

European Maritime Safety
Report

The Japan Association of
Marine Safety

London Research Office

Berlin Cathedral, rising majestically on the banks of the River Spree in Berlin, Germany

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No. 26-24. Report on SMM 2026

– Implementation and Outlook for AI and Uncrewed Systems in the Maritime Sector –

In September 2026, the author attended SMM 2026 in Hamburg, Germany, to examine the implementation of AI and uncrewed systems in the maritime sector, as well as developments in maritime security and defence.

A striking feature of this year's SMM was that discussions on AI, uncrewed systems and autonomous systems were moving beyond merely debating technical possibilities towards the stage of "implementation", that is, how these technologies can be integrated into actual operations such as ship design, vessel operations, maritime domain awareness and security.

Furthermore, although the civil maritime and defence sectors differ in their objectives and operating environments, they share a great deal of underlying technology, including AI, uncrewed systems, sensors, data, communications and cybersecurity. Going forward, it would also appear important for the two sectors to make mutual use of each other's technologies and expertise.

Key Points

1. Event Overview

- One of the world's largest comprehensive maritime trade fairs, held in Hamburg, Germany, in September 2026
- Approximately 2,300 exhibitors from 66 countries, covering virtually every field of the maritime industry
- An expanded presence of maritime security and defence exhibits this year

2. Use and Implementation of AI in the Maritime Sector

- The use of AI has advanced to the implementation stage in ship design, vessel operations, autonomy and fuel-efficiency optimisation
- Emphasis on using AI not as a substitute for people but as a means of supporting human judgement
- Key challenges include ensuring reliability, clarifying where responsibility lies and establishing verification methods

3. Maritime Security and Defence

- Progress in capability development combining crewed and uncrewed systems, AI, sensors and data
- Implementation must encompass not only technology but also operational methods, organisations, institutional frameworks and human resources
- In maritime domain awareness and related areas, information sharing and cooperation between the public and private sectors are key, alongside information gathering

4. Observations

- AI and uncrewed systems are moving from technological development to a stage that prioritises actual operation and implementation
- Although the civil and defence sectors differ in their objectives and operating environments, they share much of their underlying technology
- Mutual utilisation between the two sectors, centred on dual-use technologies, would be beneficial

Full Report

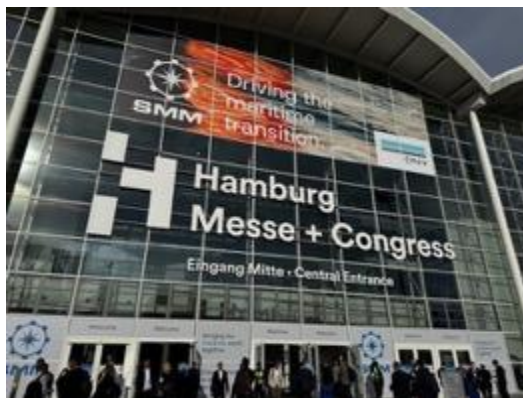
1. Introduction

SMM 2026 was held from 1 to 4 September 2026 at Hamburg Messe und Congress in Hamburg, Germany.

First held in 1963, SMM (Shipbuilding, Machinery & Marine Technology) now takes place every two years in Hamburg and is one of the world's largest comprehensive maritime trade fairs.

In addition to visiting the exhibition, the author attended two of the conferences held during the event: one on the use and implementation of AI in the maritime sector, and the other on maritime security and defence.

This report provides an overview of the exhibition and of each conference, focusing on developments relating to AI, uncrewed systems and maritime domain awareness (MDA), which this Office is following closely.



View of the venue exterior



View of the exhibition hall

2. Overview of the Exhibition

According to the organiser, SMM 2026 brought together approximately 2,300 exhibitors from 66 countries, with a total exhibition space of more than 90,000 square metres across 12 halls. Companies from outside Germany accounted for over 70% of exhibitors, and there were 26 national pavilions and delegations in total. With more than 50,000 participants from 134 countries, the event was truly international in character.

The exhibition covered virtually every field of the maritime industry, ranging from shipbuilding, marine equipment, and propulsion and engines to the environment and energy efficiency, safety, navigation and communications, electrical and electronic systems, automation, and digital technologies and AI. In particular, on decarbonisation and digitalisation, which have long been central themes of the fair, there were numerous exhibits relating to alternative fuels, energy efficiency, automation and AI. Major exhibitors included shipbuilders such as Damen Shipyards, Fincantieri and Navantia; marine equipment and automation companies such as Kongsberg, Bosch Rexroth and Anschütz; and classification societies such as DNV, ABS and Lloyd's Register.

A distinctive feature of this year's event was the significant expansion of exhibits in the field of maritime security and defence, in addition to the established themes of decarbonisation and digitalisation. More than 50 companies and organisations exhibited in the "Naval Hall" set up within the venue, while across the venue as a whole, more than 150 companies showcased

dual-use technologies in areas such as cybersecurity, uncrewed systems, maritime surveillance and critical infrastructure protection, applicable to both merchant ships and naval vessels.

3. Overview of the Conferences



The Maritime Future Summit



The Maritime Security & Defence conference

(1) Use and Implementation of AI in the Maritime Sector

The “Maritime Future Summit”, held on 2 September on the theme of generative AI, comprised three sessions: Session 1, “AI Design”; Session 2, “AI Operated Vessels”; and Session 3, “AI to Save Fuel”. Each session consisted of presentations by three speakers, followed by a panel discussion. The discussions covered a wide range of AI applications in the maritime sector, including ship design, vessel operations, autonomy, equipment monitoring and fuel-efficiency optimisation.

(a) Use of AI in Ship Design

In Session 1, “AI Design”, with a growing number of factors to be considered at the design stage, such as alternative fuels, wind-assisted propulsion, batteries and waste heat recovery, speakers presented initiatives that use AI to compare large numbers of design options and identify optimal designs more efficiently. Also presented were a technology that enables users to arrange structural members and create piping routes in design software simply by giving instructions in everyday language through a chat interface, and an initiative to search thousands of hull form options for those best suited to given operating conditions. In each case, the common approach was to use AI not as a replacement for designers, but as a tool that supports them in considering a wider range of options.

(b) Use of AI in Vessel Operations and Autonomy

Session 2, “AI Operated Vessels”, showed that autonomous navigation is making progress towards practical application, with presentations on AI-based situational awareness and equipment condition monitoring, as well as a case in which a vessel supporting uncrewed underwater vehicles for subsea work has been converted to uncrewed operation and is already in service. In addition, a company that operates uncrewed vessels for navies explained that, rather than entrusting navigation itself to AI, it uses AI to reduce the

workload of personnel monitoring operations at a shore-based Remote Operation Centre (ROC), enabling a single operator to supervise more vessels.

On the other hand, it was pointed out that, as autonomous navigation moves towards practical application, improving equipment reliability will become a challenge, since crew will no longer be on board to carry out maintenance.

(c) Use of AI to Reduce Fuel Consumption and Optimise Operations

Session 3, “AI to Save Fuel”, presented initiatives that analyse sensor and operational data using AI and apply the results to reducing fuel consumption and optimising operations. Of particular note was a case in which large language models (LLMs) are used to automate approximately 60% of fleet performance evaluations, with experts verifying the validity of the results. It was also noted that, since stable communications cannot always be assured on board ships, edge AI and LLMs that process data on board will also become important, rather than relying solely on shore-based cloud services.

(d) The Role of AI and Ensuring Reliability (Cross-Cutting Themes)

What many speakers had in common was that they did not regard the role of AI solely as a substitute for people. Emphasis was placed on enabling people to concentrate on more important decisions by entrusting AI with tasks such as comparing and exploring design options, monitoring ships and equipment, and analysing operational data.

However, the ability of AI to produce an answer is a separate matter from whether that answer can be relied upon from a safety perspective. Across the sessions, speakers raised technical challenges, such as hallucinations, in which AI presents plausible but incorrect answers, and the quality of the data underpinning its judgements, as well as institutional challenges, such as who would bear responsibility if an AI made an erroneous decision on a vessel with no crew on board. In response, it was pointed out that the reliability of AI is not determined by the performance of the model alone, but must be ensured through the overall design, encompassing the systems in which AI is embedded, the operating environment and governance. It was also stated that reliability cannot be regarded as confirmed by a single verification, but must be assessed continuously throughout operation.

Since methods for verifying AI decisions have yet to be established, the view was expressed that, at present, particularly in matters concerning safety and in responding to unforeseen situations, humans must retain responsibility for the final decision. Many also expressed the view that, even if the scope of decisions entrusted to AI widens in the future, humans will set the objectives that AI is to achieve and the conditions under which its actions are permissible, and will continue to fulfil the role of supervising AI.

In short, the focus of discussions on AI in the maritime sector was not on “whether or not to introduce AI”, but on “which tasks to assign to AI, how far to delegate decision-making to it, and who should assure the results, and how”.

(2) Implementation of New Technologies and Public-Private Cooperation in Maritime Security and Defence

The “Maritime Security & Defence” conference, held on 3 and 4 September, featured a number of sessions on themes including maritime capability development in Europe, naval strategy and fleet composition, the protection of undersea infrastructure, the resilience of

commercial shipping, and the integration of crewed and uncrewed systems. The following summarises the discussions relating to AI, uncrewed systems and maritime domain awareness, together with those on public-private cooperation.

(a) Changing Fleet Composition and the Use of AI and Uncrewed Systems

In the discussion on naval strategy and changes in fleet composition, it was recognised that possessing only a small number of high-performance, high-cost warships is not sufficient to counter saturation missile attacks or drone swarm attacks, and that navies must secure not only the quality of their equipment but also its quantity and diversity. To this end, the concept of operating high-performance crewed warships in combination with large numbers of uncrewed systems was presented, together with a vision of positioning crewed warships not merely as combat units but as hubs for operating uncrewed systems and for decision-making (Operational Capability Hubs).

Speakers also outlined an approach of using AI and autonomous technologies to accelerate information processing and shorten the decision-making cycle, so that units can continue to operate even if communications with headquarters are cut off. On this basis, speakers introduced **the concept of “Human above the Loop”, in which strategic decisions remain with humans while tactical decisions are increasingly delegated to AI-enabled autonomous systems.**

(b) Integrating Crewed and Uncrewed Systems: Implementation Challenges

In the discussion on integrating crewed and uncrewed systems, drawing on lessons from Ukraine’s use of uncrewed systems to inflict significant damage on Russia’s Black Sea Fleet, the view was expressed that, in some domains, the stage has been reached where tactics must be reviewed to take account of new technologies. At the same time, it was reported that European navies have yet to establish specific methods of operation and are not making full use of the technologies available. Factors cited included trust in the systems, organisational culture and operational doctrine, and the extent to which the risks associated with introducing new systems are accepted, while technological maturity and regulation were also identified as challenges to full integration.

In response, the view was put forward that, rather than waiting for perfect equipment, units should first put existing technologies to use and continue to refine them based on feedback from users, and it was noted that “an 80% solution today is, in many cases, more effective than a 100% solution in six years’ time”. Accordingly, for rapidly evolving technologies and interim equipment, it was argued that development and procurement should proceed on a timescale of months rather than years, and that specific methods of operation for individual missions should also be developed through the actual use of the equipment. The opinion was also expressed that **such efforts cannot be taken forward by navies alone, and that industry must also fully understand the actual needs of navies and work closely with them.**

(c) Maritime Domain Awareness and Public-Private Information Sharing

In the discussion on Europe’s security environment and maritime capability development, the EU’s European External Action Service (EEAS) described maritime domain awareness as

a foundation of security and outlined a vision of strengthening surveillance capabilities by integrating information from space, through the sea surface, down to the seabed. The shipping industry, for its part, argued that such maritime domain awareness should also be used to ensure the safety of merchant ships. With merchant vessels facing threats in areas such as the Red Sea and the Strait of Hormuz, and given that it is not possible to escort every merchant ship with naval vessels, it was argued that information held separately by navies, intelligence agencies and shipping companies should be pooled to communicate promptly the level of risk in each sea area, so that each company can make appropriate decisions on whether to transit high-risk waters, wait, or reroute around them. However, the provision of such information was regarded not as a substitute for naval escorts, but as a means of enhancing their effectiveness.

In the discussion on the protection of undersea infrastructure such as submarine cables, it was explained that integrating satellite imagery, commercial data and other sources is increasingly making it possible to detect suspicious vessel movements that could damage such infrastructure. Building on this, the view was expressed that the challenge going forward will lie less in detection technology itself than in cooperation between operators that own sensors and states with the authority to respond, and in building arrangements to deliver the detected information swiftly.

(d) Ensuring Commercial Shipping Is Resilient to Attacks and Disruptions

In the discussion on ensuring that commercial shipping and port activities can continue in the face of attacks or disruptions, it was pointed out that merchant ships can pose a threat to critical infrastructure, as seen in cases in the Baltic Sea where merchant vessels dragged their anchors and damaged submarine cables, while shipping companies and ports are themselves becoming targets of cyberattacks and other threats. In this context, it was recognised that commercial shipping has also become a frontline of security, a domain hitherto primarily the responsibility of navies.

In the cyber domain, as the aim of attacks shifts from stealing information to disrupting operations, and given that shipping companies and ports rely on software providers, satellite service providers, equipment suppliers and others, the need to ensure cyber resilience across the entire supply chain was emphasised. It was also pointed out that, while navies can protect sea lanes, the security of such supply chains can only be ensured by industry itself. Echoing the shipping industry's point in (c) above, and on the premise that naval protection has its limits, the discussion arguably highlighted **the need for the public and private sectors to cooperate while each fulfils its own role.**

(e) Integrating Capabilities and the Conditions for Doing So (Cross-Cutting Themes)

Throughout the conference, in recognition that today's complex threats cannot be met simply by reinforcing individual warships or equipment, emphasis was placed on **linking crewed warships with uncrewed and autonomous systems through sensors, data and AI so that they function as a single capability spanning multiple domains, including space and cyberspace.**

However, the existence of a technology is not the same as turning it into a capability that can actually be used. Achieving this was considered to require, first, **building the technical foundations, such as interoperability between platforms, information-sharing**

mechanisms and cybersecurity. In addition, it was stated that progress must be made in parallel **on the institutional, organisational and human fronts, including the development of operational doctrine and specific methods of operation, the building of trust in systems, acceptance of the risks that accompany new systems, and the development of personnel.**

4. Summary and Observations

(1) Progress in Discussions Towards Implementation

This year's SMM indicated that discussions on AI, uncrewed systems and autonomous systems were shifting from debating technical possibilities to considering how to implement these technologies in ship design, vessel operations, security and defence. Particularly striking was that **such efforts towards implementation were under way in both the civil maritime and defence sectors.** A challenge common to both sectors was also identified: **how to adapt institutional frameworks, procurement, organisations and operations to technological progress, and translate that progress into capabilities that can actually be used.**

(2) Similarities and Differences Between the Civil Maritime and Defence Sectors

Although the two sectors differ in their objectives and operating environments, they share much of their underlying technology, including AI, uncrewed systems, sensors, data, communications and cybersecurity.

On the division of roles between humans and AI, however, while both sectors assumed human involvement, their emphases differed. **The civil maritime sector placed its emphasis on how to verify AI decisions and ensure their reliability, whereas in the defence sector, the view was also expressed that tactical decisions should be increasingly delegated to AI-enabled autonomous systems in order to secure speed and resilience.** This is thought to reflect a difference in the environments each sector anticipates: the civil maritime sector assumes monitoring and support from shore and regards on-board processing as a safeguard against unstable communications, whereas the defence sector assumes that communications will be severed by enemy interference and requires the ability to act autonomously even under such conditions.

Notwithstanding these differences, the author believes that, rather than each sector developing common underlying technologies independently, **making mutual use of each other's technologies and expertise would be effective in advancing technological development.**

(3) Points of Contact Between the Civil and Defence Sectors

Dual-use technologies lie at the heart of such mutual utilisation. **Extending their application to both the civil and defence sectors can be expected to stimulate technological development and commercialisation through market forces,** with the results benefiting both sectors in turn. **The establishment of the new "Naval Hall" at this year's SMM, which brought maritime security and defence substantially into what has traditionally been a maritime industry exhibition, can also be seen as an attempt to promote such mutual development.** SMM as a whole suggested that **in Europe, there is a growing drive to strengthen the defence industrial base while also drawing in the civil maritime industry.**

Moreover, SMM brings together companies from a wide range of fields, including shipbuilding, marine equipment and digital technologies. The author also found it noteworthy that incorporating the defence sector into the existing market and networks of one of the world's largest maritime exhibitions makes it possible to connect companies and technologies that would ordinarily have few points of contact.

Furthermore, the conferences addressed many areas that navies cannot handle alone and in which private operators and states must cooperate while sharing roles, such as information sharing for maritime domain awareness, the protection of undersea infrastructure such as submarine cables, and cybersecurity measures for commercial shipping. In the author's view, **the points of contact between civil maritime activities and defence will expand further, not only in technological development but also in such operational aspects.**

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The River Spree, which once marked the border between East and West Berlin, and the Oberbaum Bridge, formerly used as a border checkpoint