

Input paper for the following Committee(s): check as appropriate

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## Analysis of the Impact of Digital Route Exchange within VTS Operations

### 1 SUMMARY

The 78th Session of the IALA Council listed "Develop guidance for digital route exchange within VTS operations" as the "VTS COMMITTEE TASK REGISTER FOR 2023 – 2027" with task 1.2.1. Several e-navigation projects have studied exchange of digital route plans. Its positive effects, namely increased safety, reduced administrative burden, more efficient operations, combined with reduced environmental impact, have been validated. However, the implementation of digital route exchange in VTS waters also has certain technical and regulatory challenges, which will have a certain impact on existing VTS operational procedures, functional and performance requirements of the VTS system, functional positioning, staffing and training.

#### 1.1 Purpose of the document

The purpose of this document is to systematically analyze the impact of digital route exchange on VTS and provide reference for VTS Committee to complete the task 1.2.1.

#### 1.2 Related documents

VTS COMMITTEE TASK REGISTER FOR 2023 – 2027

### 2 BACKGROUND

Exchange of real-time information is a key facilitator for improving situational awareness, which can enhance navigational safety, optimize capacity utilization, and guarantee just-in-time operations. By knowing the ship's sailing plan in advance, it also provides opportunities for shore-based personnel such as VTS operators to enhance information service and traffic organization capability.

Relevant international organizations such as the IMO, IEC and IHO attach great importance to the development of digital route exchange. With the implementation of e-navigation and S-100 standards, research and pilot projects related to digital route exchange have achieved great results:

- As part of the outcomes from the EU-funded MONALISA (2010-2013) and MONALISA 2.0 (2013-2015) projects, an industry standard for a route plan exchange format was developed. The route plan exchange format (RTZ) was standardized by the IEC and included in the IEC 61174 ed.4 standard.
- After refinement and validation of the interface in the project, the IEC initiated the development of a new standard IEC 63173-2: Secure communication between ship and shore (SECOM). The standard describes how the exchange of, e.g., route plans should be done, and was published in 2022.

<sup>1</sup>Input document number, to be assigned by the Committee Secretary

<sup>2</sup>Leave open if uncertain

- Technical standards for digital route exchange are being developed by the IEC and that the IHO has declared 2020-2030 "the S-100 Implementation Decade".
- IHO and IEC have declared the period from 2020 to 2030 as the "S-100 Implementation Decade," with technical specifications for digital route exchange currently under development.
- Amendments to ECDIS Performance Standard MSC.232(82), which enables exchange of route plans by ships, was approved at MSC 105 (April 2022).
- IMO renamed the ECDIS performance standards to MSC.530 (106) during MSC 106 (November 2022) and incorporated digital route exchange into the ECDIS performance standards, adding it to the NCSR biennial agenda for 2022-2023.

The standard IEC 63173-1: Maritime navigation and radio communication equipment and systems - Data Interface - Part 1: S-421 Route Plan Based on the S-100, is being developed by the IEC. Based on ship-to-ship, ship-to-shore, and shore-to-shore digital ship route exchange, the application cases have been organized as follows:

1. Route cross check: Ship sends route for check by shore, for example by VTS.
2. Flow management: Shore, for example VTS, organize the schedules of ships for fluent sailing.
3. Enhanced monitoring: Shore monitor sailing of the ship against the route plan.
4. Ice navigation: Traffic management for ice covered areas provide routes for ships.
5. Under keel clearance management: This operates together with S-129.
6. Fleet route planning: A tool for ship owner to manage fleet.
7. Chart management: Chart seller provide charts based on the route plan.
8. Route optimization: Ship uses 3rd party service to optimize route plan.
9. Port call synchronization: Ship participate in port call optimization or just in time arrival scheme.
10. Reference route: Shore provide reference route to sail for example from a pilot point to port.
11. Search and rescue: MRCC instruct ships about SAR sailing patterns.

### 3 DISCUSSION

For VTS, the scenarios of digital route exchange include: ship route exchange between a VTS center and ships/other VTS centers/ports, approval of ship route plans, VTS-to-ship route optimization suggestions (including point-to-point traffic flow management, point-to-point route recommendations), ship-to-VTS navigation plan updates, and improved scheduling of arrivals and departures (improved berth management).

#### 3.1 Impact of the Implementation of Digital Route Exchange on VTS

The impact of implementing digital route exchange on VTS includes, but is not limited to, the following:

- Impact on VTS Operational Procedures
  - Gathering and recording of ship dynamic information.
  - Watch handover of present/expected/developing traffic situation, incidents and special operations (e.g., SAR or military operations).
  - Handover of vessel dynamic information between adjacent VTS areas.
  - Dealing with new emergency situations, such as loss of external/internal communication.
  - Interaction with Allied Services, such as pilots, tug operators.
  - Providing timely and relevant information: position, intention and movements of ships.
  - Monitoring and managing ship traffic to ensure the safety and efficiency of ship movements: planning ship movements in advance, organizing ships under way, and providing route advice.
  - Responding to developing unsafe situations.

- Impact on Functional and Performance Requirements of the core VTS System
  - Improving data access capability: In order to support route approval or route advice, supporting data such as port berthing schedule, pilotage operation schedule, tug scheduling information and hydro-meteorological information should be accessed.
  - Improving the information processing capability: It is necessary to realize the real-time transmission, reception, updating, recording and playback of relevant information.
  - Improving decision support capability: Improving decision support and data visualization capabilities, and carrying out intelligent route-deviation warning, dangerous encounter alerts, congested water forecasting, inbound and outbound traffic organization optimization, route optimization suggestions, and other applications.
  - Enhancing data display requirements: Promoting the use of S-100 ECDIS to enable on-duty personnel to easily obtain large-scale, real-time and comprehensive information.
  - Improving the compatibility of existing systems with new technologies: accelerating the implementation of maritime services through the successful practice of data exchange to enhance the translation of E-navigation results to facilitate the development of MASS.
  - Upgrading the system's requirements for network security: improving the level of network security protection against external malicious intrusion, data theft and data tampering.
- Impact on VTS functional positioning
  - Strengthening VTS information service: After the implementation of digital route exchange, VTS will be deeply involved in port berthing planning, tug dispatch and pilotage arrangements, acting as STM Shore Centre.
  - Strengthening VTS traffic organization service: Through the review and approval of route plans, the perception of ship traffic flow situation can be improved, and the whole process management of traffic flow in the VTS area can be strengthened.
  - Expanding the effective coverage of VTS area: Through the digital route exchange of ship-to-VTS and VTS-to-VTS, the dynamic sensing waters of VTS can be greatly expanded, and the efficient coordination between adjacent VTS centers can be promoted.
- Impact on VTS staffing and training standards
  - Impact on the employment conditions of VTS personnel: VTS personnel need to strengthen corresponding theoretical and practical training to effectively receive, understand and use large-scale real-time information.
  - Impact on VTS post allocation: In order not to interfere with the performance of traditional VTS duties, in some waters with high navigation density or complex navigational environment, it may be necessary to have a full-time VTS information officer responsible for data reception, processing and interaction, and undertaking functions such as route approval or route recommendation.

### 3.2 Challenges of Implementing Digital Route Exchange in VTS Areas

Although the IMO and IALA have formulated a series of documents to standardize and coordinate the construction and operation of VTS, there are still great differences in the current functional positioning and management mode of VTS. Considering the differences in navigational environment and infrastructure in different waters, the promotion of digital route exchange in the VTS region may face the following challenges:

- The suitability of a route exchange in a particular water area needs to be further verified. "*Sea Traffic Management Validation Project Final Report*" pointed out that in areas with dense and regulated traffic and less room for strategic navigation, the value of the available STM services in improving traffic safety could not be directly demonstrated, while most port-type VTS have set up ships' routing systems but also have dense traffic zones.
- The technical risks of route exchange need to be further evaluated: The stability and load of the communication link should be fully considered. The communication links designed by STM are VDES and AIS, which are actually only verified with AIS. Due to problems such as high navigation density and

base station layout, AIS base stations are overloaded in some VTS waters, which may cause information transmission failure or delay.

- The navigational risks associated with route exchange need to be further assessed: Route exchange could be an efficient means of communication, as visuals may be more easily understood than words. However, when dealing with such information, it is difficult for navigators to keep a lookout at the same time, which may lead to navigational risks.
- The workload of VTS personnel needs to be further evaluated: It will bring a large workload to VTS operators or supervisors to receive, control, approve or reject the planned route in waters with high traffic density or complex traffic situation, which may affect the normal duty.
- There may be legal challenges for functions such as route plan approval and adjustment of berthing plans: In terms of legality, route plan approval is essentially an administrative approval that requires the authorization of the competent authority; In terms of fairness, the optimization and adjustment of berthing plan will improve the overall navigational efficiency, but it might result in decreased efficiency for certain vessels and could lead to economic disputes.
- The impact of new emergencies will need to be further assessed: Due to bad weather and sea conditions such as poor visibility and strong wind, a large number of navigation plan changes are difficult to deal with in a short time, which may lead to the delay of ship plans or affect the navigation order. The failure of the route exchange system (including the failure of the communication link, etc.) may cause the ship plan not to be loaded, approved and displayed in a timely manner, resulting in the delay of the ship plan.

### 3.3 Recommendations for the Implementation of Digital Route Exchanges in VTS Area

Based on the above analysis, it is recommended that when implementing digital route exchanges in VTS areas, it should:

- Undertake a systematic assessment of suitability, risks and challenges, taking into account the relevant information in 3.1 and 3.2
- Set two levels of the route exchange as Voluntary or Unsupported based on the evaluation results, and publish it in the VTS User Guide.
- Improve VTS operating procedures, strengthen personnel training, and set up full-time information officers when necessary, before confirming the implementation of route exchange.

## 4 REFERENCES

*MSC 104-15-7 - Proposal for a new output to amend the revised ECDIS performance standards (Submitted by Austria, Belgium, Bulgaria, etc)*

*Sea Traffic Management Validation Project Final Report*

*Report of the maritime safety committee on its 106th session, paragraph 16.49*

*NCSR 10-9 - Proposal to amend ECDIS performance standards to facilitate a standardized digital exchange... (Austria, Belgium, Bulgaria, etc)*

*NCSR 10-WP.1-Rev.1 - Draft Report To The Maritime Safety Committee (Secretariat)*

## 5 ACTION REQUESTED OF THE COMMITTEE

The Committee is invited to consider the proposals in 3.3 when developing guidance for digital route exchange within VTS operations.