POSITION PAPER

MASS (Maritime Autonomous Surface Ships) (Revision 4)

IACS
International Association of Classification Societies

Our Position

The advancement of Maritime Autonomous Surface Ships (MASS) has reinforced future trends of autonomy and the need for improved technical requirements in shipping. IACS aims to contribute to the development of MASS by actively participating in relevant forums, leveraging its maritime technical expertise, and fostering strong partnerships with regulators and industry stakeholders.

BACKGROUND

IMO, through its Maritime Safety Committee (MSC), finalised its work on a "Regulatory Scoping Exercise" (RSE) at MSC 103 in May 2021. The Legal Committee (LEG), and Facilitation Committee (FAL) have conducted discussions on Maritime Autonomous Surface Ships (MASS). In addition, at MSC, the IMO has developed Interim Guidelines for MASS trials.

MSC 104 (10/2021), LEG 109 (03/2022) & FAL 46 (05/2022) agreed to develop a goal-based MASS Code, with target completion years of 2025 (non mandatory) & 2028 (mandatory). During MSC 105 (04/2022), the re-establishment of the MASS Correspondence Group (in which IACS is an active participant) was agreed upon, with primary focus on addressing high-priority items and drafting the MASS Code.

MSC 105 (04/2022) also agreed to establish a joint MSC-LEG-FAL Working Group on MASS to address common gaps and themes identified during the RSE by the three committees.

MSC 106 (11/2022) focused on the methodology of the MASS Code development considering the generic guidelines for developing IMO Goal-Based Standards (MSC.1/Circ.1394/Rev.2).

MSC 107 (06/2023) considered the report of the MASS Correspondence Group on the draft MASS Code and the outcome of the Joint MSC-LEG-FAL Working Group 2 (04/2023), and agreed to several critical working terms (e.g., Operational Envelope, Concept of Operation, Modes of Operation).

MASS-ISWG2 (11/2023) advanced the draft non mandatory MASS Code by refining its application to SOLAS cargo ships and associated ROCs, consolidating core operational concepts (e.g. ConOps and Operational Envelope), and outlining principles for survey, certification, flag State oversight and future work on network governance and training.

MSC 108 (05/2024), MASS Working Group reshaped and advanced the draft non mandatory MASS Code, refining its structure, core principles and key technical chapters (including navigation, structure and fire safety). The Committee agreed in principle on its application to SOLAS cargo ships with autonomous/remote functions (excluding cargo HSC and government ships), retained the ROM concept for ROC oversight, and revised the roadmap to target adoption of the non mandatory Code at MSC 110 with a mandatory Code entering into force in 2032.

IMO MASS CG re established at MSC 108 (05/2024). It was tasked to report verbally to MASS ISWG 3 and MSC 109 and formally to MSC 110, and to finalize Part 1 (chapters 1–3, including key definitions) and specific Part 2 chapters (5, 8, 14, 15) of the draft MASS Code, building on MSC 108/WP.7 and prior CG/ISWG/WG work. In its report to MSC 110, the CG delivered near final text for these sections (with only limited bracketed issues outstanding), clarified the application of the Code to SOLAS Chapter I cargo ships and associated ROCs, and proposed interim certification and data logging provisions to support early MASS operations and casualty investigation.

MASS-ISWG3 (09/2024) further progressed the draft MASS Code by finalizing chapters 17 (Safety of Navigation) and 20 (Fire protection, detection and extinction) and initiating work on chapters 23 (Search and Rescue) and 28 (Emergency response). It also aligned its work with the GBS experts and the MASS Correspondence Group and proposed that MSC establish a working group to complete the remaining chapters and resolve outstanding issues.

Continues >>

MSC 109 (12/2024) further developed the draft non-mandatory MASS Code and adopted a revised roadmap for 2026 completion of the non-mandatory code and 2032 release of mandatory code. IACS has actively participated, contributing terminology and definitions including providing technical inputs on several chapters of the code.

MSC 110 (06/2025) finalized chapters 1 to 3, 6, 11, 14, 16 to 17bis, 19, 21, 22 to 26 of the draft MASS Code.

MASS-ISWG4 (10/2025) finalized chapter 15 (Manning, Training and Watchkeeping) and other human element matters within chapters 5, 8, 9, 10 and Annex 2.

The European Commission established an expert group on MASS and developed the EU Operational Guidelines for Safe, Secure and Sustainable Trials of Maritime Autonomous Surface Ships (MASS).

Various pilot MASS projects have also been undertaken by industry, such as newly built ships with decision-making functions, remote-controlled and automated ferries, long voyage autonomous navigation trials performed under the supervision of the crews of a large commercial ship, etc.

SUMMARY OF KEY ISSUES

- Internal review of all IACS Resolutions (2017)
- Pilot project for selected IACS Resolutions (2018)
- Basic Principles for drafting New and revised IACS Resolutions (2018)
- IMO Work – Development of Guidelines on MASS Trials (2019)
- IMO Work – Regulatory Scoping Exercise (RSE) (2021)
- ISO Work – ISO/TS 23860 – Ships and marine technology - Vocabulary related to autonomous ship systems (2022)
- IMO Work – MSC papers
- IMO Work – MASS-JWG papers
- Collaborative Work

IACS POSITION

- IACS believes that the primary obstacle to MASS development is the absence of clear requirements.
- IACS supports the future implementation of the non-mandatory MASS code including the experience-building phase agreed at IMO, and will contribute lessons learned to help strengthen and refine the future mandatory MASS Code.
- IACS is developing new IACS Recommendations related to MASS including:
  - Recommendation for risk assessment techniques that are appropriate considering the complexity of MASS systems and their engineering development framework;
  - Recommendation for communications and remote connectivity technology to support safe and effective MASS operations.
- IACS is investigating the need to develop new Recommendations relevant to the Remote Operations Centres (ROC) and implementation of the Concept of Operations (ConOps).
- IACS will continue to provide expertise on MASS related matters identifying areas relevant to MASS that need further investigation and technical development.
- IACS will monitor and/or participate in meetings/ activities related to MASS being undertaken by regulators and standardization bodies (IMO, ISO, EC, etc.) and will develop its Positions, when necessary.
- IACS will endeavor to keep in touch with the relevant industries and monitor technological development related to MASS to ensure best practice is included in IACS documents.
- Under the purview of the IACS Safe Digital Transformation (SDT) Panel, a Joint Working Group on Safe Digital Transformation (JWG SDT) on Maritime Autonomous Surface Ships (MASS) was formed. The MASS module concentrates on autonomous navigation, connectivity, and cybersecurity and is tasked with developing industry guidelines and supporting a regulatory framework around MASS.

Continues >>

SUMMARY OF WORK ALREADY CARRIED OUT BY IACS ON THIS ISSUE TO DATE

In parallel with IMO activities, IACS has carried out several initiatives:

1. Internal Review of all IACS Resolutions (2017)

As a result of this review, 191 IACS Resolutions (excluding the Common Structural Rules (CSR)) were identified as requiring a human presence on board ship. The review was aimed at identifying the requirements which, if left unchanged, could create barriers for fully autonomous ships. Requirements which may hinder the technical development of fully autonomous ships were identified in IACS Resolutions related to machinery, electrical and safety systems, as well as hull structures, and survey procedures.

Besides requirements identified in the review, IACS considers the lack of specific requirements for hardware and software elements of autonomous systems as the main barrier hindering the development of autonomous ships. Without such requirements, verification and validation activities cannot be clearly defined and properly executed. IACS encourages a programme of work in the coming years to tackle this issue.

2. Pilot Project for selected IACS Resolutions (2018)

An IACS pilot project to explore possible modifications to IACS Resolutions, to accommodate future MASS, was carried out to identify the extent of any barriers and to facilitate discussions on the priority and relative impact of requirements for various levels of autonomy. The pilot resolutions included:

- UR S8 Bow doors and inner doors
- UR F32 Fire-detecting system for unattended machinery spaces
- UR Z18 Periodical survey of machinery
- UR M75 Ventilation of emergency generator rooms

3. Basic Principles for drafting New and revised IACS Resolutions (2018)

As a result of the IACS review, the following general principles for drafting IACS Resolutions were agreed:

a) IACS will strive to avoid introducing new obstacles for MASS when developing new IACS Resolutions.

b) IACS will consider whether identified obstacles for MASS can be reduced when amending existing IACS Resolutions.

c) IACS will carefully consider the need for new or amended IACS Resolutions that allow more extensive automation provisions.

d) Finally, where necessary, IACS will consider the inclusion of a general statement to permit special consideration to accommodate cases where designers or operators propose automation above and beyond that which is normally provided today.

4. IMO Work – Development of Guidelines on MASS Trials (2019)

The “Interim Guidelines for MASS Trials” have been approved by MSC 101 (June 2019), with the aim of ensuring that such trials are conducted safely, securely and with due regard for protection of the environment. IACS anticipates acquiring from MASS trials essential information in relation to ship control and engineering systems.

5. EU Work – Draft EU Operational Guidelines on MASS trials (2020)

IACS reviewed the first draft of the EU Operational Guidelines on MASS Trials and relevant comments were sent to the EU’s Expert Group on MASS. IACS will continue to monitor the status and development of these Guidelines and provide comments if necessary.

6. IMO Work – Regulatory Scoping Exercise (RSE) (2021)

IACS understands that this RSE aims to establish a common understanding of technology among IMO members. IACS confirmed its involvement in the initial review and relevant technical discussion on SOLAS Chapter II-2.

Based on the results of the RSE, as of May of 2021:

- IACS echoes the call from various volunteering states that a unified list of common potential gaps and themes is required.
- IACS recognises the importance of clearly defining the boundaries between classification and statutory activities with respect to MASS as there may otherwise be gaps in the regulatory coverage within this new area.

Continues >>

- IACS considers that work on the next steps should be cognisant that autonomous ships will have to co-exist with conventional ships for the foreseeable future and any amendments to SOLAS and other regulatory instruments should consider MASS operation in a holistic way.

- IACS recognises that there is a need to clarify the application provisions for a new goal-based instrument for MASS.

IACS will continue to actively participate in future IMO work on MASS and, in particular, in the development of a "Goal-based instrument for maritime autonomous surface ships (MASS Code)".

7. ISO Work – ISO/TS 23860 Vocabulary related to autonomous ship systems (2022)

This item was proposed in January 2019 and completed in June 2022. The ISO work has been considered by IACS for definitions and terminology works.

8. IMO Work – MSC papers, MASS-JWG Papers

IACS meticulously reviews all submission papers related to MASS at IMO, to formulate its position on each paper.

9. Collaborative Work

IACS is involved in this important subject area, studying MASS development and its application, working collaboratively with regulators and industry and using its technical expertise to consolidate its position, and will look to develop and demonstrate competence through the improvement of its requirements and procedures.

Meetings/activities in this area include but are not limited to:

- Participation, as part of the liaison between IACS and ISO/IEC TC 8 – Ships and Marine Technology, in the work of SC 26 – Smart Shipping, which focuses on developing international standards for smart shipping, including MASS

- Webinar on autonomous ships organised by the Belgian government, in cooperation with Belgian Shipowners: a world of opportunities and exciting challenges (2021)

- Conference on a-Navigation organised by the Ministry of Transport of the Russian Federation with the support of IMO and in partnership with the Industry Association MARINET and the a-Navigation Promotion Center "MARINET RUT" (2021)

- Royal Belgian Shipowners' Association (RBSA) MASS-think tank kick-off meeting (2021- 2023)

- Webinar on "Autonomous ferries – the need for a regulatory framework, organised by the Canadian Ferry Association (2022)

- Lookout function – Proposal by the One Sea Association (2022)

- Conference on Autonomous Ships, organized by the Royal Institution of Naval Architects (2024)

- MASS Symposium 2025: "Maritime Autonomous Surface Ships as a reality: the need for the IMO MASS Code", co-sponsored by IMO and Norway (2025)

- Annual Tripartite Forum of shipbuilders, shipowners and classification societies (2025)

Please note if you're reading this paper in hard copy the most recent version is available at iacs.org.uk/about-us/position-papers
For more information, contact IACS Permanent Secretariat on +44 (0)20 7976 0660, permsec@iacs.org.uk. This position paper was first published in March 2019.

International Association of Classification Societies Permanent Secretariat, 4 Matthew Parker Street, Westminster, London SW1H 9NP, UK
E: permsec@iacs.org.uk T: +44 (0)20 7976 0660 www.iacs.org.uk