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WORK PROGRAMME

Introduction of Maritime Autonomous Surface Ships (MASS) operations in IMO instruments

Submitted by Japan, Russian Federation, United Arab Emirates and IACS

SUMMARY

<i>Executive summary:</i>	This document proposes a new output to take further steps for the introduction of Maritime Autonomous Surface Ships (MASS) operations in IMO instruments
<i>Strategic direction, if applicable:</i>	2
<i>Output:</i>	To be decided
<i>Action to be taken:</i>	Paragraph 31
<i>Related documents:</i>	MSC.1/Circ.1638, MSC.1/Circ.1604; MSC 102/5/29, MSC 102/INF.8 and MSC 103/5/9

Introduction

1 This document, submitted in accordance with paragraph 4.6 of the *Organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.5/Rev.2), proposes a new output for the next steps needed for the introduction of MASS operations in IMO instruments.

Background

2 The Committee, at its 103rd session, completed the "Regulatory Scoping Exercise (RSE) for the use of Maritime Autonomous Surface Ships (MASS)". The outcome of the work is presented in MSC.1/Circ.1638 and the history of discussion under this agenda is explained in section 2 of the annex to MSC.1/Circ.1638.

3 As mentioned in paragraph 6.10 of the annex to MSC.1/Circ.1638, the Committee agreed on the need for justification in relation to any future proposals for changes in the regulatory framework, and consequently recognized that any future work on MASS needs to be approved following a proposal for a new output.

4 The priorities for further work identified by the Committee are presented in section 6 of the annex to MSC.1/Circ.1638. As mentioned in paragraph 6.1 of the annex to MSC.1/Circ.1638, the main high priority items include the need to consider the development of a new instrument, review of terminology and definitions, and consideration of high-priority common potential gaps and themes. According to these main high priority items, a possible way forward in addressing MASS operations in IMO instruments under the remit of the Maritime Safety Committee is set out in table 6 of the annex to MSC.1/Circ.1638, which is reproduced below:

Table 6: Addressing MASS operations in IMO instruments under the remit of the Maritime Safety Committee

Issue	Planned activities and result
1 Consideration of a holistic approach to MASS operations in IMO instruments	
Development of a goal-based MASS instrument	Consideration on how to develop a new MASS instrument and draft amendments to the applicable instruments through which it can be made mandatory
Definition of MASS	Consideration on need to revise definition and/or degrees and if revision is deemed necessary, agreeing on the definition and/or degrees
Terminology for MASS operations in the IMO regulatory framework	Consideration on need of supplementing terminology, and if deemed necessary, agreeing on such terminology
High-priority common gaps and themes in relation to MASS operations and IMOs regulatory framework: <ul style="list-style-type: none"> - Meaning of Master, crew or responsible person - Remote control station/centre - Remote operator designated as seafarer 	Consideration of the high-priority common gaps and themes
Non-mandatory instrument	Consideration of the development of guidelines for MASS operations such as guidelines for installation and guidelines for system application

5 As shown in this table and as mentioned in paragraphs 6.2 and 6.3 of the annex to MSC.1/Circ.1638, the development of a new instrument includes the development of a goal-based MASS instrument which can be made mandatory through the amendments to the applicable instruments, and the development of a non-mandatory instrument, i.e. guidelines for MASS operations.

Discussion and proposal

6 It is well known that various R&D projects on MASS are ongoing around the world. Therefore, a new output for the introduction of MASS operations in IMO instruments should be included in the post biennial agenda of the Committee. As mentioned in paragraphs 4 and 5 in this document, the following five items should be considered in the new output:

- .1 how to develop a new MASS instrument and draft amendments to the applicable instruments through which it can be made mandatory;

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- .2 the need to revise the definition and/or degrees of MASS and, if revision is deemed necessary, agreeing on the definition and/or degrees;
 - .3 the need of supplementing terminology and, if deemed necessary, agreeing on such terminology;
 - .4 how to address the high-priority common potential gaps and themes identified by the RSE; and
 - .5 the development of guidelines for MASS operations such as guidelines for installation and guidelines for system application.

7 Taking into account the above-mentioned five items, the co-sponsors propose the development of a goal-based MASS instrument (e.g. a MASS Code) and non-mandatory instruments (e.g. guidelines for MASS operations), in parallel with the considerations of the following items:

- .1 revision of the definitions of MASS and/or degrees of autonomy, as necessary;
- .2 development of the IMO Glossary on MASS operations, as necessary; and
- .3 the way to address the high-priority common potential gaps and themes listed in the table 6 of the annex to MSC.1/Circ.1638.

8 A goal-based MASS instrument should cover the cross-cutting themes of safe, secure, and environmentally sound MASS operations and could be mandatory in nature. The development of such an instrument is challenging and careful consideration is required. As a first step the scope of the MASS instrument must be agreed. Simultaneously, the IMO instrument(s) to be amended to include texts for making the MASS instrument mandatory will need to be identified. To facilitate this work, clear instructions for the development of the MASS instrument will need to be given to the relevant Sub-Committees. The additional workload that this will create for the respective Sub-Committees should be considered, taking into account the current limited capacity for establishing working groups (WGs) and correspondence groups (CGs).

9 With regard to the proposed item "non-mandatory instrument", the co-sponsors propose the development of guidelines for MASS operations, which should take into account *Interim guidelines for MASS trials* (MSC.1/Circ.1604). This work should be undertaken at an early stage. Such guidelines may include, but not limited to:

- .1 assumptions of operational conditions for a MASS such as Concept of Operations (CONOPS);
- .2 risk assessment of the MASS operations;
- .3 goals/objectives, functional requirements and performance standards for the MASS systems;
- .4 procedures for voluntary certification of the MASS operations/systems by the relevant authorities or recognized organizations; and
- .5 education and training for the MASS operators.

10 While a mandatory instrument such as a MASS Code is undoubtedly essential, the introduction of MASS operations would start before completion of such an instrument. Therefore, a non-mandatory instrument, which could ultimately form a part of a mandatory instrument, is essential to facilitate the continued operation and development of MASS. The development of such "interim" guidelines will also provide an opportunity to gather information and experience in the practical use of MASS.

11 Taking into account the above considerations, the co-sponsors of this document propose the following new output:

"The development of a goal-based MASS instrument and associated non-mandatory instruments."

This output would facilitate and include consideration of the work completed by the RSE and take into consideration the points raised in paragraphs 6, 7 and 9 above.

IMO's objectives

12 The proposed output would allow IMO to respond to the growth in the use of MASS in a timely manner, and continue to promote safe, secure, environmentally sound, efficient and sustainable shipping.

13 This proposal would relate to Strategic direction 2 "Integrate new and advancing technologies in the regulatory framework". As such, this proposal is deemed to be within the scope of the Strategic Plan.

Need

14 Technological advances have resulted in the introduction into service of a variety of MASS. The size of these MASS and geographical spread of their use are both growing.

15 Some Classification Societies have recognised this trend and have already published design criteria and guidelines for MASS. In addition, some States have established national guidelines for the operation of MASS within their jurisdiction, e.g. via the dissemination of Maritime Safety Information (MSI) to warn other shipping.

16 In 2019-2021 Japan and the Russian Federation conducted MASS trial operations in accordance with the IMO *Interim guidelines for MASS trials* (MSC.1/Circ.1604). The proper reports were provided by Japan in document MSC 102/INF.8 and by the Russian Federation in documents MSC 102/5/29 and MSC 103/5/9.

17 IMO, in its role as the primary international forum for technical matters affecting international shipping, should therefore take a proactive role to ensure a harmonized international approach to MASS. The co-sponsors, therefore, consider that there is a need to take the next step, following the RSE, under the purview of the Maritime Safety Committee, to provide IMO instruments for enabling the safe operation of MASS, taking into account the results of the RSE, as early as possible not to preclude the research and development (R&D) of MASS.

Analysis of the issue

18 To date, except for the interim guidelines for MASS trials, consideration of the construction and operation of MASS has not been undertaken by the international maritime community. While the operation of the current MASS may be manageable in the short term,

for the reasons mentioned in paragraphs 14 to 17, the co-sponsors propose that the Organization should now begin to consider the issues pointed out in the outcome of the RSE, i.e. MSC.1/Circ.1638.

Analysis of implications

19 There would be no cost to the maritime industry or administrative requirements arising during the development of this output, and the Checklist for Identifying Administrative Requirements, set out in annex 1, has been completed on this basis.

20 The co-sponsors would like to highlight the importance of this output to prevent the proliferation of MASS in an unregulated manner, which may lead to adverse impacts on maritime safety, security and the protection of the marine environment.

Benefits

21 As the technology matures, there will be an increasing number of maritime activities which could benefit from the deployment of MASS, and this output would be the first step in ensuring that the IMO regulatory framework is prepared for the full commercial utilization of such technology. This output would contribute to the continued development of a safe, secure and environmentally friendly maritime industry.

Industry standards

22 There are a number of relevant industry standards which are already being applied by the manufacturers and operators of MASS. While these may be adequate for the limited scale at which MASS are currently being operated, they are unlikely to be adequate in the future if the trend towards increased size and geographical deployment continues, as discussed above.

23 ISO/TC 8 has established WG 10 "Smart shipping" and the WG has been developing ISO/DTS 23860 "Ships and marine technology: Terminology related to Autonomous Ship Systems". This draft technical specification may be taken into consideration during the work of the proposed output.

Output

24 The scope of this output is to develop the two instruments outlined in paragraph 7. This output is projected to take six years, taking into account the amount of the work required for creating common understanding of the wide range of issues related to MASS and for careful review of various IMO instruments. Also, it should be noted that such work on MASS will require coordination with other relevant Committees and collaboration with Sub-Committees. It will be beneficial to establish a joint LEG/MSC/FAL Working Group with the aim to tackle common gaps and themes between the Committees.

25 The proposed output would be: "The development of a goal-based MASS instrument and associated non-mandatory instruments."

26 The delivery of this output would be the responsibility of MSC with specific instructions given to the technical Sub-Committees to ensure a consistent approach is taken across all areas and with the other Committees (FAL/LEG). It is envisioned that the results of this output would be as follows:

- .1 Non-mandatory interim guidelines for MASS operations including:

- .1 the development of an IMO Glossary
- .2 Holistic goal-based MASS code including:
 - .1 scope of the MASS Code and its relationship to other instruments;
 - .2 drafting instructions to relevant Sub-Committees;
 - .3 review of the definition of MASS and degrees of autonomy; and
 - .4 the resolution of the common gaps and themes from all Committees.

Human Element

27 Regardless of whether a MASS is manned or unmanned, many of the issues that need to be considered relate to interactions between MASS and humans. These may be on board the MASS, or with humans on other vessels or ashore. The Human Element therefore must be an area of consideration within the proposed output.

28 On the other hand, the interactions between MASS and humans may vary in the future and it is impossible to sufficiently address the Human Element at this point in time. The Checklist for Identifying Human Element Issues, set out in annex 2, has been completed on this basis.

Urgency

29 As mentioned in paragraphs 14 to 17, this output is an urgent issue and should be included in the 2022-2023 biennial agenda of the Committee.

Action required

30 It is proposed that the Committee includes a new output in the 2022-2023 biennial agenda to start consideration from MSC 105.

Action requested of the Committee

31 The Committee is invited to include the proposed new output in the 2022-2023 biennial agenda of the Committee and the provisional agenda for MSC 105, to start the consideration as early as possible.

ANNEX 1

CHECKLIST FOR IDENTIFYING ADMINISTRATIVE REQUIREMENTS
(MSC-MEPC.1/Circ.5/Rev.2, annex 5)

This checklist should be used when preparing the analysis of implications required in submissions of proposals for inclusion of outputs. For the purpose of this analysis, the term "administrative requirement" is defined in accordance with resolution A.1043(27), as an obligation arising from a mandatory IMO instrument to provide or retain information or data.

Instructions:

- (A) If the answer to any of the questions below is **YES**, the Member State proposing an output should provide supporting details on whether the requirements are likely to involve start-up and/or ongoing costs. The Member State should also give a brief description of the requirement and, if possible, provide recommendations for further work, e.g. would it be possible to combine the activity with an existing requirement?
- (B) If the proposal for the output does not contain such an activity, answer **NR** (Not required).
- (C) For any administrative requirement, full consideration should be given to electronic means of fulfilling the requirement in order to alleviate administrative burdens.

1. Notification and reporting? Reporting certain events before or after the event has taken place, e.g. notification of voyage, statistical reporting for IMO Members, etc.	NR <input checked="" type="checkbox"/>	Yes <input type="checkbox"/> Start-up <input type="checkbox"/> Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
2. Record keeping? Keeping statutory documents up to date, e.g. records of accidents, records of cargo, records of inspections, records of education, etc.	NR <input checked="" type="checkbox"/>	Yes <input type="checkbox"/> Start-up <input type="checkbox"/> Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
3. Publication and documentation? Producing documents for third parties, e.g. warning signs, registration displays, publication of results of testing, etc.	NR <input checked="" type="checkbox"/>	Yes <input type="checkbox"/> Start-up <input type="checkbox"/> Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
4. Permits or applications? Applying for and maintaining permission to operate, e.g. certificates, classification society costs, etc.	NR <input checked="" type="checkbox"/>	Yes <input type="checkbox"/> Start-up <input type="checkbox"/> Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
5. Other identified requirements?	NR <input checked="" type="checkbox"/>	Yes <input type="checkbox"/> Start-up <input type="checkbox"/> Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		

ANNEX 2

CHECKLIST FOR CONSIDERING HUMAN ELEMENT ISSUES BY IMO BODIES
(MSC-MEPC.7/Circ.1, annex)

<p>Instructions: If the answer to any of the questions below is:</p> <p>(A) YES, the preparing body should provide supporting details and/or recommendation for further work.</p> <p>(B) NO, the preparing body should make proper justification as to why human element issues were not considered.</p> <p>(C) NA (Not Applicable) – the preparing body should make proper justification as to why human element issues were not considered applicable.</p>	
<p>Subject Being Assessed: (e.g. Resolution, instrument, circular being considered) Introduction of MASS operations</p>	
<p>Responsible Body: (e.g. Committee, Sub-Committee, Working Group, Correspondence Group, Member State) The Maritime Safety Committee</p>	
1. Was the human element considered during development or amendment process related to this subject?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA
2. Has input from seafarers or their proxies been solicited?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA
3. Are the solutions proposed for the subject in agreement with existing instruments? (Identify instruments considered in comments section)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
4. Have human element solutions been made as an alternative and/or in conjunction with technical solutions?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
5. Has human element guidance on the application and/or implementation of the proposed solution been provided for the following:	
• Administrations?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
• Ship owners/managers?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
• Seafarers?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
• Surveyors?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
6. At some point, before final adoption, has the solution been reviewed or considered by a relevant IMO body with relevant human element expertise?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
7. Does the solution address safeguards to avoid single person errors?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA
8. Does the solution address safeguards to avoid organizational errors?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA
9. If the proposal is to be directed at seafarers, is the information in a form that can be presented to and is easily understood by the seafarer?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
10. Have human element experts been consulted in development of the solution?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
11. HUMAN ELEMENT: Has the proposal been assessed against each of the factors below?	
<input type="checkbox"/> CREWING. The number of qualified personnel required and available to safely operate, maintain, support, and provide training for system.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
<input type="checkbox"/> PERSONNEL. The necessary knowledge, skills, abilities, and experience levels that are needed to properly perform job tasks.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA

<input type="checkbox"/> TRAINING. The process and tools by which personnel acquire or improve the necessary knowledge, skills, and abilities to achieve desired job/task performance.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
<input type="checkbox"/> OCCUPATIONAL HEALTH AND SAFETY. The management systems, programmes, procedures, policies, training, documentation, equipment, etc. to properly manage risks.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
<input type="checkbox"/> WORKING ENVIRONMENT. Conditions that are necessary to sustain the safety, health, and comfort of those working on board, such as noise, vibration, lighting, climate, and other factors that affect crew endurance, fatigue, alertness and morale.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
<input type="checkbox"/> HUMAN SURVIVABILITY. System features that reduce the risk of illness, injury, or death in a catastrophic event such as fire, explosion, spill, collision, flooding, or intentional attack. The assessment should consider desired human performance in emergency situations for detection, response, evacuation, survival and rescue and the interface with emergency procedures, systems, facilities and equipment.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
<input type="checkbox"/> HUMAN FACTORS ENGINEERING. Human-system interface to be consistent with the physical, cognitive, and sensory abilities of the user population.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> NA
Comments: At this stage, it is proposed to start the work for MASS operation and the human elements issues should be considered at a later stage.	
