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**□** ARM **□** ENG **□** PAP **□** Input

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Agenda item [[2]](#footnote-2) 8

Technical Domain / Task Number 2 1.2.5

Author(s) / Submitter(s) China MSA

Scoping exercise on the implications of MASS on VTS documents

# Summary

Being aware that vessel traffic services are provided worldwide and make a valuable contribution to safety of navigation, improved traffic efficiency and the protection of the marine environment. Recognizing that **close cooperation** between vessel traffic service personnel and participating vessels determines the level of safety and efficiency of maritime traffic in the areas covered by vessel traffic service.

In recent years, the rapid development of **MASS** (Maritime Autonomous Surface Ship) has not only demonstrated many technical advantages, but also brought new challenges to this “**close cooperation**”. How VTS will provide service for MASS in the future requires our serious consideration.

Considering the importance of item 1.2.5 of the VTS Committee’s 2018-2022 work plan- “Develop a Guideline on the implications of MASS from a VTS perspective”, China Maritime Safety Administration (China MSA) carried out preliminary research and prepared this information paper for sharing.

## Purpose of the document

The preliminary research results of China MSA:

* Introduce a research method for scoping exercise on the implications (**SEI**) of MASS on VTS documents, see Annex 1 for details;
* Take the G1141-VTS OPERATIONAL PROCEDURES FOR VTS under the S1040 standard framework as an example to deduct this research method, see Annex 2 for details.

## Related documents

IALA DOCUMENTATION RELATING TO VTS (Edition 1.1)

IALA Standards S1040- VESSEL TRAFFIC SERVICES (Edition 1.0)

IALA Guideline 1141- VTS OPERATIONAL PROCEDURES FOR VESSEL TRAFFIC SERVICES (Edition 1)

MSC 100/20/Add.1- Report of The Maritime Safety Committee on Its One Hundredth Session (Secretariat)

# Background

The 98th Session of Maritime Safety Committee (MSC) agreed to add a new output- “Regulatory scoping exercise for the use of MASS” in the 2018-2019 Biennial Agenda. MSC 100th Session approved - “FRAMEWORK FOR THE REGULATORY SCOPING EXERCISE FOR THE USE OF MASS” (MSC 100/20/Add.1). and MSC 102nd session will review the results.

The research method introduced in this paper draws on the above framework. It is also optimized on considering the characteristics of existing VTS documents in IALA and VTS operation, management and technology, including the influence of human factors. This method is divided into two steps: the first step is to scope existing VTS documents in IALA and analyse the potential gaps; the second step is to analyse the existing gaps again and determine the appropriate solution.

According to IALA DOCUMENTATION RELATING TO VTS (Edition 1.1), there are 4 standards, 15 recommendations and 34 guidelines. This paper selects G1141 under the framework of IALA S1040 as the research sample, mainly considering:

* This guide aims to assist VTS authorities in determining important factors that should be considered when establishing a VTS operation procedure;
* Internal and external procedures as well as routine and emergency procedures in this guide may be affected by MASS.

# Discussion

## Qualitative analysis of the implications of MASS on VTS

Qualitative analysis of the implications of MASS on VTS is mainly considered as follows:

* Inapplicability of traditional communication methods. Regardless of whether MASS adopts remote control station or is fully autonomous, it will inevitably require a new communication method to supplement the traditional VHF voice communication as well as meet the needs of large data transmission.
* Inapplicability of the capabilities of VTS personnel. The performance of VTS functions depends on the cooperation between VTS personnel and deck officers. However, the introduction of new technologies may break this relationship, so VTS personnel need to adapt to the challenges brought by the development of MASS.
* Inapplicability of VTS equipment. VTS equipment needs to be upgraded to meet the requirements of MASS, including VTS network security and future large-scale data transmission.
* Inapplicability of legal instruments. For example, Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) and local regulations of each VTS center.
* Inapplicability of VTS emergency procedures. The ultimate goal of MASS is to have no seafarers on board, while the existing VTS emergency procedures are mainly based on the interaction between VTS personnel and seafarers.

## Analysis of the implications of MASS on G1141

Analysis of the implications of MASS on G1141 is mainly considered as follows:

* Internal procedures. For example, the handover information of VTS operators needs to add relevant information to adapt to MASS;
* External procedures. For example, ship report procedures need to clarify new communication reporting methods and contents, besides the implementation of MSP;
* Emergency response procedures. For example, when MASS is developed to the degree of unmanned ship, the traditional emergency response procedures will face revolutionary changes. First, VTS need to communicate with MASS to know the specific situation of ship distress and relevant progress; second, in the face of loss of control, collision, capsizing and sinking of ships, how VTS plays a role in the emergency response, including the transmission of traffic control information.

## The China MSA will continue to carry out research on SEI of MASS for other VTS documents and welcomes input from Member States and all stakeholders on any initiatives that could inform the work on SEI of MASS.A workgroup maybe established if possible.

# Action requested of the Committee

The Committee is invited to take note of the research work introduced by the China MSA.

1. Framework for scoping exercise on the implications of MASS on VTS documents
2. Aim

The aim of SEI of MASS is to determine the implications of MASS on VTS, to assess the potential impact of MASS on existing VTS documents in IALA.

1. Methodology
   1. The definition and some assumptions of MASS as Table 1:
2. The definition and some assumptions of MASS

|  |  |  |
| --- | --- | --- |
| Degree of autonomy | contents | assumptions |
| Degree one | Ship with automated processes and decision support | MASS of degree one is considered as a conventional ship with some additional functions to support human decision making. The specific automated process and decision support are not considered due to their diversities. |
| Degree two | Remotely controlled ship with seafarers on board | No matter if MASS can be operated from another location, seafarers on board are assumed to be able to meet all the operation and control requirements. |
| Degree three | Remotely controlled ship without seafarers on board | The ship is controlled and operated from another location with no seafarers on board. |
| Degree four | Fully autonomous ship | The operating system of the ship is able to make decisions and determine actions by itself. |

* 1. First step: gaps analysis

1. Classification of MASS implications on VTS documents
2. apply to MASS and do not impede the function of VTS on MASS, but may need to be amended or clarified, and/or may contain gaps; or
3. apply to MASS and do not impede the function of VTS on MASS, and require no actions; or
4. do not apply to MASS and impede the function of VTS on MASS.
5. The identification process can be presented in the following flow chart:

Provisions

MASS operations

Safety and Efficiency

(Q1)

Intention of provisions relevant

(Q2)

Provisions appropriate /sufficient?

Y

B

A

N

C

Y

N

1. Template for the first step
2. Template for the first step

|  |  |  |  |
| --- | --- | --- | --- |
| Provisions | Degree of autonomy | MASS application | Comments/remarks |
|  | DEGREE ONE |  |  |
| DEGREE TWO |  |  |
| DEGREE THREE |  |  |
| DEGREE FOUR |  |  |

* 1. The second step: Analysis of the most appropriate way of addressing MASS implications

1. Classification of the most appropriate methods to address the implications of MASS:
2. equivalences as provided for by the instruments or developing interpretations; and/or
3. amending existing documents; and/or
4. developing new documents; or
5. none of the above as a result of the analysis.
6. *Template for the second step*

|  |  |  |  |
| --- | --- | --- | --- |
| Degree of autonomy | the most appropriate way of addressing MASS implications  (I, II, III, IV) | Reasons | Themes/ potential gaps that require addressing |
| DEGREE ONE |  |  |  |
| DEGREE TWO |  |  |  |
| DEGREE THREE |  |  |  |
| DEGREE FOUR |  |  |  |

1. Example of SEI of MASS on G1141
2. STEP1 Gap analysis results
3. G1141 GAP ANALYSIS

|  |  |  |  |
| --- | --- | --- | --- |
| G1141 VTS OPERATIONAL PROCEDURES FOR VTS | | | |
| **Provision** | **Degree of autonomy** | **Mass Application** | **Comments/Remarks** |
| \*General comments on G1141 operational procedures | DEGREE ONE |  | " MASS of degree one is considered as a conventional ship with some additional functions to support human decision making. Hence, it is not necessary to amend in the degree one. |
| \*General comments on G1141 operational procedures | DEGREE TWO |  | " if Seafarers onboard are assumed to be able to fulfil all the operation and control requirements, the situation with degree two is similar to the degree one; .2. If the vessel totally is operated by remote operators, the seafarers onboard just provide some maintenance work, some gaps (i.e. the communicating method between remote operators and VTS personnel) need to be addressed. |
| \*General comments on G1141 operational procedures | DEGREE THREE |  | Some potential gaps (i.e. handover, the communicating method between remote operators and VTS personnel) need to be addressed. Especially in the emergency response. |
| \*General comments on G1141 operational procedures | DEGREE FOUR |  | 1. In the process of handover, reporting to the VTS and emergency respond, the information delivery would be a key factor needed to be address. |
| Chapter1(introduction) | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B |  |
|  | DEGREE FOUR | B |  |
| 2 internal VTS procedures |  |  |  |
| 2.1.1. Gathering and Recording of Information | DEGREE ONE | B | In degree 1 of autonomy, collecting and recording information can be accomplished in the traditional way, so it need not to amend in the part. |
|  | DEGREE TWO | A | “Data from other sources” can be defied that the data of remotely controlled ships can be safely transferred to the VTS. Besides that, information about the autonomous degree and remote-control base should be included. |
|  | DEGREE THREE | A | “Data from other sources” can be defied that the data of remotely controlled ships can be safely transferred to the VTS. Besides that, information about the autonomous degree and remote control base should be included. |
|  | DEGREE FOUR | A | “Data from other sources” can be defied that the data of remotely controlled ships can be safely transferred to the VTS. Besides that, information about the autonomous degree and remote control base should be included. |
| 2.1.2 Operational Staff | DEGREE ONE | B | based upon safe and efficient operations in the VTS area to meet the operational needs. |
|  | DEGREE TWO | B | based upon safe and efficient operations in the VTS area to meet the operational needs. |
|  | DEGREE THREE | B | based upon safe and efficient operations in the VTS area to meet the operational needs. |
|  | DEGREE FOUR | B | based upon safe and efficient operations in the VTS area to meet the operational needs. |
| 2.1.3 Equipment Operation, Maintenance, Calibration and Updating | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B |  |
|  | DEGREE FOUR | B |  |
| 2.1.4 Interaction with Allied Services | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B |  |
|  | DEGREE FOUR | B |  |
| 2.1.5 Public Relations | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B |  |
|  | DEGREE FOUR | B |  |
| 2.1.6 Security | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B | Refer to the ISPS code |
|  | DEGREE FOUR | B |  |
| 2.1.7 Training | DEGREE ONE | B | refer to the V-103 |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B |  |
|  | DEGREE FOUR | B |  |
| 2.1.8 Watch Handover | DEGREE ONE | B |  |
|  | DEGREE TWO | B | Handover information: Special instructions on whether there are remote control or autonomous ships in the VTS area. |
|  | DEGREE THREE | B | Handover information: Special instructions on whether there are remote control or autonomous ships in the VTS area. |
|  | DEGREE FOUR | B | Handover information: Special instructions on whether there are remote control or autonomous ships in the VTS area. |
| 2.1.9 Vessel Handover | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B |  |
|  | DEGREE FOUR | B |  |
| 2.1.10 Maintenance of Marine Publications | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | For degree three MASS, develop an available way to receive and identify new nautical publications besides paper and electronics ways. |
|  | DEGREE FOUR | A | For degree four Mass, develop an available way to receive and identify new nautical publications besides paper and electronics ways. |
| 2.2 Emergency Procedures | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B |  |
|  | DEGREE FOUR | B |  |
| 3 EXTERNAL VTS PROCEDURES |  |  |  |
| 3.1 Routine Procedures |  |  |  |
| 3.1.1 Pre-Arrival Information | DEGREE ONE | B |  |
|  | DEGREE TWO | A | Whether the vessel is an autonomous vessel, whether there are people on board, and the specific competency of the personnel should be added, but due to the absence of seafarers on board ships, the actual reporting method or means should be clarified. |
|  | DEGREE THREE | A | Whether the vessel is an autonomous vessel, whether there are people on board, and the specific competency of the personnel should be added, but due to the absence of seafarers on board ships, the actual reporting method or means should be clarified. |
|  | DEGREE FOUR | A | Whether the vessel is an autonomous vessel, whether there are people on board, and the specific competency of the personnel should be added, but due to the absence of seafarers on board ships, the actual reporting method or means should be clarified. |
| 3.1.2 Vessels Entering VTS Area | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | "For MASS with no seafarer onboard, amendments to corresponding ship reporting method is required." |
|  | DEGREE FOUR | A | "For MASS with no seafarer onboard, amendments to corresponding ship reporting method is required." |
| 3.1.3 Vessels within VTS Area |  |  |  |
| 3.1.3.1 Mandatory Participation | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | Since the ship is not equipped with the relevant crew on board, in what way VTS provides the corresponding services to the ship, this part needs to be supplemented accordingly. And take changes of pilot guidelines into consideration when provide services to MASS. |
|  | DEGREE FOUR | A | Since the ship is not equipped with the relevant crew on board, in what way VTS provides the corresponding services to the ship, this part needs to be supplemented accordingly. And take changes of pilot guidelines into consideration when provide services to MASS. |
| 3.1.3.2 Voluntary Participation | DEGREE ONE | B |  |
|  | DEGREE TWO | A | Due to the special nature of autonomous ships, is it possible to recommend that VTS authorities be required to classify autonomous ships as mandatory reporting categories? |
|  | DEGREE THREE | A | Due to the special nature of autonomous ships, is it possible to recommend that VTS authorities be required to classify autonomous ships as mandatory reporting categories? |
|  | DEGREE FOUR | A | Due to the special nature of autonomous ships, is it possible to recommend that VTS authorities be required to classify autonomous ships as mandatory reporting categories? |
| 3.1.4 Vessels at Anchor | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | Communication requirements: should be categorised by the degree of autonomous. |
|  | DEGREE FOUR | A | Communication requirements: should be categorised by the degree of autonomous. |
| 3.1.5 Vessels at Berth | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | Since the lack of presence of seafarers on board, how to establish communication between VTS personnel and MASS needs to be clarified in the next stage. (Whether it can be in the mode of data information, or in the manual call of remote operation station, etc.) |
|  | DEGREE FOUR | A | Since the lack of presence of seafarers on board, how to establish communication between VTS personnel and MASS needs to be clarified in the next stage. (Whether it can be in the mode of data information, or in the manual call of remote operation station, etc.) |
| 3.1.6 Vessels Departing the VTS Area | DEGREE ONE | B | it is not necessary to amend this article, because the detailed reporting information can be issued by local authorities. |
|  | DEGREE TWO | B | it is not necessary to amend this article, because the detailed reporting information can be issued by local authorities. |
|  | DEGREE THREE | B | it is not necessary to amend this article, because the detailed reporting information can be issued by local authorities. |
|  | DEGREE FOUR | B | it is not necessary to amend this article, because the detailed reporting information can be issued by local authorities. |
| 3.1.7 Transition between Adjacent VTS Areas | DEGREE ONE | B | it is not necessary to amend this article, because the detailed reporting information can be issued by local authorities. |
|  | DEGREE TWO | B | it is not necessary to amend this article, because the detailed reporting information can be issued by local authorities. |
|  | DEGREE THREE | B | it is not necessary to amend this article, because the detailed reporting information can be issued by local authorities. |
|  | DEGREE FOUR | B | it is not necessary to amend this article, because the detailed reporting information can be issued by local authorities. |
| 3.1.8 Adverse Environmental Conditions | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | The important factor is how to deliver the adverse environmental information and requirements from VTS to ships or remote operation office. |
|  | DEGREE FOUR | A | the important factor is how to deliver the adverse environmental information and requirements from VTS to ships or remote operation office. |
| 3.2.1 Collision, Capsize, Sinking, Grounding, Fire On Vessel, Man Overboard | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | "Promulgate information concerning incident to vessels in VTS area; restrict traffic in the area;" how to let MASS get the broadcast safety information and keep up to latest incident information should be considered. |
|  | DEGREE FOUR | A | "Promulgate information concerning incident to vessels in VTS area; Restrict traffic in the area;" how to let MASS get the broadcast safety information and keep up to latest incident information should be considered. |
| 3.2.2 Pollution | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | "Promulgate information concerning incident to vessels in VTS area; restrict traffic in the area;" how to let MASS get the broadcast safety information and keep up to latest incident information should be considered. |
|  | DEGREE FOUR | A | "Promulgate information concerning incident to vessels in VTS area; Restrict traffic in the area;" how to let MASS get the broadcast safety information and keep up to latest incident information should be considered. |
| 3.2.3 Places of Refuge | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B |  |
|  | DEGREE FOUR | B |  |
| 3.2.4 Medical Emergency | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B |  |
|  | DEGREE FOUR | B |  |
| 3.2.5 Vessel Not Under Command (NUC) | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | two aspects should be considered, first, deliver the NUC of other ships to degree 3&4, secondly, the process of NUC of MASS 3&4 in VTS area. |
|  | DEGREE FOUR | A | two aspects should be considered, first, deliver the NUC of other ships to degree 3&4, secondly, the process of NUC of MASS 3&4 in VTS area. |
| 3.2.6 Security Incident | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | It can be rectified after the ISPS code amended by the IMO. |
|  | DEGREE FOUR | A | It can be rectified after the ISPS code amended by the IMO. |
| 3.2.7 Protest Action | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | B |  |
|  | DEGREE FOUR | B |  |
| 3.2.8 Natural Disaster | DEGREE ONE | B |  |
|  | DEGREE TWO | B |  |
|  | DEGREE THREE | A | Promulgate information to vessels in the VTS area, how to deliver the information to MASS, how to restrict the movement of MASS when necessary. |
|  | DEGREE FOUR | A | Promulgate information to vessels in the VTS area, how to deliver the information to MASS, how to restrict the movement of MASS when necessary. |

1. Step 2 analysis outcome of addressing methods
2. G1141 ADDRESSING METHODS ANALYSIS

|  |  |  |  |
| --- | --- | --- | --- |
| G1141 VTS OPERATIONAL PROCEDURES FOR VTS | | | |
| **Degree of autonomy** | **Most appropriate way of addressing MASS implications** | **Reasons** | **Themes/ potential gaps that require addressing** |
| DEGREE ONE | I | MASS of degree one is considered as a conventional ship with some additional functions to support human decision making. For MASS of degree one, crew onboard will still be responsible for ship operation including decision making, and should interact with VTS authority following VTS operation procedures (e.g. to provide information, report, intention, request permission). Hence, it is not necessary to amend in the degree one. | None. |
| DEGREE TWO | II, III | 1. if Seafarers onboard are assumed to be able to fulfil all the operation and control requirements, the situation with degree two is similar to the degree one; .  2. if the vessel totally is operated by remote operators, the seafarers onboard just provide some maintenance work, some gaps (i.e. the communicating method between remote operators and VTS personnel) need to be addressed. Item 3.1 Routing procedures and Item 3.2 Emergency procedures requires amendments. Communicating method should be considered to accommodate functions of remote control. | 1. The requirements of MASS report, including routine and emergency information 2. The emergency procedures suitable for MASS. 3. Communication between remote control station and VTS. |
| DEGREE THREE | II, III | 1.For degree three MASS, there are quite a few potential gaps identified involving many articles. Some require amendments to current provisions (item 3.1), whilst others require the reconstruction of provisions (item 3.2). With no seafarers onboard, it will be a revolutionary change for the routing procedures and emergency response procedures. On the one hand, how to transfer traffic control information, on the other hand, how VTS plays a role in the emergency response process. Hence some documents require reconstruction. Moreover, new guidelines will also need to be developed. It is suggested that the competent authority should establish emergency procedures between VTS personnel and remote operation stations or fully autonomous vessels. 2.VTS equipment is needed to meet the requirement of the development of future MASS technology | 1. VTS emergency procedures (alerts transfer, alerts categories, alerts identification); 2. Ship reporting requirements and reporting method; 3. Information transfer/ship shore communication; 4.VTS equipment. |
| DEGREE FOUR | II, III | 1.For degree three MASS, there are quite a few potential gaps identified involving many articles. Some require amendments to current provisions (item 3.1), whilst others require the reconstruction of provisions (item 3.2). With no seafarers onboard, it will be a revolutionary change for the routing procedures and emergency response procedures. On the one hand, how to transfer traffic control information, on the other hand, how VTS plays a role in the emergency response process. Hence some articles require reconstruction. Moreover, new guidelines will also need to be developed. It is suggested that the competent authority should establish emergency procedures between VTS personnel and remote operation stations or fully autonomous vessels. 2.VTS equipment is needed to meet the requirement of the development of future MASS technology | 1. VTS emergency procedures (alerts transfer, alerts categories, alerts identification); 2. Ship reporting requirements and reporting method; 3. Information transfer/ship shore communication; 4.VTS equipment. |

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-1)
2. Leave open if uncertain [↑](#footnote-ref-2)