exposure: SMEs remain dependent on primes’ payment cycles and episodic public grants, creating revenue volatility between pilots and scale-up.

These constraints disproportionately affect SMEs, despite SMEs remaining the primary source of innovation, intellectual property generation and early-stage capability within the UK Maritime Autonomy ecosystem. In combination, they help explain the sensitivity of long-term growth outcomes to policy coordination, procurement visibility and investment confidence, as reflected in the scenario analysis in Section 4.

5.8.3 Structural Shifts in Market Finance and Business Model

As the market matures, several structural shifts are expected to reshape capital flows:

- Shift from grant-led to procurement-led growth, with greater reliance on repeatable government and industry purchasing frameworks. This reduces risk profiles and increases investability;
- Expansion of service-based models such as Autonomy-as-a-Service, Remote Operations-as-a-Service and Survey-as-a-Service. These can generate predictable cash flows attractive to investors and better align with operational preferences in ports, offshore energy and defence;
- Greater Direct Contracting to SMEs - Regulators and government bodies increasingly seek to diversify supply chains. Combined with the MAAT programme and emerging assurance frameworks, this shift could enable more direct SME contracting, reduced dependence on primes, and accelerate innovation cycles;
- Increase in venture and strategic investment, particularly once regulatory certainty improves and early deployments prove commercial value (energy, logistics, defence primes, global maritime technology companies) are expected to increase their participation;
- Emergence of new financial instruments, including blended finance to de-risk adoption, robotics/autonomy scale-up funds, export credit guarantees and outcome-based procurement mechanisms;
- Assurance-backed finance via MAAT: As the MAAT produces standardised, evidence-based artefacts (test results, safety cases, conformity claims), investors can rely on objective assurance signals, reducing perceived technical and regulatory risk and enabling a lower cost of capital.

These transitions mirror trends seen in adjacent markets such as aerospace autonomy, offshore robotics and defence digitalisation.

Value in Maritime Autonomy is coalescing around three archetypes:

- Product vendors (software, sensors, platforms);
- Asset owners/operators (uncrewed fleets, ROCs); and,
- Data-/effect-as-a-service providers. Defence adds primes/integrators and sovereign constraints.

A "software-first" acquisition approach is emerging, prioritising autonomy stacks and integration over platform selection, thereby improving interoperability and reducing lock-in. For government use, COCO/GOGO/GOCO[8] ownership/operation models materially shift CapEx/OpEx, liability, spares and surge capacity; programme business cases should therefore compare these options explicitly at gateway reviews.

5.8.4 Implications for UK Competitiveness

Improved access to finance is essential for:

- Scaling UK IP from prototype to export-ready product;
- Supporting SME capability, resilience and talent retention;
- Attracting inward investment and securing appetite for global companies in the UK;
- Ensuring competitiveness against international markets with substantial coordinated funding (e.g. Norway, South Korea, Japan).

While primes[9] will continue to act as essential integrators, the UK's future competitiveness will increasingly depend on SME scale-up capacity, access to capital, and the ability to participate directly in global value chains.

A clear and coherent sovereign investment proposition, including "how British" sovereignty needs to be, must be articulated to inform procurement decisions and provide clarity for investors. Investors ultimately back markets that demonstrate credible, durable and profitable demand. For UK Maritime Autonomy, a forward-looking sovereign business case rests on:

- Sustained domestic deployment and repeatable procurement that maintain revenue;
- Sovereign control of the 'cognitive layer' (autonomy software, ROC command-and-control, data/assurance artefacts);
- Open, documented architectures that allow competitive supply;
- Export pathways validated by UK reference operations.

In this framing, sovereignty is not "100% British content"; it is the UK's freedom to design, integrate, certify, secure and operate uncrewed capability (independently, at will) while accessing global supply where appropriate.

5.8.5 Opportunities for Policy and Programme Intervention

To unlock capital flow and reduce system risk, key opportunities include:

- Clarifying procurement pipelines in defence, offshore energy, science and public maritime services to give certainty of the pipeline of demand;
- Standardising achievable and proportionate regulatory and assurance pathways, reducing perceived risk premiums;
- Supporting investment readiness - particularly for SMEs transitioning from prototype to early commercialisation;
- Strengthening regional finance networks aligned with major maritime autonomy clusters;

[8] Commercially Owned, Commercially Operated; Government Owned, Government Operated; Government Owned, Commercially Operated

[9] The term Prime refers to the major contractors responsible for delivering complex defence systems, and work with smaller suppliers to fulfil defence contracts.

- Promoting cross-sector co-investment, for example, combining offshore wind innovation with autonomy development;
- Exploring tax incentives and enhanced export credit mechanisms targeted at maritime autonomous systems;
- Procurement-led growth with SME routes-to-contract: Increase direct SME awards and publish multi-year autonomy pipelines (defence, offshore energy, public maritime services) to secure revenues and 'crowd-in' private capital;
- Investor-grade assurance packs: Operationalise MAAT outputs into an "Investor Assurance Pack" (standard safety case summaries, test artefact indexes, conformance claims) to shorten diligence cycles for VCs/CVCs;
- City engagement & export signalling: Run City-focused investor events aligned to the autonomy pipeline and export campaigns, to convert interest into late-seed/Series A cheques;
- Avoid vendor lock-in by tying public funding and procurement to open interfaces, data portability and non-exclusive partnering, so the UK can maintain sovereign freedom of action while still leveraging strategic partners.

Sustained intervention in these areas will help secure investment, accelerate commercial deployments, and enable the UK to capture a larger share of the emerging global market.

Although a definitive estimate of total UK investment in Maritime Autonomy is not yet possible, the available evidence shows sustained, diversified and increasingly material capital flows into the market. Public funding continues to play a central role, including through the Clean Maritime Demonstration Programme, Smart Sound Plymouth expansions, and major place-based commitments such as Plymouth's £250 million Defence Growth Deal. Private capital is also expanding, with investments into scale-ups, maritime robotics companies, and venture rounds in autonomy software and maritime AI, reflecting growing commercial confidence. In parallel, corporate strategic investment (from UK and global defence primes, offshore energy majors, subsea engineering companies, maritime survey operators and shipyards developing autonomy-enabled next-generation vessels) is becoming a significant driver of capability development.

Taken together, these investment flows (though irregular and varied in scale) demonstrate that the UK Maritime Autonomy market has transitioned from an experimental niche to an investable and strategically significant domain, with capital now originating from a broader range of public, private and corporate sources than at any previous point.

A procurement-focused pipeline, MAAT-enabled assurance signals and standards-based, non-exclusive partnering can make on-shore production and scale-up credibly profitable over the long term, meeting both investor requirements and sovereign capability aims.

Recommendations:

- Government should publish stable, multi-year procurement pathways across defence, offshore energy and public maritime services to provide clear demand signals for investors.
- The UK should accelerate development of achievable and predictable regulatory and assurance pathways to reduce perceived investment risk.
- Targeted support should help SMEs transition from prototype to commercial scale, including commercialisation guidance and investor engagement.
- The UK should create dedicated growth-stage funding vehicles (including blended finance or match-funding) to bridge the scale-up gap.
- Strengthen regional investment aligned with Maritime Autonomy clusters to spread access to specialist investors.
- Promote joint investment approaches linking offshore wind, subsea robotics, defence autonomy and digital maritime innovation.
- Support operators to adopt autonomy through predictable service contracts – improving revenue visibility and attracting private capital.

6 UK Position in Maritime Autonomy

This section assesses the UK's current position in Maritime Autonomy, drawing together regional, capability and comparative evidence. It examines areas of relative strength, capability gaps and constraints, and how these shape the UK's competitive standing. The section also situates the UK within an international context to inform implications for growth, resilience and strategic focus.

6.1 Chapter Overview

This chapter assesses the UK's current position in Maritime Autonomy, drawing together regional capability, industrial strengths, and international comparison to understand how well placed the UK is to convert capability into long-term economic and strategic advantage.

- The UK enters the Maritime Autonomy market with a strong ecosystem, spanning research, technology development, operations, assurance, regulation and professional services.
- Capability is geographically distributed but highly complementary, with coastal clusters delivering testing, operations and platform development, and inland hubs contributing systems engineering, software, assurance and integration expertise.
- The UK demonstrates strength in subsea systems, uncrewed surface vessels, autonomy software, assurance and regulatory innovation, creating a differentiated position relative to many international peers.
- Defence demand, research capability and offshore energy activity provide credible domestic reference markets, supporting technology maturation and export readiness.
- The UK's role as host to the International Maritime Organisation, combined with leadership in safety, assurance and classification, creates a structural advantage in shaping international norms and standards.
- International benchmarking shows that leading competitor nations have achieved rapid progress through clear strategic intent, coordinated public investment and nationally recognised test and validation pathways.
- The UK compares well on capability and innovation, and less well on coordination, long-term signalling and scale-up mechanisms, highlighting where targeted intervention could unlock disproportionate gains.
- Sovereign advantage increasingly sits in control of autonomy software, system integration, assurance frameworks and remote operations, areas where the UK already has global credibility.
- Overall, the UK is well positioned to lead, but outcomes are choice-dependent: alignment across policy, regulation, procurement and investment will determine whether the UK captures value domestically or enables others to do so.

6.2 Regional Landscape of UK Maritime Autonomy

To understand the UK's current position in Maritime Autonomy, a regional hotspot analysis was developed combining insights from the quantitative long list of organisations active across Maritime Autonomy, and qualitative market knowledge drawn from engagement with industry, academia and defence stakeholders. This combined approach provides a high-level view of where clusters of activity are emerging, the types of work being undertaken, and how regional strengths contribute to the UK's overall capability landscape.

A map of the UK has been produced as the basis for this analysis, highlighting locations where multiple organisations, facilities or programmes cluster together.

It is important to note that this is a summary-level regional view, not a company-by-company map. The hotspots represent concentrations of activity across several types of organisations, including:

- Technology suppliers and system integrators;
- Research institutions, universities and innovation centres;
- Test ranges and infrastructure providers;
- Defence establishments and associated industrial partners;
- Enabling aspects such as software engineering, AI, Machine Learning (ML), sensors, data systems, propulsion, and advanced manufacturing;
- Certification, assurance and regulatory innovation functions;
- Maritime operations, ports, and commercial end users.

Figure 6 - UK Maritime Autonomy Clusters of Activity.

This regional assessment supports this study's objective of mapping the UK Maritime Autonomy market, identifying key organisations, regional clusters and enabling sectors, and providing essential evidence to feed into the wider analysis.

This combined evidence base highlights several UK regions with distinct concentrations of Maritime Autonomy activity. These are explored in more detail in the following section, along with observations on how they compare to patterns in conventional maritime activity.

Recommendations:

- Undertake deeper regional analyses with cluster bodies to identify assets, test ranges, skills pipelines, and finance access.
- Establish an annually updated UK regional maritime autonomy landscape map.
- Expand the quantitative dataset to include supplier financials, workforce distribution, capability maturity levels, published test activity, and export activity indicators.
- Develop a standardised scoring framework for regional Maritime Autonomy capability.
- Deepen engagement with enabling sectors (e.g. AI/ML, sensing and photonics, advanced manufacturing, digital assurance and cyber) to ensure inland innovation hubs are properly understood and reflected.
- Expand analysis of future regional demand drivers (floating wind, decarbonisation, defence modernisation).
- Map regulatory and assurance functions more explicitly.

6.2.1 Qualitative Regional Insights

6.2.1.1 Solent Region

The Solent region is characterised by a concentration of research excellence, regulatory leadership, industrial capability, defence activity and real-world testing infrastructure, lending itself to a strong Maritime Autonomy presence, through enabling, developing and operating systems.

Southampton and Solent Universities centre academia with the University of Southampton's interdisciplinary Southampton Marine & Maritime Institute driving policy-relevant research, and Solent University's Warsash Maritime Autonomous Surface Ships (MASS) Research Centre delivering pioneering work on smart ships, smart ports and human–machine interaction supported by world-class simulation and model-testing facilities.

The National Oceanography Centre (NOC) is based in Southampton and strengthens this knowledge base through its newly expanded Innovation Hub - an enterprise-focused facility supporting over 40 organisations in Marine Autonomous systems and blue-economy innovation. The region also benefits from the National Oceanography Centre's Marine Autonomous and Robotic Systems (MARS) division and the annual Marine Autonomy and Technology Showcase (MATS), which brings together global researchers, operators and suppliers across surface and subsurface robotics, setting the Solent as an international focal point for marine robotic systems. NOC's operational fleet of AUVs, gliders and uncrewed systems supports world-leading activities in ocean observation, exploration and environmental intelligence, with several commercial and research missions launched from Southampton.

The region is also home to the Maritime & Coastguard Agency's (MCA) headquarters, where regulatory priorities for autonomy and emissions reduction are shaped, with long-standing collaborations with the University of Southampton, embedding the Solent at the centre of the UK's MASS regulatory development pathway.

Industrial capability is led by high-growth companies such as Ocean Infinity, which operates globally significant remote-operations and autonomous-fleet activities from the Southampton area, RoboSys Automation, which has established its UK headquarters in Southampton to expand development and deployment of VOYAGER AI autonomy software, and L3Harris (formerly ASV), a major long-standing contributor to uncrewed surface vessel development with deep roots in the region. These companies sit alongside a wider ecosystem, including Kraken, Syos, RAD Propulsion, and others engaged through NOC and regional innovation events, as well as BMT's Fareham facility, which provides specialist naval architecture and systems engineering expertise supporting autonomy and naval innovation.

In addition to surface autonomy specialists, the Solent hosts a cluster of subsea technology developers, and businesses in acoustic systems, perception sensors and subsea robotics supply chains.

Defence activity centred on Portsmouth Naval Base, including the RN's Navy Develop footprint at Whale Island and ongoing DSTL activity within the wider Solent defence ecosystem, provides strong demand signals for uncrewed systems, command-and-control technologies, and integration services across the region.

The Solent's categorised waters form one of the UK's most important real-world testbeds, underpinned by close cooperation with Associated British Ports (ABP), which has positioned Southampton as a national hub for maritime innovation. Enabling marine-engineering companies such as Chartwell Marine, Rockabill Marine Design (RMD), Stehr Consulting and others to complement this ecosystem with specialist vessel design, integration, and build capability. This activity is further amplified by the Solent Freeport, which provides targeted tax, customs and infrastructure incentives, and positions the region as a high-growth maritime innovation zone with major strengths in Maritime Autonomy, digital maritime technologies and 'green propulsion'.

Lloyd's Register's major Southampton presence adds world-leading capability in classification, digital assurance, maritime risk analytics and MASS regulatory development, reinforcing the Solent's prominence in global autonomy assurance.

The region also hosts Seawork and Ocean Business (two of Europe's largest commercial marine and autonomy relevant trade shows), bringing international buyers, suppliers and innovators into the Solent and amplifying its global visibility.

Together, these cover a significant portion of (technical) enablers of Maritime Autonomy, spanning research, regulation, industrial development, operational testing and defence collaboration, making the Solent one of the UK's most strategically significant locations for maritime autonomy.

6.2.1.2 Weymouth, Portland and Surrounding Areas

The Weymouth and Portland region forms a complementary southern hub within the UK maritime autonomy, characterised by its strong defence presence, specialist testing facilities and access to deep-water, controlled maritime environments. The area hosts the Ministry of Defence's Defence BattleLab at Dorset Innovation Park, a growing centre for experimentation, prototyping and industry collaboration focused on next-generation military technologies, including uncrewed systems and mission-level autonomy. Nearby, TKMS Atlas Elektronik UK conducts significant development and testing activity from its Portland facilities, leveraging the area's accessible deep-water ranges for trials of uncrewed surface and subsurface systems, command-and-control solutions and advanced sonar technologies. The broader region also benefits from its proximity to Poole, home of the Special Boat

Service (SBS), whose presence contributes to ongoing demand for specialist maritime technology, high-performance craft and discreet mission-support capabilities. Together, these defence-led assets (combined with established maritime engineering, training and test environments across Weymouth, Portland and Poole) create a compact but strategically important cluster supporting the UK's growing requirements for operational autonomy, rapid prototyping and mission-ready uncrewed systems.

6.2.1.3 Plymouth and South West Region

Plymouth has rapidly emerged as one of the UK's most significant centres for Maritime Autonomy, catalysed by its formal designation in June 2025 as the National Centre for Marine Autonomy (NCMA). This landmark announcement recognised the city's unique concentration of maritime assets, including Western Europe's largest naval base, a world-class scientific community, and a thriving industrial ecosystem. The NCMA brings together advanced research capabilities, state-of-the-art test ranges, an expanding skills base, and an extensive cluster of companies developing next-generation autonomous marine technologies - positioning Plymouth as the UK's foremost environment for accelerating marine autonomy from concept to deployment. This elevation of national status builds on Plymouth's longstanding role as a hub for marine science and innovation, with more than 7,100 professionals working in marine manufacturing and the city accounting for over 21% of the UK's total employment in Maritime Autonomy.

Complementing the NCMA, Plymouth has been designated one of the UK's five national defence growth areas under the 2025 UK Defence Industrial Strategy. The Defence Growth Deal unlocks access to a £250 million UK-wide investment programme designed to strengthen sovereign capability and advance dual-use innovation. Through the newly formalised Team Plymouth partnership, this initiative underpins major developments including the establishment of an Advanced Marine Technology Hub at the University of Plymouth, Babcock's expansion into new logistics and advanced-manufacturing facilities, and long-term MOD infrastructure investment at Devonport supporting the Royal Navy's submarine programmes through to at least 2070. These combined interventions are expected to create high-quality jobs, enhance local skills provision and accelerate regional uplift by aligning defence demand with Plymouth's growing autonomy supply chain.

At the heart of this cluster lies HMNB Devonport and Babcock's Devonport Royal Dockyard, which serve as critical institutions for industrial, defence and innovation activities. Their multi-billion-pound investment programme reinforces Plymouth's strategic value as a centre for heavy engineering, systems integration and naval capability development. The city's geography further strengthens this role: short transit times to deep water, low marine congestion and extensive waterside facilities provide optimal conditions for real-world testing, prototyping and demonstration of maritime autonomous systems.

Plymouth's autonomy ecosystem is also distinguished by its highly developed SME community, particularly the cluster based at Turnchapel Wharf, home to a concentration of autonomy and marine-tech companies including Fugro, Oshen, ACUA, Thales, ZeroUSV, Marine AI and MSubs. This highlights Plymouth's two-decade track record in the development and deployment of autonomous marine systems, with SMEs engaged in defence trials, offshore survey operations, sensor integration and next-generation platform development. This density of capability, coupled with strong linkages to major primes and research organisations, gives Plymouth one of the most mature SME ecosystems in the UK's autonomy landscape.

The city's academic and research strengths are provided by the University of Plymouth and Plymouth Marine Laboratory (PML), both of which play pivotal roles in marine robotics, ocean science, digital maritime systems and autonomy assurance. These institutions are deeply embedded in national programmes, including the National Marine Autonomy Accelerator, launched in partnership with Tech South West and Babcock, to support high-growth companies across the autonomy market. PML contributes further specialist capability in environmental monitoring, sensor systems and autonomous ocean observation, forming a critical link between science-driven and defence-driven autonomy applications.

Plymouth's position is reinforced by a broad network of innovation initiatives, including the Future Autonomous at Sea Technologies (FAST) Cluster, which maps and engages South West innovators across autonomy, sensors and digital marine technologies. This activity sits alongside Smart Sound Plymouth, the UK's leading real-world testbed for autonomous systems, offering instrumented offshore ranges, remote operation centres and a 5G-enabled digital backbone integrated with the region's marine observatories and coastal infrastructure. Together, these assets deliver a seamless pipeline from research to operational validation unmatched elsewhere in the UK.

Regulatory innovation has also become a defining capability for Plymouth. The Maritime Regulatory Innovation Framework (MRIF) programme - funded through the UK Regulators' Pioneer Fund and delivered by Plymouth City Council alongside the University of Plymouth, PML, the University of Exeter, Stehr Consulting and the MCA - aims to accelerate early-stage testing and certification by developing new regulatory approaches tailored to emerging maritime autonomous systems. Activities include legal reviews, international benchmarking, and the development of a "Physical Sandbox" concept to enable controlled, regulator-endorsed experimentation in real-world conditions. These interventions position Plymouth at the forefront of UK regulatory reform for Maritime autonomy and enhance its attractiveness as a centre for both prototyping and assurance.

Plymouth's strategic importance is heightened further by its position as a Levelling Up priority region and its proximity to the Celtic Sea (one of the UK's fastest-advancing markets for floating offshore wind). Expected multi-GW build-out in the 2030s is driving demand for autonomous survey, inspection and monitoring systems, reinforcing Plymouth's role as a dual-use innovation hub serving both defence and clean-energy sectors.

The South West is also attracting new investment from major defence and AI companies (including Helsing, which has expanded its UK presence into the region), adding advanced software, AI-enabled maritime sensing and mission-system integration expertise to the local autonomy ecosystem.

The region's industrial base is strengthened by MECAL, one of the UK's certification bodies for small craft, which plays a central role in supporting new autonomous and hybrid vessel designs for both commercial and defence operators.

Beyond Plymouth, the wider South West region provides complementary strengths. Further west, activity around Hale includes organisations such as Uncrewed Survey Solutions (USS), the Connected Places Catapult and the Marine Management Organisation (MMO), offering capabilities in governance, coastal data systems, remote operations and maritime policy. The South West is increasingly recognised as a leading UK hub for advanced marine technologies, with strong alignment between defence, offshore energy, environmental science and commercial autonomy innovation.

Taken together, Plymouth and the South West form a high-growth, strategically vital autonomy ecosystem, characterised by the integration of defence, research excellence, industrial capability, advanced testing infrastructure and regulatory innovation. The region offers a uniquely complete environment for the development, validation and scaling of maritime autonomous systems, underpinning the UK's long-term ambitions in sovereign capability, ocean science, net-zero engineering and dual-use maritime innovation.

6.2.1.4 Bristol and Bath

The Bristol and Bath region serves as one of the UK's most dynamic inland centres for defence, systems engineering and autonomy-enabling technologies, underpinned by the presence of Defence Equipment & Support (DE&S) - the MOD's primary organisation for procurement, acquisition and capability delivery. DE&S enables a sophisticated spread of technical consultancies and engineering specialists whose combined capabilities play a central role in shaping, assuring and enabling maritime autonomy programmes across the UK.

The region is also home to major defence 'primes' whose engineering and digital capabilities underpin national autonomy programmes, including Babcock (complex systems integration), Rolls-Royce (marine propulsion, onboard power, control systems) and L3Harris (advanced mission systems and uncrewed surface vessel technologies). Their presence amplifies Bristol/Bath's role as a national centre of excellence for high-integrity systems engineering and defence-grade digital autonomy solutions.

This ecosystem comprises a diverse mix of high-end engineering organisations, including BMT, Frazer-Nash Consultancy, Safeguard Engineering, and Occam Group, each contributing complementary skills spanning systems engineering, naval architecture, safety and environmental assurance, cyber-physical resilience, digital engineering and complex systems integration.

These organisations represent just a sample of the region's highly capable engineering corridor, which collectively supports the full lifecycle of maritime autonomy - from research, modelling and design through to safety engineering, systems assurance and procurement oversight. The Bristol and Bath area's cross-sector engineering strengths, bolstered by a significant defence footprint and strong collaboration networks, position the region as a crucial inland complement to the UK's coastal testbeds and operational clusters. As a result, it plays an indispensable role in enabling the UK's maritime autonomy ambitions, particularly in domains requiring safety assurance, high-integrity engineering and complex systems integration.

6.2.1.5 London

London acts as a central strategic hub for the UK maritime autonomy, bringing together the highest concentration of international governance, national policy-making, regulatory development and professional services relevant to the future of Maritime Autonomy.

At the global level, the city is home to the International Maritime Organization (IMO), the UN body responsible for shaping the international regulatory framework for autonomous shipping. The IMO continues to advance key workstreams, including the MASS regulatory scoping exercise, the development of the non-mandatory and mandatory MASS Code, and the activities of the Joint MSC-LEG-FAL[10] working group - making London the global focal point for MASS governance and future rulesets.

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[10] Joint MSC-LEG-FAL refers to joint sessions involving three International Maritime Organization committees: the Maritime Safety Committee (MSC), the Legal Committee (LEG), and the Facilitation Committee (FAL). These joint meetings are convened to address cross-cutting issues that span safety, legal, and facilitation domains.

Nationally, London hosts the UK Government departments and agencies most directly involved in developing maritime autonomy policy, including the Department for Transport (DfT), which is accountable for domestic regulatory updates and the UK's stance in international MASS negotiations. London is also home to other major government actors such as the National Shipbuilding Office (NSO), Department for Science, Innovation and Technology (DSIT), and cross-government teams shaping digital, data, cyber, and regulatory innovation for autonomous and remotely operated systems.

Beyond regulation and government, London provides unmatched reach in finance, legal services and insurance, sectors that increasingly underpin the commercialisation and global deployment of autonomous Maritime technologies. The city's legal companies, insurers and P&I clubs play a pivotal role in addressing emerging issues such as liability, risk, cyber-security, and operational insurance for MASS - areas identified as rapidly evolving within the wider legal and regulatory landscape for unmanned systems. This concentration of professional services provides the UK's autonomy market with access to world-leading expertise in contractual frameworks, compliance, risk transfer and investment.

London is also a major locus for national maritime industry coordination, with the Society of Maritime Industries (SMI) headquartered in the city. SMI plays a central convening role for industry. SMI's councils, working groups, industry forums and cross-sector events further reinforce London's role as a national centre for thought leadership and industry alignment.

Another major London-based organisation is the NPL in Teddington, home to the MAAT programme. NPL leads this national consortium focused on creating evidence-based, internationally relevant frameworks for test, evaluation and certification of MASS technologies. MAAT brings together government agencies, academia and industry to develop standardised, scalable assurance approaches and to strengthen the UK's international leadership in autonomy assurance.

London is further reinforced by its status as the host city for the market's largest global events, including Oceanology International and Defence and Security Equipment International (DSEI), both of which act as major showcases for commercial and defence-oriented maritime autonomy technologies. These events provide international visibility for UK capability, offer high-value networking opportunities for innovators and suppliers, and facilitate engagement with overseas customers, regulators and allied navies.

Taken together, London provides the policy, regulatory, financial and international institutional backbone for the UK's Maritime Autonomy ecosystem. While the technical development and real-world testing of autonomous systems take place across the UK's coastal regions, it is London's unique concentration of global governance bodies, national regulators, assurance institutions, professional services and major industry convenors that form the connective infrastructure enabling MASS technologies to scale safely, securely and commercially - both nationally and internationally.

6.2.1.6 Scotland

Scotland's maritime autonomy landscape shaped heavily by its global leadership in offshore energy, subsea engineering and North Sea operations. The region's industrial base (particularly in Aberdeen, the long-established centre of the UK's offshore oil and gas and offshore wind sectors) provides a natural foundation for the deployment and scaling of autonomous marine systems. The Port of Aberdeen's major decarbonisation initiatives, including Scotland's largest green-shore-power programme, demonstrate the region's commitment to next-generation maritime operations and highlight a strong appetite for innovation across offshore energy logistics, vessel support, and port-side operations. These energy-driven use-cases continue to fuel market demand for uncrewed systems, persistent offshore monitoring, lower-carbon operations and data-rich environmental solutions.

Scotland is also home to rapidly scaling autonomy-enabled companies such as Sulmara, headquartered in Glasgow, which delivers advanced offshore survey, inspection and geodata services across global offshore wind and renewable-energy markets. Sulmara have made a recent investment to accelerate the adoption of low-carbon and robotic solutions. This reflects a broader Scottish trend: companies emerging from the offshore-energy and subsea-engineering sectors are rapidly pivoting toward autonomy, advanced robotics, and digital offshore operations.

Scotland’s position is reinforced by its substantial defence and commercial shipbuilding activity, centred around the Clyde with BAE Systems and supporting suppliers. While these facilities are not exclusively focused on maritime autonomy, they provide a highly relevant skills base in naval systems integration, platform design, digital shipbuilding and mission-system engineering - all directly transferable into future autonomy-enabled ship classes and uncrewed surface vessels. Alongside major yards, Scotland hosts smaller shipbuilders and integrators experienced in advanced workboat, robotic and survey vessel construction, offering pathways for future maritime autonomy platform builds.

Scotland’s defence-related autonomy capabilities are reinforced by sites such as the British Underwater Test and Evaluation Centre (BUTEC) range in the northwest Highlands. BUTEC provides one of the UK’s most important deep-water, instrumented testing areas for underwater systems, including autonomous underwater vehicles, acoustic systems and complex subsea trials. Its combination of deep water, sheltered geography and secure operational control makes it a vital national asset for defence-oriented testing, evaluation, and mission-level autonomy development.

Across the region, Scotland benefits from a powerful blend of offshore-energy demand, subsea-engineering heritage, emerging autonomy innovators and world-class deep-water test ranges. Together, these assets position Scotland as one of the UK’s most strategically valuable autonomy ecosystems - particularly for subsea autonomy, low-carbon offshore operations, and mission-critical test and evaluation.

6.2.1.7 Northern Ireland

Northern Ireland has established itself as a new but growing hub for Maritime Autonomy, developed through its growing clean-maritime innovation base, strong export performance and alignment with global offshore energy markets. Two companies in particular - Artemis Technologies in Belfast and XOcean, headquartered in Ireland but with significant operations serving the UK market - illustrate the region’s strategic strengths across uncrewed systems, low-carbon vessel design, and data-driven offshore operations.

Artemis Technologies, based in Belfast, has emerged as one of the UK’s most successful clean-maritime innovators and a global leader in zero-emission vessel technology. The company has secured multiple multimillion-dollar international partnerships, including a recent Memorandum of Understanding with US-based Delta Marine to accelerate the deployment of electric hydrofoil vessels across major ferry networks. These agreements build on earlier commitments to supply 20 cutting-edge hydrofoil vessels to UrbanLink in Miami, highlighting the global competitiveness of Northern Ireland’s maritime technology exports. Artemis’ electric vessels (developed through the Belfast Maritime Consortium) reflect a regional specialism in high-efficiency hybrid and electric propulsion, hydrodynamic optimisation, and advanced digital control systems. The company’s ongoing expansion, including a new US office opened in 2024, reinforces its position as one of the UK's most internationally influential clean-maritime enterprises.

Across the wider island, XOcean has become a major operator of Uncrewed Surface Vessels (USVs) for offshore survey, inspection and environmental data collection. XOcean is widely recognised across the UK offshore-energy ecosystem for its fleet of remotely-operated USVs supporting offshore wind development, subsea asset inspection, seabed mapping and environmental monitoring. Its presence in Northern Ireland's supply chain reflects the region's strong alignment with offshore energy markets - particularly as Scotland and the North Sea continue to scale autonomous operations in offshore wind, subsea maintenance and environmental assurance. XOcean's expansion across Europe and North America mirrors Artemis' international trajectory, further strengthening Northern Ireland's role in data-rich, autonomous offshore operations.

Northern Ireland's strength is also reinforced by its links to UK-wide technology clusters and its embedding in 'clean-technology' and decarbonisation agendas. The region's maritime technology companies benefit from the strong export support ecosystem provided by Invest Northern Ireland, which has played a central role in enabling companies like Artemis Technologies to scale internationally and attract new investment. The focus on zero-emission vessel design, robotic offshore operations and digital maritime innovation positions Northern Ireland as a complementary capability hub to the UK's other regional clusters.

Taken together, Northern Ireland represents a nimble, export-oriented, clean-maritime cluster, enabled by world-leading innovators in uncrewed systems and zero-emission vessel technology. Its growing ecosystem offers the UK valuable strengths in robotic survey, offshore energy support, hydrodynamic vessel design, and autonomous operations and continues to expand its global presence through high-profile international partnerships and sustained investment in clean maritime technologies.

6.2.1.8 Other Regional Hotspots

In addition to the major coastal clusters, a number of smaller but strategically important hotspots are emerging across the UK, driven by research excellence, specialist engineering capability, and demand from adjacent sectors.

The Midlands hosts growing autonomy-related activity through the Safe Autonomy Research Group at the University of Warwick Manufacturing Group, which conducts cross-domain autonomy research (including maritime) and contributes directly to government reviews and national recommendations on safe and assured autonomy.

Further north, York is home to the Centre for Assuring Autonomy, a partnership between the University of York and Lloyd's Register Foundation. The Centre combines academic research with practical regulatory and assurance frameworks, supporting the development of safety guidance, contributing directly to IMO MASS Code working groups, and developing safety cases for emerging autonomy concepts.

In Cambridge, a concentration of software, electronics and sensor technology companies is playing an increasingly important role in Maritime Autonomy. Organisations such as Cambridge Pixel support autonomy deployments in Plymouth Sound and through NPL programmes, while Cambridge Consultants contributes to defence uncrewed vehicle programmes, including test architectures for AI models and sensing systems. The UK arm of Plextek are specialists in low-size, weight, and Power sensor and RF technologies, systems that will support the hardware aspects of Maritime Autonomous systems.

Along the East Coast, autonomy is being pulled rapidly into real-world deployment through the offshore wind sector, which is more mature here than anywhere else in the UK. While the region is not yet a fully formed “maritime autonomy cluster” comparable to the Solent or Plymouth, locations such as Lowestoft, Great Yarmouth and the Humber are becoming focal points for autonomous survey, inspection and O&M applications as floating and fixed bottom offshore wind expands.

Together, these emerging locations for autonomy development demonstrate how Maritime Autonomy capability is beginning to diffuse into a wider set of UK regions - driven by research strength, adjacent industry demand and the growing role of software, sensing and digital innovation in the maritime domain.

6.2.2 Comparison to Conventional Maritime Activities

Maritime autonomy is reshaping the geography and structure of the UK Maritime sector in ways that differ markedly from traditional shipbuilding. Because autonomous and remotely operated vessels tend to be smaller, more modular and increasingly defined by their software, sensors, electronics and digital control systems, the sector is no longer constrained by the historic need for large coastal shipyards.

Smaller platforms and modular architectures allow much of the design, assembly and integration work to take place inland, with only final testing and validation requiring access to water. Many autonomy components (navigation systems, perception sensors, communications hardware, AI/ML software stacks and mission-system electronics) are not geographically tied to the coast. This enables suppliers, software developers and advanced-manufacturing businesses to operate from established commercial, academic and technology hubs, benefitting from access to relevant engineering talent and adjacent high-tech industries.

Post-COVID working models have also reduced the dependency on co-location with end users. Remote collaboration, digital twins, cloud-based development pipelines and remote-operations architectures allow teams to work across greater distances than was previously practical in the maritime domain. This mirrors the distributed nature of autonomy development in aerospace, automotive and robotics markets, and enables high-value activity to take place far from traditional centres of shipbuilding.

In parallel, the market’s growing reliance on sensors, communications systems, data platforms and digital assurance draws heavily on markets that have existed inland for decades - particularly in electronics, photonics, artificial intelligence, cyber security, and test and evaluation. As these technologies become the dominant value drivers in autonomous vessels, the UK’s Maritime economy is expected to disperse further inland, following concentrations of digital and engineering capability rather than coastal infrastructure alone.

Together, these shifts create new opportunities for regional regeneration, supply-chain diversification and inward investment. Autonomous systems broaden the geography of maritime industrial activity, allowing value to be created across a wider spread of regions than was possible through conventional shipyard-centric shipbuilding.

6.3 UK Capability Analysis - SWOT

Stehr Consulting led several workshops to help qualify the current UK Maritime Autonomy strengths, weaknesses, opportunities and threats. This SWOT analysis has been captured below as a summary, with further detail in Annex E.

S — STRENGTHS

- World-class academic community, research institutions, and innovation ecosystem;
- Strong multi-departmental government engagement, even without clear ownership;
- Deep culture of collaboration, networking, and knowledge exchange;
- Existing Maritime international regulatory, assurance, and safety leadership;
- Financing, insurance, classification, and assurance excellence centred in London ;
- Deep and diverse industrial base across surface, subsurface, and enabling technologies;
- Strong crossover with major growth markets (offshore wind, defence, and ocean science);
- Varied geographical and nautical landscape offering variety in testing conditions; Strong existing sovereign supply chain;
- Experience in existing autonomy adjacent systems and processes through north sea oil and gas;
- Strong boat build capability for country size;
- Technical success stories through DSTL funding;

W — WEAKNESSES

- Fragmented policy landscape and unclear ownership of maritime autonomy;
- Autonomy regulatory and assurance challenges are multifaceted, inconsistently communicated, and poorly coordinated;
- Unclear definitions of "sovereign capability" and its implications for industrial strategy;
- Limited dedicated public R&D investment targeted specifically at maritime autonomy;
- Limited access to scale-up finance and constrained capital for UK SMEs;
- Difficulty quantifying defence demand and future market size, leading to strategic uncertainty;
- Historically limited economic modelling makes investment cases difficult;
- UK's early regulatory caution creates competitive disadvantages for testing and deployment;
- Legislative limitations hinder the regulator's ability to enable maritime autonomy;
- Few successful exits from early stages, leading to little circle back of finances and experience;
- Small regional thinking leading to reduced collaboration at what is the micro scale from a global perspective;
- Lack of industrial strategy;
- Conservative approach and reluctancy to disrupt proven models especially where safe systems already exist;
- Inconsistent collaboration without clear opportunity or threat;

O — OPPORTUNITIES

- Convert a mature UK ecosystem into global market share and exports;
- Establish the UK as the global hub for Assurance, Test & Evaluation (ATE), and certification;
- Leverage defence as an anchor customer for dual-use scale-up;
- Build exportable operational infrastructure and "ROC-as-a-service";
- Shape international standards and corridors via IMO and bilateral pilots;
- Monetise the maritime data economy;
- Cross-sector autonomy knowledge transfer;
- Transform ageing NERC/DEFRA fleets into an autonomous system-of-systems model;
- Build regional economic and skill gains;
- Optimisation led reductions in local and global emissions;
- Exploit International Academic R&D Collaboration;
- Exploit the rapid development available from research investments;

T — THREATS

- Intensifying international competition in domestic and export markets;
- Regulatory divergence and a potential "race to the bottom" abroad;
- Delays in defence procurement clarity reduce industry confidence;
- Cybersecurity incidents or high-profile failures erode public and insurer trust;
- Talent competition and skills shortages;
- Infrastructure bottlenecks;
- Technological bottlenecks;
- Fragmented messaging to government and investors;
- Public finance pressure constraining core science demand;
- Foreign competitors targeting science and climate-monitoring markets;
- Accident occurrence leading to major regulatory or financial setbacks;
- Social objection to autonomous vessels;

Recommendations:

- Develop a quantitative capability index (e.g. TRL, assurance maturity, IP strength, export readiness) to complement SWOT.
- Develop a Political, Economic, Social, Technological, Legal and Environmental (PESTLE) analysis to complement SWOT.

6.4 International Benchmarking

To benchmark the UK's competitiveness in Maritime Autonomy, a targeted high-level review of four comparator nations was conducted with demonstrable leadership in the field: Norway, Singapore, South Korea and Japan. These countries were selected based on their clear strategic investment, regulatory innovation, and early deployment of autonomous technologies. Importantly, each nation embeds Maritime Autonomy within a different form of industrial strategy, supported by varying levels of public, private and philanthropic finance. Together, they provide a diverse cross-section of global approaches - ranging from highly coordinated, state-led industrial strategies to industry-driven ecosystems and advanced testbed deployments. This international review underpins the study's comparative assessment of regulatory environments, test and evaluation models, funding structures and market-shaping interventions, all of which are integrated into the subsequent subsections. All four nations support maritime autonomy with significant public investment, industry co-funding, and, in Japan's case, major philanthropic financing - creating better-resourced development pipelines than those currently available in the UK.

In each comparator nation, Maritime Autonomy is positioned explicitly within wider industrial strategies - whether for shipbuilding competitiveness, logistics modernisation, technology sovereignty, or national innovation agendas. This strategic framing is a major driver of progress and provides essential context for interpreting their relative levels of adoption. The way these nations structure regulatory pathways, trial permissions, 'sandboxes'[11] and national test ranges provide important insight into how market entry, R&D validation and early-stage deployment are enabled internationally - an embedded theme throughout the comparative analysis that follows.

Across these nations, Maritime Autonomy is not simply an R&D activity - it is increasingly treated as a strategic technology, tied to sovereign capability, national competitiveness, and long-term industrial resilience. Their experiences offer valuable insights into the policy levers, public interventions and financial mechanisms - including long-term public finance, industry co-funding models, and philanthropic investment structures - that have accelerated international progress. These contrasts with UK practice help to identify lessons for strategic funding design, export readiness and domestic capability growth, presented throughout this section. Taken together, these comparator cases illustrate the conditions under which Maritime Autonomy ecosystems scale - providing actionable lessons for the UK on regulation, funding, capability development, assurance and industrial strategy; each of which is explored through the following country analyses.

[11] In this context, 'sandboxes' refers to structured regulatory environments that allow innovators to test emerging technologies (such as autonomous or remotely operated vessels) under controlled, risk-managed conditions. These frameworks enable regulators and industry to trial novel concepts, gather evidence, and refine requirements before full regulatory approval is possible.

6.4.1 Norway

Norway has a major global part in the Maritime industry, hosting the world's 4th largest merchant fleet by value [14] and one of the most comprehensive Maritime innovation clusters globally (covering aspects such as ship owners and manufacturers, Maritime research and development, and well-established authorities and non-governmental organisations). Norway's industrial strategy places strong emphasis on Maritime digitalisation, green shipping and autonomy (priorities set out clearly in the Maritim21 strategy and the government's 'Blue Opportunities' ocean strategy [15]) and is delivered through a mature 'Triple Helix' partnership model between government, industry, and research institutions. Autonomy forms part of Norway's broader Maritime digitalisation strategy, and the government recognises it as a strategic technology underpinning the competitiveness of its shipping, offshore, and Maritime services industries.

Norway's significance in the wider Maritime industry is reflected in its commitments and activities within the Maritime Autonomy market. Starting with the establishment of the Norwegian Forum for Autonomous Ships, founded in 2016 and backed by the Norwegian Maritime Authority [16], Norway has completed a series of projects with the goal of growing its capacities in the market. The foremost of these projects is the Yara Birkland, a short-sea, electric container ship used for industrial logistics [17]. When construction began on the Yara Birkland in 2017, it was then the first autonomous container ship in the world [18]. Now in operation for almost four years (as of early 2026), the ship has completed hundreds of successful journeys semi-autonomously, with supervised autonomous sailing and auto-docking. Norwegian authorities were heavily involved with the project, with a government grant covering around a third of the construction costs [19] and authorities supporting its passage to regulatory approval. Norwegian authorities have been similarly involved in the regulatory approval process and, in some cases, have provided grants and funding for several other projects in the autonomous Maritime vehicles sector [20]. This level of public financial involvement reflects Norway's intent to retain sovereign capability in next-generation shipping technologies.

Norway has also made major contributions to the industry by providing a well-adjusted regulatory and R&D environment for Maritime Autonomy projects. The world's first officially designated test area for autonomous (unmanned) ships was established at Trondheimsfjorden in 2016 [21], sending an early signal to the industry that Norwegian authorities intended to support the development of autonomous Maritime projects. Notably, Norway's designated test area does not benefit from any separate or preferential regulatory regime - an important point that underscores that progress has come from proportional, risk-based regulatory engagement rather than deregulation.[12]

This support was further strengthened in 2020 with the onset of the SFI Autoship project [22], a well-funded (240 million NOK ~ £18.7 million GBP), multi-year (8-year), research collaboration between Norwegian authorities and the Maritime industry, working on developing autonomous marine technologies, infrastructure and protocols that will allow the Maritime Autonomy industry to continue

[12] Although Norway established the world's first officially designated test area for autonomous ships at Trondheimsfjorden in 2016, discussions with the Norwegian Maritime Authority (NMA) confirm that the designation does not confer any distinct or relaxed regulatory treatment. Autonomous and remotely operated vessels operating within the test area remain subject to the same underlying legislative requirements (e.g. the Ships Safety Act and size-based thresholds) as any other vessel. The NMA emphasised that their support for innovation is expressed through proportionate, risk-based authorisations for trials. This distinction is important, as Norway's progress reflects regulatory responsiveness and collaboration rather than the exemption of autonomy projects from standard requirements.

to grow and develop into the future. The project is also an investment by the Norwegian authorities and the Maritime industry in human capital (in the form of trained researchers and expertise) that will provide for the industry long into the future. SFI AutoShip is also a deliberate industrial capability programme, designed to secure Norwegian expertise and ensure long-term leadership in autonomous shipping technologies.

Norway has also signed the 2024 North Sea cooperation agreement [23] (now joined by the UK, Denmark, the Netherlands, Belgium, France, and Germany), which aims to deepen collaboration on Maritime Autonomy. Importantly, the MoU focuses on knowledge sharing and developing a common understanding rather than creating or adopting a single consolidated set of requirements. Over time, this shared insight is expected to indirectly support greater harmonisation across national approaches.

Norway's model shows how early regulatory clarity, substantial public funding, and publicly backed test ranges can rapidly accelerate commercial deployment of Maritime Autonomy. Significant state co-investment, long-term R&D programmes and targeted support for flagship projects have created favourable conditions for innovation and early adoption. However, despite this strong national framework, progress remains concentrated within specific industrial corridors and clusters rather than evenly distributed across the entire maritime economy.

6.4.2 Singapore

Singapore is another one of the world's leading Maritime hubs, hosting the world's second busiest container port [24] and a well-developed Maritime economy offering financial, legal and technical services [25]. Within Singapore's national Industry Transformation Maps (ITMs) [26] and Research, Innovation and Enterprise 2025 (RIE2025) agenda [27], autonomy is treated as a strategic enabler of core economic infrastructure, rather than a vessel technology in isolation, especially when it comes to enabling port competitiveness and trade resilience.

Singapore's government plays a central role in financing and orchestrating autonomy development. The Centre of Excellence for Autonomous and Remotely Operated Vessels [28], funded by the Singapore Maritime Institute, acts as the national R&D focal point, while the "Living Lab" [29] (a combined digital and physical test environment) provides a regulated yet flexible 'sandbox' for industry trials. This has included a multinational initiative with a major Japanese shipping group to test the viability of MASS in Singaporean ports [30], and a Finnish-Singaporean collaboration working on autonomous harbour tug-boats; with a senior member of the Singaporean Maritime and Port Authority noting on the latter project that "it is critical that we prepare the Port of Singapore for MASS" [31]. Unlike nations with large domestic fleets, Singapore's interest in autonomy is largely tied to safeguarding its role as a sovereign global port hub, ensuring resilient operations and minimising workforce dependency in high-throughput port environments. These programmes rely on blended financing: public grants de-risk early R&D, while private investment from major Asian and European shipping groups accelerates applied testing.

The Singaporean Government has also been a buyer of autonomous vessels, with the Republic of Singapore Navy owning and deploying USVs, designed in Singapore, for autonomous patrols in the Singapore Strait [32], with recent reports indicating government intentions to expand this fleet and equip it with new capabilities in the future [33]. Unlike Norway, Singapore lacks a well-established base of civilian procurement in autonomous maritime, with progress thus far largely limited to trials and testing.

Though not directly related to autonomous maritime technologies, the Tuas Mega Port, opened in 2022 and due to be completed in 2040, will become the world's largest and most autonomous (in terms of terminal operations) consolidated port [34]. This illustrates how autonomy is embedded at the strategic infrastructure level. Even where autonomy refers to port rather than vessel technologies, Singapore's approach demonstrates how state-directed capital investment and long-range planning can rapidly mature national capability.

Singapore's strategic orientation as one of the world's foremost deep-sea trading hubs shapes its approach to maritime autonomy. As a global transhipment centre and operator of one of the busiest deep sea container ports, Singapore's autonomy strategy is closely aligned with enhancing efficiency, resilience and competitiveness in deep sea and major port operations rather than domestic or near shore commercial vessel deployment. Much of its autonomous R&D, including multinational port-based MASS trials and the Living Lab initiatives, is therefore designed around high-throughput deep-sea logistics ecosystems that demand seamless integration with complex global supply chains. This global trade focus differentiates Singapore from countries with more domestic or industrial corridor autonomy use cases, and influences the types of technologies, partnerships and operational concepts it prioritises.

Singapore demonstrates the value of a tightly coordinated R&D ecosystem and controlled "sandbox" environment, though its progress is still limited by relatively low levels of domestic commercial demand.

6.4.3 South Korea

South Korea maintains a strong maritime industry, centred on a well-developed shipbuilding industry that delivers around 20% of global shipbuilding output [35], making it one of South Korea's most valuable manufacturing export sectors [36]. It includes well-developed ports, with the container port at Busan considered one of the busiest in the world [24], and spans shipping, shipbuilding, marine equipment and digital maritime services. South Korea designates maritime autonomy as a strategic industrial technology central to the next phase of shipbuilding competitiveness. Major companies include Samsung, Hyundai and Hanwha. The indigenous maritime industry is complemented by active state involvement and a proactive industrial strategy, with sustained public support via mechanisms like R&D funding, investment in ports, tax incentives, and regulatory reform.

South Korean maritime industrial strategy has paid particular focus to the development of autonomous maritime technologies through the primarily government-funded Korea Autonomous Surface Ship (KASS) project [37], investing approximately US$120 million in the development of autonomous maritime technologies through a collaboration with private-sector actors like Hyundai. The KASS programme sits within a wider state-led industrial strategy aimed at ensuring Korea's shipbuilding sector remains globally dominant against Chinese competition. Outputs from KASS have included an operational semi-autonomous container ship, equipped with functionality for uncrewed operation and automated engine management, and the development of an Autonomous Ship Verification & Evaluation Research Centre [38], a government-backed test and assurance facility that will streamline the certification and commercial deployment of autonomous maritime technologies in South Korea into the future. KASS also had an important role in the creation of new South Korean autonomous ships legislation that defined autonomous ships and provided government-designated maritime zones for their operation [39]. KASS is one of the most heavily funded autonomy programmes globally, reflecting Korea's willingness to use large-scale public finance to accelerate sovereign industrial capability.

Government support for autonomous maritime technologies is already demonstrating favourable outcomes. Samsung Heavy Industries has launched several successful voyages using autonomous technologies, including international voyages from Korea to Taiwan [40] and a trans-Pacific voyage from Taiwan to Oakland, USA [41]. These voyages involved autonomous route-planning, ship management and navigation, but were not uncrewed.

South Korea's maritime autonomy efforts are strongly shaped by its highly significant position in deep-sea commercial shipbuilding. Its autonomy programmes (including KASS, large-scale R&D investments and government-supported verification centres) are tightly linked to enhancing the competitiveness of high-value export ship types such as large container ships, Liquefied Natural Gas (LNG) carriers, and deep-sea commercial vessels. As a result, South Korea's autonomy agenda is oriented toward long-range, deep-sea operational contexts and integration of advanced autonomous navigation and machinery management into large oceangoing vessels, rather than small-scale or near-shore applications. This reflects both its industrial strengths and its objective of maintaining global leadership in major vessel shipbuilding markets.

6.4.4 Japan

Like all the countries listed so far, Japan hosts one of the world's premier indigenous maritime economies. As much as 99% of Japan's international trade by volume is moved by sea [42], and 40% of its ton-kilometre domestic freight transportation is taken up by coastal shipping [43], emphasising the significant role that maritime transport has developed in connecting the Japanese archipelago internally, and with the rest of the world. Japan's national Roadmap for autonomous ships explicitly recognises vessels as a long-term, strategically important technology with economic and societal significance.

Japan has a clear industrial strategy and set of targets for autonomous maritime shipping and technologies. Japan's maritime industrial policy is, unusually, not driven primarily by the state, but rather by the philanthropic Nippon Foundation (originally the *Japanese Shipbuilding Industry Foundation*), which has driven development and innovation in the Japanese maritime industry since the 1960s [44]. The Nippon Foundation's principal autonomous maritime project (the MEGURI2040 Programme) is recognised informally as Japan's national autonomy programme, despite not being a formal government scheme [45]. According to the Nippon Foundation, MEGURI2040 aims to put autonomous ships into commercial service by 2025 [46], and make it so that autonomous navigation accounts for around 50% of Japan's domestic shipping by 2040 [46]. This approach is tightly coupled with national industrial policy: autonomy is seen as essential for retaining Japan's competitive position in high-value shipbuilding, mirroring South Korea's strategic framing. MEGURI2040 has thus far succeeded in delivering fully autonomous navigation aboard container ships [47], ferries [48] and coastal voyages, including on commercial journeys [49]. MEGURI2040 has also led to the completion of a mobile fleet operation centre that will facilitate remote support of multiple autonomous vessels into the future [50].

Though the MEGURI2040 project has ensured Japan a strong position at the frontier of autonomous maritime capabilities, further development will be necessary for it to achieve crewless autonomous operation and the widespread automation of domestic shipping in Japan by 2040.

Japan's interest in maritime autonomy is also closely tied to its legacy as a leading builder of large, deep-sea commercial vessels, with major shipyards and Original Equipment Manufacturers (OEMs) playing central roles in MEGURI2040's project. Like South Korea, much of Japan's technological focus is on applying autonomous navigation and operational optimisation to oceangoing cargo ships, ferries and coastal shipping networks that form the backbone of its domestic logistics system. A further major driver is Japan's acute demographic challenge: an ageing population and shrinking maritime workforce, which has intensified political and industrial pressure to automate coastal and domestic shipping routes. Autonomous vessel technologies are therefore viewed not only as an innovation opportunity but as a structural necessity to maintain freight connectivity, reduce crew dependency and ensure long-term resilience of Japan's maritime transport system.

Japan's autonomy has progressed significantly through long-term philanthropic and industrial investment, enabling advanced prototypes and trials, but wider adoption will depend on regulatory evolution and scaling beyond past and current projects.

6.4.5 Conclusion

Across all four nations discussed above, progress is strongly correlated with deliberate strategic positioning of maritime autonomy within national industrial policy, backed by sustained public investment and clear signals of sovereign intent. They demonstrate that capability accelerates when governments combine coordinated industrial strategies, structured test and evaluation environments, and proportionate regulatory pathways with long-term funding for R&D and leading projects. These approaches provide the industry with the clarity and confidence required to invest, commercialise, and compete internationally. Taken together, the trajectories of Norway, Singapore, South Korea and Japan demonstrate that targeted public intervention, coherent governance, and a unified national vision are central to unlocking economic opportunity in Maritime Autonomy - in contrast to the UK's more distributed and less coordinated approach to date; this highlights where strengthened alignment could materially enhance the UK's competitiveness and growth.

To strengthen its competitive position, the UK should treat Maritime Autonomy as a strategic technology and support its exploitation with a coordinated mix of long-term public investment, structured test and evaluation environments, a clear regulatory pathway, and strong public-industry-research partnerships. Establishing leading projects, skills pipelines and an export-leaning international strategy would further reinforce industry confidence and accelerate safe, scalable adoption - enhancing the UK to the levels of deliberate, well-resourced approaches seen in Norway, Singapore, South Korea and Japan.

Recommendations:

- Future work should build on this high-level assessment through a deeper comparative analysis of national industrial strategies, long-term funding structures, regulatory pathways, and sovereign capability objectives.
- A formalised benchmarking method should be developed to enable consistent cross-nation comparison, incorporating metrics across industrial strategy alignment, strategic-technology designation, financing models, test-range accessibility, regulatory maturity, and commercial readiness.
- Formally designate Maritime Autonomy as a strategic technology within UK industrial, innovation and maritime policy frameworks, signalling long-term government commitment and enabling coherent cross-Whitehall coordination.
- Develop multi-year, mission-driven funding mechanisms for Maritime Autonomy R&D, test infrastructure, and early commercial adoption - reducing fragmentation and giving industry confidence to invest.
- Establish a coordinated UK Test & Evaluation network with defined operating boundaries, clear regulatory routes, and national recognition, rather than isolated regional facilities.
- Create a transparent UK regulatory roadmap for MASS trials and early-stage deployment, including recurring mechanisms for regulatory learning and industry engagement.
- Establish a UK-wide partnership body or alliance that brings together government, regulators, academia and industry to coordinate priorities, share information and accelerate innovation.
- Fund and publicise UK leading demonstrator programmes that integrate multiple capabilities (platforms, sensors, remote operations, assurance) to build domestic confidence and international visibility.
- Create targeted training pathways in autonomy, remote operations, digital maritime systems and assurance, embedding them in maritime colleges, naval programmes and STEM pipelines.
- Define a UK export and international collaboration strategy for Maritime Autonomy, including standards development, North Sea cooperation, and partnerships with key trading nations.
- Prioritise assurance standardisation and export-readiness; leverage UK insurance/P&I leadership as risk models mature.

7 Conclusion

This study provides the first vigorous, UK-specific, evidence-based quantification of the Maritime Autonomy market, addressing a long-standing gap in the evidence base available to policymakers, industry and investors. By establishing a clear and transparent definition of Maritime Autonomy, developing a fit-for-purpose segmentation framework, and combining quantitative economic modelling with structured qualitative insight, the report sets out a credible baseline for understanding both the current economic footprint of the market and its future growth potential.

7.1 Summary of Key Findings

The analysis demonstrates that Maritime Autonomy already represents a material and economically significant UK market, rather than a purely speculative or future technology domain. In 2023, the UK Maritime Autonomy market generated approximately £625 million in annual turnover, supported around 2,000 jobs directly, and contributed £215 million in direct Gross Value Added (GVA). When indirect and induced effects are included, the wider economic footprint rises to approximately £469 million GVA and over 5,000 jobs, underlining the market's broader contribution across the UK economy.

Looking forward, the study finds that growth potential is substantial but highly sensitive to policy, regulatory and investment choices. Under the central growth trajectory, the UK Maritime Autonomy market could reach approximately £3.7 billion in GVA by 2040 and £8.3 billion by 2050, with materially higher outcomes possible under more supportive conditions. Conversely, delayed adoption, regulatory friction, or constrained capital flows could significantly limit growth and erode the UK's competitive position.

The UK enters this period of market expansion with clear structural strengths. These include world-class research capability, a dense and innovative SME base, established defence demand, and growing leadership in autonomy assurance and regulatory innovation. Regional clusters such as the Solent, Plymouth and the South West, Scotland, and selected inland technology hubs collectively form a nationally distributed ecosystem that spans research, development, testing, operations, and assurance.

At the same time, the study identifies systemic risks that could constrain value capture. These include fragmented and uncertain regulatory pathways, limited visibility of long-term procurement pipelines, capital constraints for scale-up companies, and intensifying international competition from well-funded overseas entrants. Without coordinated action, there is a material risk that early technical leadership is not translated into sustained economic growth, export success or sovereign capability.

7.2 Interpretation and Strategic Implications

A central conclusion of this work is that Maritime Autonomy should be understood as a system-of-systems market, rather than a narrow platform or vessel category. Value increasingly accrues in autonomy software, ROCs, data, assurance, integration and operating models, rather than in hull fabrication alone. This has important implications for how policy, investment and industrial strategy are framed.

The evidence suggests that sovereignty, export competitiveness and domestic deployment are tightly interlinked. Strong domestic adoption, supported by credible regulatory and assurance frameworks, provides the reference cases and confidence required to unlock international markets. Conversely, reliance on overseas testing, early deployment or foreign platforms risks value leakage and weakens long-term industrial resilience.

The study also reinforces the importance of defence as a near-term anchor customer, capable of accelerating technology readiness and de-risking innovation. However, defence-led growth alone is unlikely to maximise economic value unless complemented by clearer pathways for commercial, offshore energy, public-service and scientific adoption. Balanced growth across these segments is critical to sustaining skills, supply chains and investor confidence.

7.3 Limitations and Use of the Evidence Base

This report provides a point-in-time baseline for understanding the UK Maritime Autonomy market. It is intended to inform near-term decisions while providing a structured foundation for future updates as the market evolves. Market projections are indicative ranges rather than forecasts, and future outcomes will depend on external factors including technology development, regulation, investment cycles and geopolitical conditions.

Importantly, the study does not attempt to quantify wider second-order impacts on the broader maritime sector, such as displacement of crewed operations, labour transitions or changes in operational expenditure. These effects may be significant and warrant dedicated future analysis.

As such, the evidence base established here should be treated as a baseline. To remain relevant and useful, it will require periodic refresh and refinement as the market matures, data quality improves, and adoption accelerates. It is recommended that this study should be treated as a living evidence base, with regular updates to track market evolution, regional development and international competitiveness.

7.4 Strategic Priorities Going Forward

Taken together, the findings point to a clear set of strategic priorities if the UK is to capture the full economic and strategic value of Maritime Autonomy:

- Maintain and develop Maritime Autonomy as a strategic national capability, with coherent alignment across policy, regulation, procurement and investment.
- Accelerate proportionate, predictable assurance and regulatory pathways, building on programmes such as MAAT to reduce uncertainty and support both domestic deployment and export credibility.
- Provide clearer demand signals through multi-year procurement pathways, particularly across defence, offshore energy and public maritime services, to crowd-in private investment.
- Support SME scale-up and value capture, recognising that SMEs remain the primary source of innovation, IP creation and early-stage capability.
- Protect sovereign freedom of action in critical autonomy functions, including command-and-control, assurance, integration and mission-system design, while remaining globally connected in supply.

7.5 Concluding Observation

The UK stands at a pivotal moment in the development of Maritime Autonomy. The market is no longer nascent, but it is not yet locked in. The evidence in this report shows that the UK has the technical capability, institutional foundations and early-mover advantages required to lead internationally. Whether these translate into sustained economic growth, export success and strategic resilience will depend on the choices made now.

The evidence presented demonstrates that the opportunity is real, material and actionable. The choices made in the near term will determine the extent to which the UK converts early leadership into sustained economic and strategic advantage.

Annex A - Detailed Economic Modelling Methodology

Data Sources and Analytical Approaches: RAG Assessment

To ensure a thorough and transparent estimation of the UK Maritime Autonomy market, several alternative methodological approaches were considered during the study design phase. Each approach was assessed – at a high level – against key criteria, including data coverage, methodological transparency, reproducibility, and suitability for estimating UK-specific economic activity. Table 8 summarises the assessment with judgements shown in RAG format.

Table 8: RAG assessment of different analytical approaches

Approach	Description	Pros	Cons	RAG rating
Top-down national statistics	Estimating market size using SIC codes from national statistics or official reports	Official datasets; consistent economic measures	Maritime Autonomy does not have a dedicated SIC code; the activity is spread across multiple sectors	Red
Existing literature and market reports	Use published estimates of the Maritime Autonomy market size from academic and industry studies	Provides high-level global benchmarks and market trends	No consistent UK-specific estimates; methodologies are often not transparent; the definition of Maritime Autonomy varies widely	Red
Purely the Data City taxonomy approach	Identify Maritime autonomy companies directly using the Data City Maritime robotics and autonomous system taxonomy	Scalable dataset; automated classification allows broad coverage of companies	Misclassification risks; missing companies not captured in the taxonomy; no attribution for multi-activity companies; may overstate market size	Amber

Approach	Description	Pros	Cons	RAG rating
Manual company list from industry experts	Use a manually curated list of companies provided by Stehr Consulting and subject matter experts	High market relevance and expert validation	Likely incomplete; smaller or emerging companies may be omitted	Amber
Hybrid bottom-up approach (selected)	Combine The Data City taxonomy with expert input, followed by company-level attribution and financial analysis	Broad coverage, expert validation, and transparent attribution of Maritime Autonomy activity allow estimation of UK-specific economic indicators	Requires manual review and sampling assumptions; more resource-intensive	Green

Methodology for Estimating the Economic Baseline

The economic baseline of the UK Maritime Autonomy market was estimated using a bottom-up, company-level approach, designed to construct a transparent and evidence-based picture of the market. This methodology combines structured company identification, financial data extraction and estimation, and attribution of the company's activity to Maritime Autonomy. Given the early-stage nature of the market and the lack of consistent historical data, the approach combines robust assumptions, expert validation and careful consideration of multi-activity companies. The methodological approach in deriving the economic baseline of the Maritime Autonomy market includes the following steps:

Step 1: Identifying Companies in the Maritime Autonomy Market

We adopted a bottom-up methodology to define and estimate the size of the Maritime Autonomy market. This approach was selected due to two key challenges:

- Lack of a consistent definition of Maritime Autonomy across existing studies;
- Limited UK-specific estimates of the market's economic contribution.

While several global assessments exist, many provide limited transparency regarding their underlying methodologies. A bottom-up approach was therefore considered the most accurate way to construct evidence-based estimates.

The analysis builds the market from the company level upward, identifying the relevant companies, compiling available financial data, estimating it where there are gaps, and estimating economic activity attributable to the Maritime Autonomy market. The starting point was The Data City's taxonomy, which uses web scraping and AI/ML techniques to classify companies by sector. Within the RTIC 'Marine and Maritime', we focused specifically on the Robotics and Autonomous Systems sub-sector in the Maritime domain. This process identified an initial population of over 520 companies. During this stage, some organisations were reclassified or excluded where they were found to be:

- Industry associations;
- Oversight or coordinating bodies;
- Non-operating entities rather than commercially registered Maritime companies;
- Organisations whose main operations are outside the UK.

However, the resulting list was still not considered representative of the Maritime Autonomy market, as, through some spot checks, it was apparent that some known Maritime Autonomy companies were not included, and some non-Maritime Autonomy companies were included. To address this, we incorporated Stehr Consulting and subject-matter expert judgment to refine the list.

This step also introduced an additional layer of validation, prompted by the findings from our initial spot checks, which indicated that the automated classifications alone were not sufficiently reliable. To enhance confidence and credibility in the resulting dataset, we developed a supplementary list of companies known to be active in the UK Maritime Autonomy market, drawing on Stehr Consulting's internal networks, industry insight and professional connections. This list was then validated with SMI, PML and the FAST Cluster to provide a non-exhaustive but mature view of organisations understood to operate within the market. This cross-check served both to validate the automated outputs and to identify organisations unlikely to generate Maritime Autonomy related revenue. The classification process combined expert market insight with a targeted desk-based review of publicly available information to assess whether each organisation's likely activities aligned with the definition of Maritime Autonomy used in this study.

Through this, a further 186 entities were added to those captured through the automated classification, and around 400 of the automatically captured entities were removed as not being relevant to Maritime Autonomy.

This step left a total of 308 entities understood to be operating in Maritime Autonomy in the UK.

Step 2: Data Extraction and Economic Indicators

For companies identified as operating in the Maritime Autonomy market, we extracted financial and operational data from The Data City, where this data is available, which was for around 130 companies. Where data is not available, in many cases, this is likely to be due to the company not meeting Companies House reporting requirements, including needing to have a turnover of over £10 million.

Given the large number of Maritime Autonomy identified companies without reported financial information, recognising that the market includes a substantial proportion of smaller firms, we judged it important to estimate their economic contribution rather than exclude them. This was an important additional step to avoid underrepresenting the market and, in turn, undermining the credibility and accuracy of the outputs. Our approach for incorporating these companies is set out in Step 3.

For those with financial data reported, we extracted the following information:

- Real-time Industrial Classification (RTICs) produced by The Data City;
- SIC codes as registered in the Companies House;

- Number of reported employees;
- Turnover;
- Operating profit;
- Wages and salaries;
- Depreciation and amortisation.

Step 3: Estimating Activity for Companies without Financial Data

A proportion of companies did not have available financial information. To estimate their economic contribution, a multi-step approach was adopted.

First, Stehr Consulting reviewed the companies' list, and approximately 43% of companies were classified as Maritime Autonomy related. This proportion was applied to companies with missing financial data to estimate the number of relevant companies. This resulted in 212 companies requiring imputed financial values. This review constituted an expert qualitative assessment of the companies to ensure the robustness of the classification and the reliability of subsequent estimations.

Companies without reported financial information are assumed, in most cases, to be smaller entities that fall below statutory reporting thresholds. Smaller companies are less likely to publish detailed accounts, particularly in emerging technology markets where many organisations are early-stage or recently established. On this basis, the estimation approach assumes that companies with missing financial data broadly follow the size and turnover characteristics observed among comparable small companies. For the companies with unreported financials, we reviewed Companies House filings guidelines, where small entities are not required to publish a profit and loss account. Small companies are usually allowed not to publish financials, but some small companies are not eligible for the exemption and must file fuller accounts (examples include public companies, authorised insurance companies, management companies, etc).

As set out on the Companies House website, for accounting periods beginning between 1 January 2016 and 5 April 2025, micro-entities are those that meet at least 2 of the following conditions:

- An annual turnover of no more than £632,000;
- A balance sheet total no more than £316,000;
- No more than 10 employees on average.

Small companies are those that meet at least two of the following conditions:

- An annual turnover of no more than £10.2 million;
- A balance sheet total no more than £5.1 million;
- No more than 50 employees on average.

Given that we cannot fully verify all three conditions for each company, this analysis focuses on the turnover criterion, particularly for smaller companies with turnover below £10 million. While this is a simplification, it provides a practical and transparent method to identify companies likely to be exempt. We assume that this rule broadly applies to small companies within the Maritime Autonomy market. Turnover estimates were derived using evidence from a 2015 HMRC research paper [51], which examined the number of small unlisted companies across different turnover bands.

Table 6 Turnover distribution of smaller unlisted companies in the UK [51][13]

Turnover band	% of UK smaller companies in this band
£0	5.7%
£1 to £10,000	8.0%
£10,000 to £25,000	11.4%
£25,000 to £50,000	12.5%
£50,000 to £100,000	17.0%
£100,000 to £500,000	28.4%
£500,000 to £1 million	10.2%
£1 million to £10 million	12.5%

We use this distributional information to estimate the average turnover of companies in our Maritime Autonomy sample without reported financial information. The average turnover applied is £325,858. This filled in the turnover gaps we had in our sample of companies.

Step 4: Adjusting for Multi-Activity Companies

Many companies identified in the dataset are not exclusively active in Maritime Autonomy but operate across multiple sectors/markets. To avoid overstating the size of the Maritime Autonomy market, we applied an attribution method to approximate Maritime Autonomy-specific activity. This approach balances robustness and credibility with proportionality and practicality. This involved applying an attribution method to estimate the share of each company's activity attributable to the Maritime Autonomy. A balanced sampling approach was adopted across company size bands. All large companies were individually reviewed due to their potential to materially influence market totals, particularly in relation to turnover and GVA. For medium and smaller-sized companies, a proportionate sampling approach was used. This reflects both the larger number of companies in these smaller bands and their comparatively smaller individual economic impacts. The methodology is explained in the following table.

Meanwhile, smaller companies represent an important component of the Maritime Autonomy ecosystem. Previous industry research suggests that small and medium-sized enterprises account for around 44% of activity within maritime autonomous technology markets [52]. Sampling was therefore designed to ensure sufficient representation of SMEs, particularly small companies, while maintaining analytical proportionality.

[13] The turnover distribution presented in the 2015 study also covers companies with an annual turnover over £10 million. The distribution presented here was rescaled proportionally across the applicable turnover bands to sum to 100%.

Table 10: Approach to deriving the proportion of activity related to Maritime Autonomy by company size

Large companies (turnover over £100 million) - 27 companies	All companies in this category were individually reviewed. A Maritime Autonomy attribution percentage was assigned based on qualitative research of each company's activities.
Medium-sized Companies **(Turnover below £100 million and above £10 million) – 63 companies**	Companies were grouped into turnover bands, and samples within each band were drawn. All the companies within these samples were then individually assessed to determine the Maritime Autonomy share of their activity. The sample sizes for each turnover band are detailed in the table below, with every turnover band having a sample size of at least 33% of the companies within the band. For each sample, an average Maritime Autonomy share was then calculated by averaging across the individual maritime autonomy shares - shown in the right-most column of the table below. These averages were then applied to the remainder of the companies in that band, but not in the sample.
Small Companies – 212 companies **(Turnover below £10 million)**	Having filled the turnover gaps in our overall list of companies as per Step 3 above, we then took samples of these smaller companies and all the companies within these samples were individually assessed to determine the Maritime Autonomy share of their activity. The sample sizes for each turnover band are detailed in the table below. For each sample, an average Maritime Autonomy share was then calculated by averaging across the individual Maritime Autonomy shares - shown in the right-most column of the table below. These averages were then applied to the remainder of the companies in that band, but not in the sample.

A qualitative, insight-led review of a selection of companies was undertaken to allocate an appropriate share of current activities to Maritime Autonomy. This assessment drew on Stehr Consulting's knowledge of the market and understanding of individual companies' operations, and was supplemented by targeted desk-based research using publicly available information. Together, this enabled an informed estimate of the likely proportion of each company's revenue or activity attributable to Maritime Autonomy as defined for this study.

This additional, more qualitative step was not part of the original analytical plan, but was introduced after spot checks of conventional RTIC-based classifications indicated that they did not provide a sufficiently defendable or representative picture of the market. Incorporating expert judgement was therefore considered critical to ensure accuracy, credibility and alignment with what is known about the structure and maturity of the Maritime Autonomy ecosystem.

Consideration during this review included:

- Whether the company's business model is wholly or predominantly focused on Maritime Autonomy;

- The extent to which its products or services (e.g. sensors, software, integration services) are applicable to Maritime Autonomy and the likely proportion supplied into autonomy- focused markets;
- An informed financial estimate of the share of its current activities that sit within the Maritime Autonomy domain.

Table 11: Turnover bands and maritime autonomy attribution rates

Turnover range	Total count in our sample	Total count given an individual assessment for Maritime Autonomy%	Share of companies given an individual assessment for Maritime Autonomy%	Average Maritime Autonomy%
>£1bn	8	8	100%	0.66%
Between £100m and £1bn	19	17	89%	6.73%
Between £50m and £100m	15	5	33%	23.27%
Between £15m and £50m	25	13	52%	30.10%
Between £1m and £15m	20	15	75%	35.33%
Between £0 and £1m	6	4	67%	45.63%

Step 5: Direct Market Size Estimation

The extracted economic indicators in Step 2, and our proxy turnover values added in for companies without financial information, were combined and aggregated to produce total estimates of:

- Turnover;
- GVA;
- Total Employment.

For companies without reported financial information. GVA and employment values were estimated using the ratios observed among companies with available financial data, and verified Maritime Autonomy attribution was applied. These ratios were applied to the estimated turnover of companies with missing data to derive their implied GVA. This ensured consistency between reported companies and estimated companies.

All market estimates presented in the economic baseline analysis relate to 2023 company financial data. This year was selected as it provides the most recent and complete set of reported financial information across the identified company population. Given the emerging nature of the Maritime Autonomy market and the relatively small number of companies operating within it, using later years (i.e. the year 2024 and 2025) would reduce the number of entities available for the analysis and weaken the accuracy of the estimates. The 2023 dataset, therefore, represents the most reliable basis for constructing market-wide indicators.

Step 6: Indirect and Induced Impacts

WPI Economics' input-output model is used to estimate the indirect and induced effects of the direct gross value added generated by the Maritime market in the area.

- Indirect impact: includes other industries that supply goods and services to the Maritime Autonomy market;
- Induced impact: refers to other industries affected by the spending of the Maritime Autonomy market's employees.

To derive the indirect and induced output multipliers, Type I and Type II Leontief Inverse matrices are employed to generate the indirect and induced GVA per unit of output multipliers. The indirect and induced benefits are calculated by using these multipliers from the direct benefits using the SIC codes we identified from the Maritime Autonomy company list.

Limitations

This methodology provides a thorough, transparent estimate of the size of the Maritime Autonomy market. However, it remains subject to limitations, including but not limited to:

- Incomplete coverage of early-stage or small companies. Many companies in the Maritime Autonomy sector are new or exempt from Companies House reporting requirements, resulting in missing financial data. We have attempted to fill in proxy values for these companies through the most robust method we could establish, but these proxy values are, of course, subject to considerable uncertainty. Estimations for companies without reported turnover assume that these companies follow similar turnover distributions and GVA ratios as comparable companies. This simplification may under- or over-estimate contributions for some companies, particularly newly established or rapidly growing companies.
- Use of sampling for Maritime Autonomy attribution rates. For companies operating across multiple sectors, we applied a sampling-based methodology to estimate the proportion of activity attributable to Maritime Autonomy. While this provides a reasonable approximation, it does not capture the precise activity of each company. Larger companies were individually reviewed to minimise distortion, while medium and small companies were sampled proportionally to balance robustness with proportionality. More precise attribution would require company-level disclosure or detailed surveys, which are beyond the scope of this study.
- Reliance on publicly reported financial and employment data. The analysis primarily uses 2023 company-level financial data, which provides the most complete and recent coverage across the sector. However, due to the fast-moving nature of the Maritime Autonomy market, some developments, investments, or new entrants may not be fully reflected. There is, therefore, a potential lag between sector activity and reported figures.
- Allocating Maritime Autonomy Percentages to select companies relied generally on expert analysis and understanding of the activities the company would be undertaking. Most large companies do not declare exact revenue associated with Maritime Autonomy, as it is not considered a market yet, based on the scale (compared to 'shipbuilding'). Smaller companies do not provide market breakdowns at all, so estimation relies on understanding of the products and services they offer, and how these may involve Maritime Autonomy, exact share is impossible to quantify without direct engagement.

Annex B - Detailed Methodologies for Quantifying Use-Case Growth and Adoption

Throughout this annex, we set out the methodologies used to quantify the potential for growth across a number of use cases. Baseline market sizes and growth rates are derived from evidence-based data sources, supplemented by clearly defined assumptions where required. To assess the opportunity and applicability for Maritime Autonomy within each use case, we apply qualitative insight and expert judgment to estimate the likely pace and extent of technology adoption.

The following sections break this methodology down in detail, outlining how baseline values were constructed, how growth assumptions were derived, and how qualitative assessments were used to determine autonomy applicability across the individual use cases.

Use cases developed here were selected based on a combination of factors, answering these questions:

- Potential for autonomy adoption: How much of this application could be autonomous?
- Market size: If this market adopted autonomy, how large could the revenue generated be?
- Data Transparency: Is there enough information publicly available to support interrogation?

Avoiding stretch assumptions whilst still aiming to get a sufficiently wide spread of use cases and total proportion of the Maritime Autonomy market value was the goal. Initially, a selection of 15 use cases was made, but due to the data available, this was restricted to 11.

Recommendations:

- Further consider the roles autonomy will specifically take in each use case, adopting a more technical basis for quantifying the potential for uptake in the use cases.
- Expand use case set to model a wider range of maritime activities in more detail, providing a wider basis for future growth estimation.
- Consider the potential for market dynamic shifts through the adoption of autonomous technologies and what this may mean in terms of value.

Offshore Wind Operation and Maintenance (O&M) Spares Delivery

To assess the role of Maritime Autonomy in offshore wind O&M spares delivery, we first consider the current and projected scale of UK offshore wind capacity. As of 2026, the UK had 16 GW of operational capacity [53]. Government targets indicate 50 GW by 2030 [54], with indicative capacity of 93GW by 2040and 125GW by 2050 [55].

Assuming that an 'average' wind farm can be approximated as 'medium-sized', total annual O&M costs are estimated at £45.5k/MW (2023/24 costs) [56]. While these costs may fall over time, they are assumed to remain broadly constant, reflecting increased average windfarm size and turbine complexity. Historically, around 43% [57], of O&M expenditure relates to regular maintenance, repair and spare parts, and 38% of this is associated with vessel costs [58]. On this basis, vessel-related O&M expenditure is estimated at £7.6k/MW/year (38% of 43% of £45.3k/MW) (Assuming that the costs are constant and the reliability improvements expected are mitigated by the increase).

Using projected capacity growth, annual vessel-related expenditure can therefore be estimated for each milestone year. It should be noted that this cost category includes Crew Transfer Vessels (CTVs), which are unlikely to see reduced crewing or autonomy adoption at the same rate as other vessel types, but without exact knowledge of the comparative operations of each type of vessel, it is assumed that CTVs may match other supply vessels.

To estimate the potential Maritime Autonomy contribution, we consider the operational characteristics of offshore wind O&M. The high repeatability of routes and generally well-defined operating patterns support increased autonomy adoption. However, complexity in the handover of spare parts and potential congestion around turbines and substations may moderate uptake. On balance, autonomy adoption is expected to increase steadily and reach relatively high levels by 2050.

Table 12: Maritime Autonomy Contribution from Offshore Wind Spares Delivery[14]

Year:	2025	2030	2040	2050
O&M Vessel Costs (£m/year)	121.6	379.9	706.6	949.8
Maritime Autonomy Portion (%)	-	5	30	40
Maritime Autonomy Value (£m/year)	-	18.9	212.0	379.9

[14] 2025 value left blank to avoid providing estimates in an area that is currently using autonomous systems, but at unknown scales, and at varying magnitudes depending on a number of factors.

Offshore Wind Undersea Inspections

This section provides a step-by-step description of the approach used to assess the role of Maritime Autonomy in undersea inspection (and, by extension, maintenance). The methodology focuses on autonomy-enabled inspection activities; however, as current operators often undertake inspection and maintenance simultaneously, the cost estimates are likely to reflect a combination of both.

At the end of 2025, the UK operated 52 offshore wind farms, generating 16GW of capacity across 2,878 turbines. Current national targets aim for 50GW by 2030, with indicative capacity rising to 93GW by 2040, 125GW by 2050. Assuming new turbines are all around 15MW, and the number of wind farms grows broadly in line with capacity requirements [53], we can project turbine and wind farm numbers out to 2050.

Each 15MW turbine typically requires a minimum of 1.5km of array cabling [59] to connect to local converters via medium voltage cables. Assuming this length is consistent across turbine sizes, the projected increase in turbine numbers allows us to estimate future array cable lengths. While current in-service turbines are not all 15MW, the larger number of smaller turbines is offset by shorter cable lengths - meaning that using an average per-turbine estimate provides a reasonable approximation across the existing fleet.

Export cables transmit power from wind farms to shore (using high voltage cables). As of 2018, 32 wind farms used a total of 62 export cables [60], suggesting an average of approximately two cables per wind farm. Larger future projects will require more cables, smaller projects fewer, but this average provides a workable estimate. An aggregated list of UK offshore wind farms indicates an average distance of 20 km from shore [61], which is likely a conservative lower bound as future development moves further offshore. These assumptions allow us to estimate total export cable lengths as capacity expands.

Beyond wind farm infrastructure, the UK also operates a significant network of subsea interconnector cables. In 2025, these totalled 3,310km [62]. By 2030, a further 3,531km is in construction, proposed or approved, with an additional 3,345km expected by 2040 [62]. It is reasonable to assume a similar scale of growth between 2040 and 2050. These figures enable projections for total subsea cable length requiring routine inspection.

At present, inspections are carried out using a combination of manned survey vessels equipped with specialist sensors, remotely operated vehicles (ROVs), and divers. Using assumptions of 3kts survey speed, 10kts transit speed, a 12 hour working day, and an average charet cost of £60,000 per day, we calculate the annual cost of inspecting 10% of total cable length[15]. Vertical inspections (e.g. turbine foundations) are assumed to take twice as long as horizontal surveys due to their complexity and 3D inspection requirements.

Expert insight suggests that autonomy adoption will begin slowly but increase rapidly before 2040, with autonomous systems completing the majority of inspection tasks by mid-century.

[15] 10% was reached with consultation with industry experts and aims to reflect the requirement to spot check rather than fully inspect cabling.

Table 13: Maritime Autonomy Value from Offshore Wind Subsea Inspection

Year:	2026	2030	2040	2050
Cable Inspection Revenue (£m/year)	9.69	21.03	34.26	45.04
Maritime Autonomy Portion (%)	2	10	60	80
Maritime Autonomy Inspection Revenue (£m/year)	0.19	2.1	20.6	36.1

Tugboat Operations

This section provides a step-by-step description of the approach used to estimate the role of Maritime Autonomy in tugboat operations.

To establish a UK baseline, several data sources were combined. The global tugboats market is valued at around $7.8b as of 2026 [63]. Because tug operations are closely tied to port activity, we use port call volumes to approximate the UK share of the global market. In 2023, the UK accounted for 183,473 port visits, compared to 4,790,186 worldwide [64], representing 3.8% of global port calls. Applying this proportion to the global market gives an estimated UK tugboat market value of £221 million in 2023 (assuming £1:$1.35). Assuming a 4.5% annual growth rate [63], we can project future tugboat market values.

To estimate the potential adoption of Maritime Autonomy, we draw on an autonomous shipping industry survey that captured expert expectations for the uptake of autonomy across commercial shipping (including tugboats). The results are summarised below.

Table 14: Expected adoption rate of autonomous systems in commercial shipping [65]

Marit	Proportion of Experts	
Expected Adoption Rate (%)	**2030**	**2040**
0-5	40	14
5-10	40	36
10-20	13	29
20-50	0	21
50-100	0	0
Net %	7.6	20.25

Net adoption percentages were calculated using an average weighted by the upper bound of each band (except for 0–5%, where 2.5% was used):

$$Net\ \% = \frac{(2.5 * ExpAdop_{0-5} + 10 * ExpAdop_{5-10} + 20 * ExpAdop_{10-20} + 50 * ExpAdop_{20-50} + 100 * ExpAdop_{50-100})}{100}$$

Assuming negligible autonomy adoption in 2025, and growth to 30% by 2050, we can estimate the share of tugboat revenue that may be attributed to Maritime Autonomy in the UK:

Table 15: Maritime Autonomy Revenue from Tugboat Operations

Year:	2025	2030	2040	2050
Tugboat Revenue (£m/year)	241.6	301.2	467.7	725.3
Maritime Autonomy Portion (%)	-	7.6	20.25	30
Maritime Autonomy Tugboat Revenue (£m/year)	0	16.5	94.7	217.9

Currently industry data suggests that around 30% of new build tugboats globally already include remote operation capabilities, which sits inside our definition of Maritime Autonomy [63].The British Tugowner Association reports that its members operate approximately 180 tugboats with 1,000 seafarers [66].

Assuming the tug fleet grows at 4.5% a year on year, fleet size would increase to 245 by 2030, a net increase of 65 vessels. If 30% of these new vessels have autonomous potential, around 22 would incorporate Maritime Autonomy – representing roughly 8% of the total UK tug fleet. This aligns closely with the survey-based adoption trajectory and supports the projected autonomy-related revenue shown above.

This assessment assumes that revenue is proportional to fleet size and that the rate of adoption does not accelerate beyond current expectations.

Defence Sector

This section sets out the step-by-step approach used to estimate the role of Maritime Autonomy within UK Defence. The methodology is informed by Stehr Consulting's defence expertise and is based on an expected £7 billion of investment over the next 10 years.

The approach applies a steady incremental increase over the first decade, followed by a comparable trajectory through to 2040 and 2050. This provides a cumulative value consistent with the £7 billion expectation, while also reflecting the need for continued capability development, fleet expansion, and the ongoing maintenance and support of existing infrastructure and vessels. The estimated annual values are presented in The process applied for each use case, to provide these estimations, is detailed in Annex B alongside the references used to support the analysis.

Table 2 within 4.4.3.1.

Border Security

Border Force undertakes a significant proportion of the UK's non-MOD civil maritime security activities. It currently operates 11 vessels, and under the Maritime Capability Replacement Programme (MCRP) it is reasonable to expect that a similar number of vessels will be procured to maintain existing operational commitments. As a baseline for estimating costs, we have drawn on the procurement prices of comparable US Coast Guard vessels. While the US Coast Guard is likely to require more capability (being a defence-focused organisation), economies of scale may reduce unit costs; therefore, it is assumed that Border Force vessels procured under MCRP will be of comparable cost.

Border Force currently operates five 42m Customs Cutters [67] and six 17.5m Coastal Patrol Vessels (CPV) [68]. Over the last 15 years, the US Coast Guard procured 45m Fast Response Cutters for $507m for a batch of 10 in 2025 [69], equivalent to approximately £37.84m per vessel. Similarly, in 2003, it procured 47ft lifeboats at $1.214m each, equivalent to £1.595m per vessel today.

Assuming the MCRP delivers new vessels at similar cost over the next 15 years (one new cutter every two years and one new CPV on the same cycle), annual expenditure is estimated to be around £21m. Although MCRP delivery is currently paused, it is expected to begin in 2029. Investment is likely to increase over time due to inflationary pressures on materials and personnel, and potential design changes to address evolving operational requirements. For this analysis, a 5% year-on-year growth in expenditure is assumed, with investment continuing beyond initial delivery either to expand the fleet or undertake refits and upgrades.

Border Force is also expected to make increasing use of autonomous vessels to support operations. While initial adoption may be modest (assumed at 5% of total vessel expenditure), the proportion allocated to autonomous capabilities is expected to grow over time, reaching 10% by 2050. This allows us to estimate potential Border Force investment into Maritime Autonomous technologies.

Table 16: Maritime Autonomy Revenue from Civil Security Investment

FY Start	2025	2030	2040	2050
Vessel Expenditure (£m/year)	0	22.6	36.8	250
Maritime Autonomy Portion (%)	0	5	7.5	10
Maritime Autonomy Vessel Expenditure (£m/year)	0	1.12	2.76	6.0

Fishing

This section outlines the approach used to estimate the potential growth of Maritime Autonomy within the UK fishing industry.

In 2024, the UK fishing industry landed £1,158.6 million of fish, representing a CAGR of 1.72% since 2021 [70]. Assuming this growth rate continues, we can project the future value of landed catch. Historically, 30-40% of landed value has come from sea-floor and above-sea-floor fishing, with a further third from shellfish. As shellfish operations are less applicable to Maritime Autonomy, we focus on the non-shellfish elements and apply a 35% share to both sea-floor and above-sea-floor fishing.

While trawlers may be able to navigate autonomously and automate net deployment, the overall applicability of Maritime Autonomy in fishing is expected to be limited initially [71]. This reflects several factors:

- Sea-floor fishing is more complex and therefore less suited to early autonomy adoption;
- A high proportion of UK fishing operations are run by small, family-owned businesses with limited capital for new technologies;
- Social acceptance of autonomy within the fishing community is likely to be low;
- The earliest adoption is expected in smaller support vessels rather than in primary trawlers.

Based on these considerations, conservative adoption rates are applied across the different fishing areas.

Table 17: Maritime Autonomy Revenue from the Fishing Industry

Year	2025	2030	2040	2050
Value Landed (£m)	1,159	1,283	1,522	1,805
Maritime Autonomy portion - above-sea-floor fishing %	0	1	5	15
Maritime Autonomy portion - sea-floor fishing %	0	0.5	3	12
Total Value from Maritime Autonomy (£m)	0	6.7	42.6	170.6

Freight Shipping

This section outlines the approach used to estimate the potential growth of Maritime Autonomy in the UK shipping sector [72].

The Centre for Economics and Business Research provides turnover figures for both international and domestic commercial freight operations. As of 2023, international shipping generated £21,241 million, while UK domestic freight contributed £78 million [72]. Given the close relationship between UK and global shipping markets, and in line with industry expectations, both components are assumed to grow at approximately 2% per year.

Based on a UK Chamber of Shipping report, it is estimated that 50% of the UK's exports and import is trade to the EU [73], with the remainder representing trade that can be considered 'long sea'. Considering that autonomy will likely be adopted sooner and at a greater scale in shorter transits [74], due to the repeatability of the sailings, assumptions around the uptake of autonomy across domestic, EU and International freight can be made. By combining this 50:50 split of international shipping and these estimations for autonomy uptake, the total value can be estimated.

Table 18: Maritime Autonomy Revenue from the Shipping Industry

Year	2025	2030	2040	2050
International Shipping revenue (£m)	21,666	24,399	29,743	36,256
Domestic Shipping Revenue (£m)	80	90	109	133
EU Maritime Autonomy Portion (%)	0.1	2	5	15
Other International Maritime Autonomy Portion (%)	0.05	0.5	1	8
Domestic Maritime Autonomy Portion (%)	1	2	10	20
Total Value from Maritime Autonomy (£m/year)	17	309	903	4,196

Passenger Vessels

This section outlines the approach used to estimate the potential Maritime Autonomy market within UK passenger vessel operations.

The Cebr report on UK shipping provides UK revenue for both international and domestic shipping operations [72]. In 2023, these were £10,760 million for international passenger services and £961 million for domestic services [72]. Both markets are assumed to grow at approximately 2% [75], in line with wider commercial shipping growth expectations.

Internationally, the UK classifies passenger movements into cruise, long sea, and short sea categories, with short sea accounting for the highest passenger numbers [76]. Domestically, the UK handled 38.3 million passengers in 2024, roughly twice the international total. These domestic movements comprise:

- 46% river ferry services;
- 44% inter-island routes;
- 10% domestic crossings (e.g., England-Northern Ireland).

Maritime Autonomy is generally more applicable to shorter, repetitive routes with lower operational complexity - conditions typically found in ferry and short-sea operations. However, autonomy adoption within passenger transport is expected to remain conservative because:

- Passenger-carrying vessels are long-life, high-capital assets;
- Crews are already relatively lean in many operations;
- Safety and public-acceptance considerations create higher barriers to deployment;
- Regulatory caution is likely to persist for human-carrying services.

As such, autonomy penetration is assumed to be modest initially, increasing gradually as technologies mature and societal acceptance improves.

Table 19: Maritime Autonomy Revenue from Passenger Vessels

Year:	2025	2030	2040	2050
International Revenue (£m/year)	11,194	12,359	15,066	18,366
Domestic Revenue (£m/year)	999	1,103	1,345	1,640
International Maritime Autonomy Percentage (%)				
Cruise	0	0	1	2
Long Sea	0	0	1	3
Short Sea	0	0	3	8
Domestic Maritime Autonomy Percentage (%)				
Domestic Crossings	0	0	1	5
Inter-Island	0	0	2	10
River ferry	0	1	10	20
Maritime Autonomy Revenue (£m/year)	0	5.08	476.2	1,515

Remote Pilotage

This section outlines the approach used to quantify the potential growth of Maritime Autonomy within pilotage, specifically focusing on remote pilotage operations.

In 2022, the Port of London Authority (PLA) completed 13,699 pilotage acts, generating approximately £29.77 million in revenue [77]. Although the PLA does not undertake every pilotage operation within the port, this provides a useful benchmark for revenue per piloted act. In the same year, the PLA handled 54.9 million tonnes of freight, giving an indicative revenue-per-tonne figure.

The UK handled 449 million tonnes of freight in 2022 [64], meaning the PLA represents around 12% of national freight volume. Extrapolating based on this share suggests the UK may have completed approximately 112,000 pilotage acts in 2022. Applying the PLA's average revenue per act (around £2,173) gives an estimated total UK pilotage market value of £243.5 million. Assuming annual growth of 4.5%, we can project pilotage revenue forward to 2050.

Evidence from Danish remote pilotage trials suggests that remote pilotage may initially apply to around 10% of operations [78]. As technology, regulation, and operating models evolve, applicability could plausibly increase to 40% by 2050. Adoption (the proportion of applicable pilotage acts actually performed remotely) is initially expected to be very low (the UK currently has no operational remote pilotage services) but could rise to 50% of applicable acts by mid-century.

Combining overall pilotage market growth with assumptions on applicability and uptake provides the estimated Maritime Autonomy market values shown below.

Table 20: Maritime Autonomy Revenue from Remote Pilotage Operations

Year	2025	2030	2040	2050
Pilotage Market (£m)	227.9	346.3	537.8	835.9
Operational Applicability of Remote Pilotage (%)	10	16	28	40
Remote Pilotage Use in applicable operations (%)	0	1	10	50
Maritime Autonomy Value (£m)	0	0.498	13.6	150.3

Research

This section outlines the step-by-step approach used to estimate the potential growth of Maritime Autonomy within the UK Maritime research market.

As it is not feasible to map every research project, budget line or the proportion spent on autonomy-related activity, the most practical and transparent method was to focus on research that uses autonomous vessels directly. This approach estimates the potential Maritime Autonomy contribution based on the chartering costs of in-service research vessels, supported by expert judgement.

As of 2026, 14 dedicated UK research vessels were identified as being operational, operated by a range of organisations and varying in size from 6.8m to 129m, with a combined length of nearly 700m. The vessels included[16,17]:

- NOC RV Discovery;
- NOC RV James Cooke;
- BAS RV Sir David Attenborough;
- Marine Biological Associations RV Sepia;
- University of Swansea RV Mary Anning;
- PML RV Plymouth;
- PML RV Explorer;
- Marine Scotland RV Scotia;
- Marine Scotland RV Alba na Mara;
- University of Southampton RV Callista;
- Agri-Food and Biosciences Institute RV Corystes;
- University of Plymouth RV Falcon Spirti;
- Bangor University RV Prince Madog;[18]
- Newcastle University RV Princess Royal;

[16] Other research vessels may be in service, but during the research here these were not identified.
[17] References to each vessels spec sheet has not been provided to avoid over-populating the page, the reader is referred to the websites of the organisations owning each vessel, or to this Wikipedia directory: Category:Research vessels of the United Kingdom - Wikipedia
[18] Note this is currently undergoing hydrogen power refit but is still included

- CEFAS RV Cefas Endeavour.

Estimated charter rates were derived by applying typical daily charter cost ranges (provided through expert insight) to each vessel based on length. Acquiring true costs was not possible within the timeframe of this study but could be considered if deemed valuable for further work.

Table 21: Chartership Cost Estimations for Research Vessels by Vessel Length

Size (m):	16-24	24-40	40-100	100
Lower Bound (£k/day)	3.5	30	100	150
Upper Bound (£k/day)	9	100	150	200

By applying the appropriate daily charter value to each vessel, summing the totals, adding 20% to account for non-research vessels occasionally chartered for research, and assuming a 20% utilisation rate, the total annual research vessel charter market is estimated at £86.7 million per year.

Assuming annual growth of 5% (reflecting increases in research activity and vessel operating costs), alongside the assumption that a growing proportion of research will either use autonomous vessels directly or integrate autonomous systems into conventional platforms, we estimate the Maritime Autonomy share as follows:

Table 7 Maritime Autonomy Revenue from Research Applications

Year	2025	2030	2040	2050
Research Market (£m)	86.7	110.7	180.3	293.7
Maritime Autonomy Proportion (%)	1	2.5	10	20
Maritime Autonomy Value (£m)	0.87	2.77	18.0	58.7

Aquaculture

This section outlines the step-by-step approach used to estimate the value of Maritime Autonomy within the UK aquaculture industry.

In 2022, the UK aquaculture sector was valued at approximately £1 billion, with an expected growth rate of 6.7% per year [79]. While this level of growth may not persist over the full 25-year horizon, a steady growth trajectory is assumed for the purposes of this analysis.

When assessing the opportunity for Maritime Autonomy, we focused on the elements of aquaculture operations where autonomy can meaningfully contribute - primarily inspection of infrastructure and equipment (e.g. cages, moorings, feeding systems, pipelines). These activities represent a relatively small share of total industry value, and autonomy adoption is expected to be gradual.

Given these constraints, Maritime Autonomy is not expected to account for more than 2% of the total aquaculture market by 2050.

Table 8 Maritime Autonomy Revenue from Aquaculture

Year	2025	2030	2040	2050
Aquaculture Market (£m)	1,105	1,306	1,825	2550
Maritime Autonomy Proportion (%)	0.01	0.05	0.5	2
Maritime Autonomy Value (£m)	0.11	0.65	9.1	51

Assumptions

- Value of maritime autonomy is considered a proportion of revenue or expenditure within a market, representing the proportion that is generated/spent from developing or using autonomous systems.
- Market growth is independent of autonomy's input, whilst autonomy may benefit or reduce market growth, historical trends are used to build future wider market trajectories, and the role autonomy plays to change the market is not considered at this stage.

Limitations

- The modelling here does not consider any sudden growth or recession components; there is no rapid adoption or stagnation.
- Autonomy value proportioning is considered at a very surface level, with less consideration for the difference in value from supporting maritime industries that are not specifically autonomy related.
- Reliance on historical trends only for market growth, as very few market quantification studies are available publicly (e.g. freight market, tugboat market, etc.) and therefore acquiring more accurate projections within time and budget was challenging.

Annex C - Detailed Methodology in Projecting Future Growth of the Maritime Autonomy Market

Methodology for Project Future Growth

Projecting the future development of the Maritime Autonomy market is important for understanding its potential economic contribution and the scale of opportunities that may emerge over time. As an emerging technology-driven industry, the market is expected to evolve rapidly as new technologies develop, commercial applications expand, and regulatory frameworks and policy support develop. Given the uncertainty associated with emerging markets such as Maritime Autonomy, our analysis explores multiple growth trajectories to capture uncertainty in potential future development. This allows a range of plausible development pathways to be explored rather than relying on a single projection. The projections focus on the short to long term outlook (approximately for the next 25 years). To inform how to calibrate the trajectories, we undertook a number of evidence-gathering activities, set out below.

Step 1: Establishing the Baseline Market Size

The growth analysis uses the 2023 Maritime Autonomy market estimates as the baseline year, representing the most recent period with the most complete company financial reporting. The baseline estimates of market turnover, GVA, and employment were derived using the methodology described in Annex A. This analysis is based on company-level data obtained from The Data City's database and includes attribution of Maritime Autonomy activity for companies operating across multiple sectors/markets. The same dataset and attribution approach was applied retrospectively to construct historical estimates for the period 2019-2023, enabling a consistent time series for analysing market growth, as set out in Step 2 below.

Step 2: Analysing Historical Market Growth

Using the reconstructed dataset, historical growth in the Maritime Autonomy market was analysed over the period 2019-2023. Annual estimates of turnover, GVA and employment were calculated using the same approach applied in the baseline year, allowing year-on-year and multi-year growth rates to be derived. This historic period was chosen as it best balances having a wide enough span of years from which to observe trends, while not being so wide as to excessively reduce the pool of companies with financial data. The time period also ensures that both pre- and post-COVID years are included in our trend assessment. The analysis indicates rapid sector expansion during the early development phase. Annual growth between 2019 and 2023 averages around 34% in GVA and 23% in employment. The rapid growth is influenced by the relatively small size of the sector in earlier years, which can amplify percentage growth rates. To determine how sensitive our past growth estimates are to a narrower time window, we alternatively calculated the growth trends observed from 2020 to 2023 (noting the start of this time period falls during the Covid-19 pandemic, which is likely to skew - and in this case reduce – the average annual growth rate). Using this narrower set of years generates an average rate of approximately 15% - 16% in turnover, 13% - 18% in GVA and 5% - 6% in employment.

Step 3: Benchmarking Against Adjacent Autonomous Technology Sectors

Given the early-stage nature of the Maritime Autonomy market, historical sector trends alone may not fully capture the potential pace of future market development. To provide additional context for the growth scenarios, the analysis benchmarks against adjacent high-growth autonomous technology sectors that have undergone comparable technology adoption cycles.

Two sectors were selected for this benchmarking exercise:

- The commercial drone market;
- The autonomous vehicle (self-driving car) market.

While unique in their own rights, these sectors were chosen because they share several structural characteristics with Maritime Autonomy, including:

- Significant technological innovation and R&D investment;
- Evolving regulatory and safety frameworks;
- Gradual commercial deployment through pilot programmes;
- Increasing private investment and scaling of enterprise applications.

Evidence from the Drone Market

Analysis of the global commercial drone market indicates a sustained growth trajectory over the past decade, with revenues expanding from approximately US$1 billion in 2016 to over US$10 billion by 2024 [80]. Market forecasts suggest continued expansion with a CAGR of around 10-11% over the coming decade [81].

This pattern suggests a steady enterprise-led scaling phase, where adoption gradually expands across commercial applications rather than experiencing a sharp early peak followed by a rapid slowdown.

The UK and Europe are identified as leading regions for commercial drone adoption, with forecasts continuing to project double-digit growth across both enterprise and consumer segments through to 2030 [82].

Evidence from the Autonomous Vehicle Market

Growth projections for the autonomous vehicle market are generally more accelerated, reflecting the scale and potential transformation of the automotive sector.

Industry projections estimate global market growth exceeding 20% annually through to 2030, with some forecasts suggesting even higher expansion rates as commercial deployment increases [83] [84]. For example, market estimates suggest the autonomous vehicle market could expand from approximately US$2.2 billion to over US$25 billion within the current decade, implying growth rates exceeding 30% in some sectors.

Implications for Maritime Autonomy Growth

The drone market illustrates a steady enterprise-led scaling pathway, with growth stabilising at around 10% CAGR as adoption broadens across industries. In contrast, the autonomous vehicle market demonstrates how earlier-stage autonomy technologies can experience more rapid expansion, with growth rates exceeding 20% during initial scaling phases.

These benchmarks suggest that the Maritime Autonomy market is likely to follow a technology adoption curve characterised by an initial acceleration phase followed by more sustained long-term growth, consistent with an S-shaped technology diffusion pattern.

Step 4: Incorporating Qualitative Market Analysis

Quantitative trend analysis is complemented with qualitative research and sector analyses to capture developments that may not yet be visible in historical data and adjacent sectors. In particular, the analysis focuses on individual Maritime Autonomy market segments and use cases, examining how various parts of the market may evolve. The assessment considers factors including:

- Expected technological readiness and advancements;
- Emerging niche markets and anticipated market adoption;
- Private investment and industry activity;
- Emerging operational use cases across Maritime industries;
- Policy and government support.

This evidence provides additional context on how different components of the market may develop at different speeds. For example, certain applications may scale more rapidly due to clearer commercial demand or stronger policy support, while others may develop more gradually as technological adoption matures. This provides illustrative evidence to support the overall market growth narrative.

Step 5: Defining the Baseline Growth Trajectory

Using the evidence gathered in the previous steps, a baseline growth trajectory for the Maritime Autonomy Market was constructed. In the short to medium term (approximately the next 15 years), growth assumptions are primarily informed by:

- Historical market growth patterns;
- Benchmark evidence from adjacent industries.

For the longer-term projection horizon, uncertainty increases as the market evolves and new applications emerge. As Maritime Autonomy remains at an early stage of technological and commercial development, it is difficult to determine precisely where the market currently sits within a typical technology adoption lifecycle. While emerging technologies often follow S-shaped diffusion patterns, it is not yet clear whether Maritime Autonomy will follow a similar trajectory or how quickly it may transition between phases of growth. To address this uncertainty, longer-term projections leaned on the use case analysis, where we aggregated the potential revenue associated with each use case to derive an overall potential market trajectory. The aggregation allows an implied CAGR to be estimated over the longer-term horizon, providing a reference point for the market's potential future scale.

Step 6: Constructing Multiple Growth Scenarios

Based on the identified growth trajectories, three growth trajectories are developed to reflect uncertainties in the future development of the markets. These include conservative, central and high growth. The trajectories were calibrated based on the following information and judgements:

Conservative:

- Using a narrower window - from 2020 to 2023 - for the past growth analysis gives an annual average growth rate of Maritime Autonomy of 15%. The beginning of this narrower window falls during the COVID-19 pandemic, likely making it less representative. However, given the lower growth figure it generates, we use this as a lower bound for the short term projection;
- In the medium term, it is possible that the Maritime Autonomy market might follow the lower estimate (10%) for the current predicted annual growth of the drones market;
- In the longer term, a conservative view could be that the growth of the Maritime Autonomy market converges to the average annual growth rate of the traditional Maritime market, estimated at 5%.

Central:

- For our short-term projection, we use the midpoint (25%) between the two past growth estimates we generate using different time windows. This also aligns with short-term estimate from the aggregation of the use-case studies;
- In the medium term, it is possible that the Maritime Autonomy market might follow the midpoint estimate (14%) for the current predicted annual growth of the drones market;
- We use an 8% figure generated from the midpoint between the conservative and high longer-term growth estimates for our central longer-term growth rate.

High growth:

- For our short-term projection, we use the upper estimate (34%) from our past growth analysis.;
- In the medium term, it is possible that the Maritime Autonomy market might follow the upper-end estimate (18%) for the current predicted annual growth of the drones market;
- The Use-Case Growth and Adoption examples suggest growth in the Maritime Autonomy market will reduce into the longer term, and so even under our more optimistic scenario we assume a tapering down in growth over time. In the longer term, we apply the growth rate estimated from the aggregation of the use case studies (12%).

Annex D - Detailed Supply Segmentation

Platforms & Vehicles Sector					
Surface	Cargo and commercial vessels	Lean-crewed merchant ships	Autonomous workboats, harbour craft, survey vessels	Offshore support vessels	Defence: *ISR USVs, ASW decoys, mine countermeasures craft, EW/sensor platforms*
Sub-Surface	Defence: ASW, MCM, seabed warfare, persistent surveillance	Offshore energy: inspection, survey, intervention	Research: deep-water/long-duration science platforms		
Maritime UAS	Commercial: monitoring, inspection, pollution tracking, logistics	Defence: ISR, targeting, ASW adjuncts, deck-launched UAS			
Autonomy Technology, Sub-Systems & Systems Integration Sector *This sector includes everything that enables autonomy behind the scenes.*					
Hardware	Sensor suites (EO/IR, radar, LIDAR, sonar, AIS fusion)	Edge computing, mission computers, navigation units	Communications hardware	Propulsion and Power Systems	Electrical & Mechanical Sub-Systems
Software	Autonomy engines (decision-making, routeing, COLREGs compliance)	Mission planning & payload control	Simulation & digital twins	Verification & validation tooling	Cybersecurity (platform, mission, and network security)
System Integrators	Naval/defence primes and SMEs integrating autonomy into complex mission systems	Shipyards and SMEs embedding autonomy into newbuild/refit	Autonomy solution providers	Engineering and Naval Architecture organisations	
Infrastructure & Shore Systems Sector *Autonomy is impossible without the shore ecosystem*					
Remote Operations Centres (ROCs)	Mission control, remote navigation and systems supervision	ROC-to-ship communications management	Defence: classified, hardened, multi-domain C2 integration		
Connectivity & Communications	SATCOM, Low Earth Orbit (LEO)/Medium Earth Orbit (MEO),	HF, 5G Maritime, mesh networks	Underwater comms nodes (acoustic & optical)	Redundant high-integrity links	
Port & Coastal & Naval Infrastructure	Smart ports, autonomous berthing, automated pilotage aids	VTS systems integrated with autonomous traffic	Facilities for USV/UUV deployment, recovery & maintenance		
Test, Evaluation & Trials Infrastructure	Instrumented test ranges (coastal, deep-water)	Mission rehearsal environments	Autonomy stress-test infrastructure	Test-as-a-service providers	

Data, AI & Analytics Sector *Increasingly recognised as a standalone sector*					
Data Acquisition & Management	Environmental & oceanographic datasets	Platform telemetry & health monitoring	Sensor fusion data layers		
AI & Analytics	Predictive maintenance & degradation modelling	Route optimisation & mission efficiency	Behaviour modelling & anomaly detection	Defence: target classification, threat detection, autonomy assurance AI	
Operations, Logistics & Services Sector *Autonomy transforms the whole Maritime logistics chain. MASS are recognised as system innovations that affect supply chains and institutional structures*					
Fleet Management & Operations Services	Multi-vessel autonomous fleet scheduling	Mission services (commercial & defence)	Predictive logistics		
Maintenance, Repair & Overhaul (MRO)	Remote diagnostics & condition-based maintenance	Modular replacement of autonomy-critical subsystems	Autonomy-certified shipyards/private yards		
Consultancy services	Operational integration	Organisational change support for lean-crewed operations			
Training & Simulation	Digital twin-based simulators	ROC operator training	Swarm / multi-platform defence mission simulation		
Regulatory, Assurance & Classification Sector *A critical enabler sector*					
Consultancy services	Safety case design and development	Regulatory pathway development	Independent Safety Assessors (ISA)	Independent V&V orgs	Specialist consultancies (military and civilian)
Test & Evaluation (T&E), Verification & Validation (V&V)	Trials planning	Autonomy behaviour validation	Military robustness testing	Independent verification	
Classification Societies	e.g. LR, DNV, ABS, ClassNK	Developing autonomy class rules and approval frameworks			
Regulators	IMO	Flag States (e.g. UK MCA)	Defence regulators (e.g. DMR)		
Standards Bodies & Certifying Authorities	ISO, IEC, IEEE, SAE	UK Certifying Authorities for autonomous vessels	International safety & performance standards organisations		
Finance, Insurance, Legal & Investment Sector					
Insurers	Autonomy-specific underwriting	Risk & liability models	Naval unmanned systems insurance		
Investors & Finance	Venture & infrastructure finance	Sovereign and defence innovation funds	ESG-aligned capital for autonomy & decarbonisation		
Legal Services	Maritime Autonomy liability	Data governance	Defence: LOAC, rules of engagement, autonomy ethics & authorisation	Contracting & risk advisory	

Annex E - SWOT Assessment of the Maritime Autonomy Market

This expanded qualitative SWOT assessment draws together Stehr Consulting's expert insights, informed by inputs from our qualitative workshops, targeted stakeholder engagements, and focused desk-based reviews. It is intended to provide an indicative, insight-led view of the market's strengths, weaknesses, opportunities and threats, rather than an exhaustive or definitive assessment. The analysis reflects the collective professional judgement developed through our work across the Maritime Autonomy ecosystem and should be read as a structured synthesis of the evidence and perspectives gathered throughout the study.

Strengths

World-class academic community, research institutions, and innovation ecosystem
The UK's leadership in Maritime Autonomy is underpinned by a globally recognised academic and research base that spans ocean science, robotics, autonomous systems, and digital innovation. Institutions such as the National Oceanography Centre (NOC), Plymouth Marine Laboratory (PML), University of Southampton, University of Plymouth, Heriot-Watt, University of York, Cranfield University, and others form a dense network of marine, autonomy, data science, and cyber-physical systems expertise. This research base supports:

- A strong entrepreneurial culture, with numerous spin-outs and start-ups emerging from leading universities;
- Accelerated technology innovation across sensing, perception, hydrodynamics, data analytics, and autonomy algorithms;
- A pipeline of skilled talent feeding commercial, defence, and research organisations.

Collectively, this ecosystem has given the UK a first-mover advantage, producing early commercial leaders in uncrewed surface and subsurface vehicles, autonomy software, and specialist engineering services. Many of these companies have naturally diversified into dual-use markets, pivoting from commercial survey and oceanographic applications into defence ISR, MCM, and logistics autonomy.

Importantly, the UK climate and ocean science community has been an early global adopter of autonomous systems, driving high-integrity operational experience and enabling dual-use technology to progress quickly from research to defence and commercial markets.

Strong multi-departmental government engagement and supportive policy landscape
The UK benefits from broad cross-government engagement, with departments including DfT, MCA, MoD, NSO, DSIT, DESNZ, and the Home Office all holding mandates relevant to Maritime Autonomy. This multi-departmental footprint reinforces autonomy as:

- A national infrastructure, defence, and innovation priority;
- A strategic technology area linked to industrial capability, Maritime safety, and digital transformation;
- A cross-market enabler for energy transition and resilience.

This multi-departmental footprint, when viewed through the lens of the UK's current strategic documents and reform programmes, reinforces autonomy as:

- A core element of the UK's Strategic Defence Review, which emphasises technological overmatch, uncrewed systems adoption, contested logistics, and the role of autonomous systems in delivering distributed lethality and persistent ISR;
- An essential component of the Royal Navy's "Hybrid Navy" ambition, which seeks to integrate uncrewed surface and subsurface assets at scale, fundamentally shifting force structure, operational concepts, and procurement pipelines;
- A central pillar of Maritime 2050, which explicitly highlights autonomy, digitalisation, safety innovation, decarbonisation, operational efficiency, and regulatory leadership as core to the UK's future Maritime competitiveness;
- Embedded in the UK's Industrial Strategy and the Defence & Security Industrial Strategy (DSIS), which champion sovereign capability development, regional industrial growth, dual-use innovation, and the strengthening of UK supply chains;
- Reinforced by regional and sector-specific growth initiatives, such as the Plymouth Defence & Maritime Growth Deal, which supports autonomous systems testbeds, innovation clusters, workforce development, and regional capability uplift.

This comprehensive policy ecosystem is further strengthened by the UK's history of regulatory innovation, including MCA's MARLab (and latterly Maritime Future Technologies), the formation of the new MCA Innovation Hub, NSO's role in shipbuilding capability development, and DSIT's broader focus on high-integrity AI, cyber-physical security, and robotics.

Deep culture of collaboration, networking, and knowledge exchange
The UK is characterised by a highly collaborative ecosystem at national and regional levels. Key convening bodies include:

- SMI's Maritime Autonomous Systems Group (MASG), providing industry-wide coordination;
- The Future Autonomous at Sea Technologies (FAST) Cluster in the Southwest, linking academia, industry, defence, and research institutes;
- The NOC Innovation Hub and equivalent centres in the Solent and Scotland;
- Internationally recognised events such as Oceanology International and Ocean Business, which solidify the UK's position as a global hub for autonomous marine technology.

This collaborative culture helps SMEs access customers, primes, regulators, and funders more easily, accelerating innovation and supporting a balanced, interconnected industrial ecosystem.

International regulatory, assurance, and safety leadership
The UK is widely recognised as a global leader in Maritime regulation, safety, and assurance - a reputation enhanced by hosting the International Maritime Organisation (IMO) in London. The UK has:

- Played a proactive role in shaping IMO discussions on MASS, influencing global direction and harmonisation;
- A Maritime administration known for quality, safety culture, and robust regulatory oversight;
- A long heritage as a Maritime nation, lending credibility in both commercial and defence contexts.

This leadership extends into innovation-focused regulatory development, where the UK was among the first to:

- Publish the MASRWG Industry Code of Practice, now the MASS UK Industry Conduct Principles & Best Practice Guide;
- Implement risk-based certification pathways to safely enable trials of novel technologies;

- Introduce the Workboat Code Edition 3, including one of the world's first annexes dedicated to uncrewed and remotely operated vessels.

These frameworks are often referenced by other jurisdictions as examples of "good practice" and acceptable means of compliance, meaning UK-developed approaches influence regulation globally.

Financing, insurance, classification, and assurance excellence centred in London
London's position as a global Maritime services capital adds a powerful strategic advantage. The UK hosts:

- Lloyd's Register, a world leader in classification, assurance, and safety engineering;
- Major P&I Clubs, the International Group, and specialist insurers exploring autonomy-specific risk models;
- London's financial markets, enabling access to Maritime-focused venture capital, infrastructure investment, and asset financing;
- Standards and assurance institutions, including NPL, BSI, and university-led safety and verification centres (e.g. University of York's safety-critical systems expertise).

Crucially, these capabilities extend beyond Maritime into self-driving vehicles, advanced air mobility, drones, and robotics, meaning the UK sits at the intersection of multiple autonomy sectors. This cross-pollination accelerates innovation in assurance, certification, and regulatory methodologies that can be applied to Maritime systems.

Deep and diverse industrial base across surface, subsurface, and enabling technologies
The UK's industrial footprint covers:

- USVs, AUVs, ROVs, hybrid platforms, and increasingly larger uncrewed vessels;
- Autonomy software, control systems, navigation AI, and mission-level autonomy;
- Sensors, communications, digital twins, and cyber-physical integration technologies;
- Operations, simulation, training, MRO, and V&V/T&E services.

This ecosystem includes heritage Maritime primes, leading SMEs, and niche innovators, with strong regional clusters in the Southwest, Scotland, the Solent, and the Northeast. The result is a balanced, resilient supply chain spanning concept development through to deployment and lifecycle support.

Strong crossover with major growth markets (offshore wind, defence, and ocean science)
Maritime Autonomy aligns naturally with several high-growth UK priority sectors:

- Offshore wind - the UK is a global leader in offshore renewables and Net Zero strategies. Uncrewed or lean-crewed systems offer cost, safety, and performance advantages across survey, construction, inspection, maintenance, and logistics;
- Defence and security - the UK has been forward-leaning on uncrewed and hybrid naval concepts, accelerated by geopolitical uncertainty. This is driving significant demand for ISR, MCM, ASW, and autonomous logistics systems, as well as sovereign supply-chain development;
- Oceanography and research - The increasing demand for persistent, distributed, lower-cost ocean sensing makes climate and ecosystem science a natural early adopter, strengthening domestic demand and creating a strong export proposition.
  These adjacent sectors multiply the demand signals for Maritime Autonomy, reinforcing commercial viability and supporting long-term capability growth.

Varied geographical and nautical landscape, enabling rigorous and progressive testing and evaluation

The UK benefits from an exceptionally diverse marine geography, spanning inland waterways, lakes, reservoirs, estuaries, sheltered coastal areas, tidal inlets, exposed coastline, and open-ocean environments. This range of environments enables:

- Progressive testing from benign to highly challenging conditions;
- Real-world validation of autonomy in tidal, congested, and meteorologically complex waters;
- Development of robust autonomous behaviours suited to global operating environments.

This natural "living laboratory" gives UK companies an efficient domestic route to high-integrity testing without relying on overseas ranges, strengthening R&D productivity and export competitiveness.

Strong sovereign capability in electronics, sensors, and Maritime systems integration

The UK retains a substantial sovereign supply base in radios, ruggedised electronics, sonar and sensing systems, navigation instruments, and specialised Marine components. Many of these are UK-designed and UK-manufactured, supporting:

- Reduced reliance on non-allied supply chains;
- Faster integration cycles;
- Improved resilience for defence and critical national infrastructure applications.

This existing supplier network forms a strong foundation for scaling Maritime Autonomy without requiring long lead times to establish new manufacturing capacity.

Deep operational experience from North Sea oil and gas autonomy precursors

For decades, the North Sea has served as a proving ground for early ROV, AUV, and unmanned surface technologies. This has fostered:

- A mature engineering culture around remote operations;
- Highly skilled technicians and operators experienced in harsh-environment autonomy;
- Well-established commercial practices for deploying uncrewed assets safely and reliably.

This legacy creates a natural bridge into next-generation autonomous systems, particularly for offshore energy, subsea inspection, and defence mission sets.

Strong small-vessel shipbuilding and rapid-production capability

Despite its size, the UK hosts a strong network of boatyards capable of producing composite, aluminium, and steel vessels at pace. Many have proven hull forms already used in defence, scientific, and commercial applications. This enables:

- Rapid prototyping of autonomy-ready platforms;
- Scalable production of small and medium USVs;
- Tailored builds for operators requiring bespoke configurations.

This capability aligns well with global demand for modular, reconfigurable, and exportable uncrewed systems.

National technical success stories driven by DSTL and defence innovation funding

DSTL's sustained investments have produced several high-impact autonomy demonstrators across ISR, MCM, underwater systems, and uncrewed surface platforms. These programmes have:

- Accelerated the UK's technology base;

- Stimulated SME participation;
- Generated world-leading prototypes adopted by allied navies.

These defence-led achievements reinforce the UK's credibility in autonomy R&D and strengthen the pipeline of dual-use innovation.

Weaknesses

Fragmented policy landscape and unclear ownership of Maritime Autonomy
Although multiple government departments have touchpoints with Maritime autonomy (DfT, MCA, MoD, NSO, DSIT, DESNZ and others), no single department holds clear ownership or stewardship of the agenda. This results in:

- Disjointed policy signals and sometimes overlapping or conflicting priorities;
- Limited clarity for industry on where to direct asks, evidence, and investment-related engagement;
- Slower, less coordinated progress on enabling regulation, funding, infrastructure, and R&D strategy.

While cross-departmental involvement should, in theory, be a strength, in practice the absence of a unified lead creates ambiguity in governance, weaker prioritisation, and lack of accountability for progress in Maritime Autonomy.

Lack of sustained long-term political commitment reducing stability and investor confidence
While Maritime Autonomy features in several UK strategic documents, political commitment to the market has fluctuated across electoral cycles and changes in ministerial portfolios. This has resulted in:

- Stop-start momentum and shifting priorities between governments;
- Limited continuity in funding programmes, R&D roadmaps, or regulatory reform;
- Difficulty for industry and investors to rely on long-term political signalling;
- Reduced confidence that autonomy will remain a persistent national priority across successive Parliaments.

The absence of durable, cross-party commitment undermines planning certainty for major infrastructure investments (e.g. remote operations centres, test ranges), slows private capital deployment, and prevents the UK from building the long-term stability needed to scale sovereign autonomy capability.

Regulatory and assurance challenges are multifaceted, inconsistently communicated, and poorly coordinated
The UK's early leadership in risk-based regulation (e.g. Workboat Code 3, early certification pathways, autonomous vessel guidance) has been valuable; however, the regulatory and assurance landscape has grown increasingly complex, characterised by:

- Inconsistent interpretation of requirements across industry sectors;
- Diverse maturity levels across commercial, defence, offshore energy, and ocean science operators;
- A lack of harmonised industry articulation of regulatory needs when engaging government.

The result is a fragmented assurance ecosystem, where the collective "ask" of government is often not precise, aligned, or backed by unified evidence. This ambiguity hampers progress, slows trials and deployments, and makes it harder to articulate what is practically possible in the near term.

Unclear definitions of "sovereign capability" and its implications for industrial strategy
Despite increasing focus on strategic autonomy (especially under heightened geopolitical tensions) the UK does not yet have a consistent definition of what constitutes sovereign capability in Maritime Autonomy. Missing clarity includes:

- Which elements of the autonomy value chain must remain sovereign (e.g. mission systems? control software? assured connectivity?);
- Which elements can be imported or blended with allied supply chains;
- How sovereign capability should influence procurement, R&D priorities, export controls, or investment incentives.

This ambiguity complicates industrial policy, defence planning, and investment signals, and weakens the UK's ability to shape a coherent long-term growth and security strategy.

Limited dedicated public R&D investment targeted specifically at Maritime autonomy
Compared to adjacent markets (e.g. automotive autonomy, advanced air mobility, defence robotics), Maritime Autonomy receives minimal, inconsistent, or indirect R&D funding. Key issues include:

- Funding routes often require autonomy projects to be framed under broader themes such as "clean Maritime", which emphasises propulsion rather than autonomy;
- Funding is frequently channelled to academic institutions rather than the full enabling ecosystem (industry, integrators, test facilities, assurance bodies, and supply-chain partners);
- Lack of programme-level, sustained investment (structured in the right way for the organisations required) results in limited downstream commercialisation and slow development of essential infrastructure such as ROCs, test ranges, and digital assurance platforms.

This mismatch means the UK's innovation pipeline is not optimally structured to support scale, transition, or export competitiveness.

Limited access to scale-up finance and constrained capital for UK SMEs
The UK's investment landscape presents several barriers to growth in Maritime Autonomy:

- Maritime Autonomy is still relatively invisible to mainstream investors who gravitate toward high-multiple digital or AI-only sectors;
- Hardware-intensive and safety-critical technology businesses typically face longer return cycles, which UK investors are often more cautious about compared to US VC or state-backed foreign competitors;
- SMEs struggle to secure capital at the pace required to compete with larger, better-funded Ukrainian, US, and Nordic companies, whose funding ecosystems more strongly support autonomy ventures.

This financing gap restricts the scaling of manufacturing, fleet deployment, technology maturation, and international expansion.

Difficulty quantifying defence demand and future market size, leading to strategic uncertainty
Defence remains a major potential driver of Maritime Autonomy, but the market outlook is:

- Opaque, with limited visibility of future procurement timelines, platform programmes, or autonomy-specific pipelines;
- Dependent on the delayed forthcoming Defence Investment Plan (DIP) and clarity regarding delivery agencies, timelines, and funding;
- Challenged by long procurement cycles, which are out of step with the pace of autonomy innovation.

Companies (particularly VC-backed) require clearer demand signals to justify continued investment. Without faster conversion of intent into funded programmes, early momentum risks dissipating.

Historically limited economic modelling makes investment cases difficult
To date, the UK has lacked:

- A rigorous, unified economic model quantifying the size, segmentation, and impacts of the Maritime Autonomy market;
- A clear valuation of cross- market benefits (e.g. safety, decarbonisation, productivity, resilience);
- Transparent modelling of sovereign capability boundaries or defence–commercial crossover value.

This has made it harder for both government and industry to build robust cases for investment, infrastructure deployment, regional development, or export strategy. This study aims help to address some (not all of this), but gaps remain around sovereign and defence valuation.

UK's early regulatory caution creates competitive disadvantages for testing and deployment
While the UK's early regulatory leadership in safety and assurance has brought credibility, it also means:

- Other jurisdictions with lighter regulatory regimes have become more attractive for rapid testing, higher-risk trials, or commercial deployments - particularly for surface systems;
- The UK's high safety standards and conservative risk appetite, if not balanced with commercial pragmatism, risk pushing innovators to test abroad.

In an increasingly global, fast-moving market, this creates a competitive disadvantage, especially for companies needing fast iteration cycles.

Legislative limitations hinder the regulator's ability to enable Maritime Autonomy
Several aspects of the UK's primary and secondary legislation restrict the MCA's ability to:

- Approve or oversee uncrewed and lean-crewed operations at scale;
- Modernise rules to reflect remote operations, human-on-the-loop frameworks, or future autonomy adoption;
- Establish a modern regulatory environment without legislative amendments.

Securing parliamentary time to update legislation has proved difficult, causing long delays that directly affect the pace of commercial and defence deployments.

Limited successful scale-ups and a few high-value exits are weakening reinvestment cycles
While the UK has produced several technically strong autonomy SMEs, few have scaled to the point of generating significant reinvestment into the ecosystem. The absence of notable exits means:

- Experienced founders and investors are not re-entering the market at scale;
- Capital recycling is limited;
- Growth lessons and operational best practices are not feeding back into earlier-stage companies;
- The ecosystem lacks a critical mass of repeat founders, mentors, and "pattern-recognition" investors who have successfully navigated the commercialisation journey.

This slows market maturity and reduces the UK's ability to form globally competitive mid-tier autonomy companies.

Regional fragmentation and micro-scale thinking are hindering national coherence
Despite its relatively small geographic size, the UK Maritime Autonomy market continues to frame activity through the lens of regional clusters (Southwest, Solent, Scotland, Northeast, Wales) as though they were distinct national markets. On a global stage, however, the UK is one small but high-capability nation, and this regional fragmentation dilutes its collective impact. As a result:

- Collaboration is constrained by regional identities rather than national objectives;
- Infrastructure, test facilities, and innovation programmes are frequently replicated rather than specialised;
- The UK's international footprint appears fragmented, weakening its ability to present a unified, globally competitive offering;
- Opportunities to combine the strengths of major regions (for example, the Solent and Southwest acting together as a single world-class hub) remain under-realised.

This micro-scale thinking limits the UK's strategic coherence, reduces efficiency, and prevents the country from "punching at its true weight" internationally. A national, coordinated approach (emphasising integration over regionalism) would unlock significantly greater competitiveness and visibility on the global stage.

Absence of a coherent civil defence industrial strategy for autonomy
Despite autonomy's centrality to Maritime 2050, the Hybrid Navy, and national security priorities, the UK lacks an explicit industrial strategy addressing:

- Long-term demand signals for uncrewed systems;
- Sovereign capability boundaries;
- Workforce development across autonomy engineering and operations;
- Investment pathways for scaling production and infrastructure.

This leaves the industry uncertain about future roadmaps and reduces confidence in investment.

Cultural conservatism and risk aversion are hindering the adoption of novel technologies.
Across commercial marine, offshore energy, and defence markets, middle-management layers often default to proven legacy systems, even when senior leadership articulates strong commitments to innovation. This "frozen middle" leads to:

- Slow procurement of novel autonomous systems;

- Under-utilisation of trial exemptions and flexible regulatory tools;
- Preference for incremental upgrades rather than disruptive change.

Without deliberate policy and leadership intervention, innovation uptake will remain inconsistent.

Inconsistent collaboration in the absence of a clear opportunity or shared threat
In many areas, the default commercial posture is competition rather than collaboration. Without coordinated incentives or shared problems to solve:

- Knowledge transfer is limited;
- SMEs and primes duplicate effort;
- Government receives fragmented messaging.

This reduces UK influence on global standards and slows ecosystem scaling.

Opportunities

Convert a mature UK ecosystem into global market share and exports
There are multiple growth scenarios where the UK can scale from early leadership to exportable platforms, software, and services, especially in offshore energy, defence support, and ocean data services.

Establish the UK as the global hub for Assurance, Test & Evaluation, and certification
By combining London's insurance and classification strengths with NPL/BSI standards leadership and university safety-critical expertise, the UK can position itself as the preferred jurisdiction for autonomy assurance, model-based certification, and V&V/T&E services. This plays to existing capability, aligns with IMO engagement, and creates high-margin exports in "assurance as a service" even when platforms are built elsewhere.

Leverage defence as a core customer for dual-use scale-up
Clearer pipelines and acquisition routes for uncrewed and hybrid naval concepts could secure demand, de-risk scale-up for SMEs, and accelerate TRL progression. Coordinated defence-commercial testbeds (e.g. shared ranges, ROCs, data environments) would shorten iteration cycles and convert R&D into deployable capability faster.

Build exportable operational infrastructure and "ROC-as-a-service"
UK expertise across remote operations centres, comms/connectivity, shore systems, and digital twins can be packaged as deployable infrastructure and services for overseas ports, energy operators, and navies - creating recurring revenues and lock-in.

Shape international standards and corridors via IMO and bilateral pilots
As host nation to the IMO and a proactive contributor to MASS discussions, the UK can co-lead standard-setting and stand up bilateral "green lanes"/corridors for autonomous operations with aligned partners. This increases UK companies' time-to-market and reduces regulatory friction on exports.

Monetise the Maritime data economy
Persistent autonomous operations will generate large multi-modal datasets; UK strengths in data, AI and analytics open opportunities for premium services (predictive maintenance, mission planning, risk analytics) and cross-domain products.

Cross-sector autonomy, knowledge transfer, accelerating certification and safety leadership
The UK's strong position in automotive autonomy assurance and advanced air mobility provides directly transferable methodologies for Maritime. Opportunities include:

- Model-based assurance frameworks;
- Scenario-based testing;
- Hazard analysis and autonomy safety cases;
- Synthetic environments for validation.

This cross-domain leverage could allow the UK to become the world's leading jurisdiction for autonomy safety.

Expanded international R&D collaboration and defence cooperation
Participation in AUKUS Pillar 2, together with growing bilateral cooperation with Norway, the Netherlands, Canada and other aligned partners, provides the UK with significant opportunities to deepen technical collaboration and open new market channels. These relationships enable the UK to:

- Jointly develop autonomy architectures, mission systems, and enabling technologies;
- Share test data, verification methods, and safety frameworks;
- Participate in co-development programmes with strong export pathways and aligned capability needs.

Crucially, this sits alongside rapidly increasing European defence expenditure, driven by heightened geopolitical tensions and accelerating military modernisation across NATO states. This trend creates substantive new opportunities for UK industry to:

- Export uncrewed platforms, autonomy software, and mission-system components;
- Provide specialist engineering, test & evaluation, and assurance expertise;
- Support allied fleet modernisation through consultancy, integration services, and digital infrastructure.

Together, these international programmes expand both capability development and market access, strengthening the UK's position as a trusted autonomy partner in an increasingly interconnected defence landscape.

Transforming NERC/DEFRA fleets into an autonomy-enabled system-of-systems
Many UK science vessels are reaching end-of-life at the same time. This creates a once-in-a-generation opportunity to shift toward:

- Lean-crewed research vessels;
- Persistent USV/AUV fleets;
- Distributed sensing networks;
- Digital twin-enabled monitoring.

This transition reduces lifecycle cost while increasing scientific output and is also exportable to nations modernising their science fleets.

Regional skill development, workforce diversification, and broader socio-economic uplift
The shift toward digitalisation, remote operations, and autonomous systems is creating entirely new categories of Maritime employment. As autonomy-enabled operations scale, new technological and

operational streams will grow across regions, supporting both existing Maritime hubs and new inland centres. This evolution creates opportunities to:

- Upskill technicians, engineers, seafarers, and operators into high-value digital, data, and cyber-physical roles;
- Attract individuals who would not traditionally enter seagoing careers, offering meaningful Maritime employment in shore-based remote operations, data management, simulation, mission support, and digital fleet management;
- Broaden participation geographically, as many autonomy-enabled roles no longer require workers to live near coasts or ports, opening opportunities to inland regions and enabling a more distributed national workforce;
- Support regional regeneration, with autonomy and digital-operations clusters stimulating local investment, creating new high-value jobs, and embedding technical expertise in communities across the UK.

As the UK builds these capabilities, it can also export this expertise internationally - through training programmes, remote operations services, and globally deployable skillsets developed within the UK workforce. This positions the UK as a leader not only in autonomy technology but in the human capital required to operate, supervise, and assure next-generation Maritime systems.

Emission reductions through operational optimisation and smarter tasking
Autonomy-enabled optimisation can reduce fuel use, greenhouse gases, and operational waste across commercial, science, and defence fleets. These benefits are:

- Immediately achievable;
- Measurable in both cost and carbon terms;
- Scalable across global fleets.

This aligns strongly with Net Zero policy and ESG-driven investment.

High leverage from targeted research funding
Given the relative immaturity of the market, even modest investment from DSTL, DASA, or IUK can produce disproportionately high returns in capability, export readiness, and dual-use uptake.

Threats

Intensifying international competition in domestic and export markets
Better-funded US and Ukrainian companies, among others, are expanding rapidly and competing for UK customers and export contracts, potentially eroding UK share if domestic companies can’t scale at similar pace.

Capital constraints leading to consolidation or overseas acquisition of UK innovators
Persistent funding gaps may force promising SMEs to pause programmes, downsize, or accept acquisition by foreign entities - shifting IP, jobs, and value capture overseas and weakening sovereign capability. (This risk is amplified by investor caution for hardware-intensive autonomy.)

Regulatory divergence and a potential “race to the bottom” abroad
If other jurisdictions continue to offer faster approvals with lighter oversight, testing and early deployments may move offshore. Conversely, loosening UK standards to compete could harm safety, reputation, and insurer confidence - undermining long-term leadership in assurance. Balancing

commercial agility with safety integrity is critical. Without maintaining regulatory agility and technological uptake, the UK stands to become a reactionary state rather than a market leader.

Delays in defence procurement clarity reduce industry confidence
Prolonged uncertainty around the Defence Investment Plan (DIP), programme timelines, and delivery agencies risks dampening private investment and slowing dual-use innovation cycles, especially for VC-backed companies with limited runway.

Cybersecurity incidents or high-profile failures erode public and insurer trust
Maritime Autonomy remains exposed to cyber threats; significant incidents could trigger insurance tightening, regulatory retrenchment, and public opposition, slowing market growth.

Talent competition and skills shortages
Ongoing gaps in autonomy software, systems engineering, and remote operations - combined with global competition for talent - may constrain UK capacity to execute at scale.

Public scepticism and societal resistance to autonomous vessels
Public acceptance represents a critical enabling factor for ferry operations, harbour services, and coastal commercial autonomy. Without effective engagement:

- Social licence may be withdrawn for high-visibility deployments;
- Local authorities may resist approvals;
- Operators may avoid investment due to perceived reputational risk.

Negative sentiment could significantly delay adoption in commercial passenger or port-side contexts.

High-profile accidents triggering regulatory tightening and investor caution
As autonomous systems move into real-world trials, the likelihood of incidents increases. Any major accident may:

- Reduce public trust;
- Lead regulators to pause or tighten trial frameworks;
- Increase insurance costs;
- Reduce investor appetite for autonomy markets.

This poses a systemic risk to the market's momentum.

Infrastructure bottlenecks (spectrum/comm, ranges, ROC capacity)
Constraints in communications resilience, dedicated test ranges, and certified remote operations capacity may slow commercialisation timelines unless addressed programmatically.

Technological bottlenecks and uneven maturity across subsystems
Significant discrepancies remain between the maturity of:

- Autonomy software;
- Perception systems;
- Cybersecurity;
- Communications and assured positioning;
- Mission-level reasoning.

Without coordinated investment, these gaps could slow integration, stall procurement, and undermine export readiness.

Fragmented messaging to government and investors
Without a unified industry voice (clear asks, consistent definitions, aligned priorities), the UK risks missing policy windows and confusing investors - reducing funding flow into the market at a critical scaling moment.

Public finance pressure constraining core science demand
Climate and ocean science (NERC, DEFRA, Met Office) is a critical early adopter and secure market, yet public-finance tightening risks:

- Delaying vessel-replacement programmes;
- Reducing investment in autonomous fleets;
- Slowing procurement of persistent monitoring capabilities essential for UK climate commitments.

Because science acts as a dual-use technology driver, reduced budgets weaken downstream defence and commercial innovation. Extending the life of legacy vessels delays the transition to autonomy-enabled science architectures and dampens market momentum.

Foreign competitors targeting science and climate-monitoring markets
Norway, the US, Canada and the Netherlands are aggressively positioning autonomy platforms for climate and research missions. Without a strong UK science demand signal, domestic SMEs may be displaced.

Annex F – Report Body Assumptions Limitations Recommendations

Introduction & Study Objective: Assumptions Limitations Recommendations

Scope, Purpose and Framing of the Study

Assumptions

- The analysis prioritises near to medium-term policy relevance.

Limitations

- This report provides a point-in-time view of a rapidly evolving market and balances depth against deliverability within project timescales.
- Findings are aggregate and strategic; the analysis does not attempt exhaustive application-level quantification.
- The definitions and segmentation adopted are fit for purpose for this study, not universal.
- The study provides a high-level, single-dimensional analysis. More detailed, multi-dimensional analysis is out of scope for this phase.

Evidence Base, Data Availability and Use of Judgment

Assumptions

- Publicly available datasets combined with triangulation are sufficient to quantify the market effectively.

Limitations

- Where quantitative data are limited or inconsistent, qualitative assessment and triangulation are used; this introduces interpretive uncertainty.
- Where data are sparse, structured expert judgement informs interpretation; this may embed subjectivity despite attempted mitigation via triangulation.
- Data availability and consistency vary markedly across segments; triangulation rather than uniform datasets support some inferences.

Economic Quantification and Modelling Constraints

Assumptions

- Company-level apportionment for multi-activity businesses reasonably reflects their Maritime Autonomy contribution.

Limitations

- Quantitative analysis is constrained by limited time-series data in an emerging sector; scenario trajectories are informed and triangulated using a combination of qualitative and quantitative evidence and insight.
- The Data City does not include trade/export data; export insights are qualitative and sit outside the economic modelling.

Market Coverage and Exclusions

Limitations

- This study does not assess the wider economic or operational impacts of Maritime Autonomy on other parts of the Maritime sector or adjacent industries. For example, the analysis does not consider potential reductions in crewed operations (e.g. survey, inspection, or logistics), displacement effects in commercial or defence spending, or changes to labour demand. These effects could be significant but were outside the scope of this initial economic quantification.

Future Growth, Scenarios and Structural Uncertainty

Limitations

- Qualitative opportunity investigation is largely built around the potential for operational demand and is not entirely informed by policy or explicit data, instead relying on insight-led understanding of technological capability and societal benefits or barriers.
- Key uncertainties remain around defence procurement visibility, export measurement, and differentiation, where different reliance on autonomy exists; these are flagged in relevant sections and should be revisited in updates to this work.

Longevity and Use of the Evidence Base

Limitations

- Market, regulatory and investment conditions are evolving; this report's findings and evidence base should not be treated as enduring.

Defining Maritime Autonomy: Assumptions Limitations Recommendations

Definition, Scope, Framing and Boundary Setting

Assumptions

- The agreed definition of Maritime Autonomy is not assumed to be universal nor permanent but is designed to be practical for economic analysis within this study.
- Payloads or capabilities that may be installed on autonomous vessels or systems, but are not inherently unique to autonomy (e.g. defence weapon systems), are assumed to fall outside the scope of the definition.

Limitations

- The multi-lens approach was intentionally expansive at the outset and refined iteratively; boundaries reflect study objectives and time/budget constraints.
- Some Marine science/environmental activities are excluded unless directly relevant to operational Maritime activity, based on expert judgement.

Market Segmentation Framework: Assumptions Limitations Recommendations

Segmentation Logic, Application Scope and Analytical Boundaries

Assumptions

- A demand-led approach best supports policymaking and investment communication within current data constraints.
- Elements of deeper supply chains are likely captured in indirect GVA estimates via multipliers.

Limitations

- Applying multiple segmentation frameworks in parallel would add uncertainty and complexity and was therefore not attempted.
- Market quantification is not further differentiated by reliance on autonomy (e.g. decision support, remote, supervised, autonomy).
- This set of use cases is non-exhaustive, and there are other applications for autonomy within Maritime.
- The supply-led framework informs interpretation but is not used for economic quantification in It has not been as deeply validated through application to the market as the demand segmentation.
- Detail is intentionally limited to maintain clarity and usability.

Quantifying the Market Size & Economic Opportunity: Assumptions Limitations Recommendations

Evidence Base, Modelling Approach and Projection Uncertainty

Assumptions

- Company-level apportionment for multi-activity businesses reasonably reflects their Maritime Autonomy contribution.
- Defence demand is treated as a parameterised anchor, pending publication of a detailed Defence Investment Plan (DIP).
- Publicly available datasets combined with triangulation are sufficient to effectively quantify the market.

- Employment growth follows output growth but at a slower rate, reflecting productivity improvements over time.

Limitations

- Early-stage or small companies lack reported financial data, and their turnover, GVA, and employment were estimated using proxy values based on comparable companies.
- For companies operating across multiple sectors, a sampling-based method was applied to estimate the proportion of activity attributable to Maritime Autonomy, balancing robustness and proportionality and providing a reasonable approximation, particularly for smaller companies.
- Analysis relies on publicly reported 2023 financial and employment data, which provides the most complete and recent coverage across the market, though it does not capture the very latest activity.
- It has only been possible to complete a regional breakdown of companies; the supply-led segment breakdown sat outside the scope of this study.
- Post Codes from registered address does not give the exact location where revenue is generated, potentially shifting economic hotspots.
- The regional heatmap only uses demand-led companies that have reported GVA (a total of around 50), meaning that a large portion of companies are not accounted for here.
- The bottom-up approach uses proxies and expert inputs, which may embed uncertainty at the use-case level.
- Bottom-up approach relies on varying and limited depth of quantifying use cases, with the variety of depth, the detail provided is inconsistent with the accuracy, reducing where larger groupings of applications are considered.
- Maritime Autonomy adoption is not a precise metric and is built on some understanding of policy and intent, but predominantly on an expert understanding of the feasibility of Maritime Autonomy in the use case, alongside the potential for acceptance of systems by key stakeholders. These use case estimates are not to be used as specific estimations for growth in the demonstrated segments, instead provides an indication of the orders of magnitude that may be possible.
- 2025 numbers are difficult to gather in the context of the demand segmentation; a large amount of revenue is not coming from operators at this stage, where funding comes increasingly from public and private investment rather than sales or services. The numbers here are included to provide a contextual baseline and are unlikely to reflect any real value.
- Scenarios aim to provide indications of trends qualitatively, rather than provide a fully developed economic impact analysis.
- These growth scenarios are qualitatively informed, using expert understanding, but may not fully reflect the complexity of the variables involved, and the true impact of any number of triggers.
- The economic forecasts generated from these scenarios are just one interpretation of the economic impact on the selection of applications of Maritime Autonomy considered, and reflect one story, not necessarily the truth.
- The growth trajectories are illustrative ranges rather than point forecasts. They were constructed by combining both qualitative insights (e.g. expert judgement, use-case assessments) and quantitative evidence sources (e.g. historical trends and benchmarking) and therefore reflect informed projections rather than statistically derived predictions.
- The final projection trajectories were aggregated into central, upper, and lower bounds, which may mask variation across sub-segments.

- Future market development is sensitive to a range of external factors, including technological progress, regulation, investment levels and adoption rates. The extended projection period increases exposure to compounding uncertainties and structural market shifts.

Cross-Cutting Drivers, Risks and Enablers of Growth: Assumptions Limitations Recommendations

System-Wide Influences, Market Risks and Enabling Conditions

Assumptions

- Increased UK deployment of autonomy systems will improve credibility and export readiness.
- Assumes that European markets - where UK defence exports recently strengthened (38.4% of UK exports from 2020–2024) - remain receptive to UK autonomy solutions.
- The analysis assumes a continued shift in value from physical platforms toward software, Remote Operations Centres (ROCs), digital assurance and mission-system integration - areas where the UK currently holds relative strengths. This reflects observed market trends but is not guaranteed.
- The section assumes that accelerated UK regulation and test range access will increase international buyer confidence and improve competitiveness.
- The export outlook presumes continued UK strength in MCM, subsea robotics, mission systems and autonomy assurance - areas where barriers to entry favour established capability.

Limitations

- The study does not model the broader evolution of foundational AI technologies, compute availability, or global AI-industry consolidation. Their rapid progression could accelerate or fundamentally reshape Maritime Autonomy capability in ways not captured within the scope of this initial analysis.
- No authoritative global dataset exists for the Maritime Autonomy market. Estimates of market size, export potential and competitive positioning are therefore indicative rather than definitive.
- Public information on the funding scale, operating models and commercial strategies of Ukrainian, US and Asian competitors is uneven. Comparative assessments rely on observable deployments, venture disclosures and defence sector reporting.
- UK defence export statistics (e.g. growth in European markets) provide a useful context but are not disaggregated to isolate autonomy-specific systems or subsystems. Conclusions, therefore, are drawn on proxies rather than autonomy-exclusive export data.
- International market conditions, venture funding cycles and geopolitical drivers (e.g. post-Ukraine defence spending increases) are volatile. Export projections may shift quickly as new entrants scale, particularly in the US and Asia-Pacific.
- These export forecasts depend on the assumption that the UK will continue to procure Maritime Autonomy systems at a meaningful level. If future UK procurement is reduced, delayed, or reprioritised, this would weaken the UK's ability to demonstrate real-world deployments and materially reduce the likelihood of export success.

UK Position in Maritime Autonomy: Assumptions Limitations Recommendations

Regional Capability, Structural Shifts and Comparative Positioning

Assumptions

- Autonomy shifts some of the value from hull fabrication to digital systems.
- Smaller, modular platforms reduce the geographical dependence on coastal shipyards.
- Inland high-tech clusters can meaningfully contribute to maritime autonomy supply chains.
- Remote and distributed working will persist in the Maritime Autonomy market.
- Demand for certification, assurance and data infrastructure will grow faster than hull construction demand.
- Inland growth does not replace coastal capability but complements it.

Limitations

- Regional analysis is high-level and not a comprehensive company-by-company or asset-by-asset map.
- This regional landscape review is based on current understanding, further developed through the long-list built for this report. It may not capture every hotspot, company or organisation, but it is intended to be broadly representative of the key elements of the market.
- SWOT outputs reflect structured expert judgement and are not weighted by quantitative performance metrics.
- This assessment is high-level in nature and does not constitute a detailed comparative study of each nation's full industrial strategy, funding mechanisms, or regulatory regime.
- The review does not apply a formal international benchmarking methodology or maturity assessment framework; findings should therefore be interpreted as directional rather than definitive.

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