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| IALA Guideline |

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Guideline on VTS Digital Communications – updated on VTS57

For VTS58

* Finalise the paper
* Use Cases [Topical Matters]
* Mention the separation between GL and Annex

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# INTRODUCTION

Effective communication is an essential component for operations in the maritime domain and is achieved when the intended meaning of the sender and the perceived meaning of the receiver is the same.

If a vessel intends to use MS-1 services, it must be capable of receiving these and must subscribe to the services. The vessel is responsible for managing its subscriptions to and unsubscriptions from the services. Vessel Traffic Service (VTS) should ensure that VTS personnel are aware of which vessels have received information digitally, eliminating the need for duplication via VHF. If a vessel has not received the information digitally, the VTS personnel are responsible for providing it via VHF voice communication in the conventional manner.

Modern technologies have improved communication through digital means. Compared to traditional voice communication, digital communication offers several advantages, including speed, efficiency, and reduced risk of misunderstandings. It can be used both with human involvement and in automated processes without human intervention.

Providing digital communication in a globally harmonized way necessitates a common understanding of the operational procedures and standardised technical services.

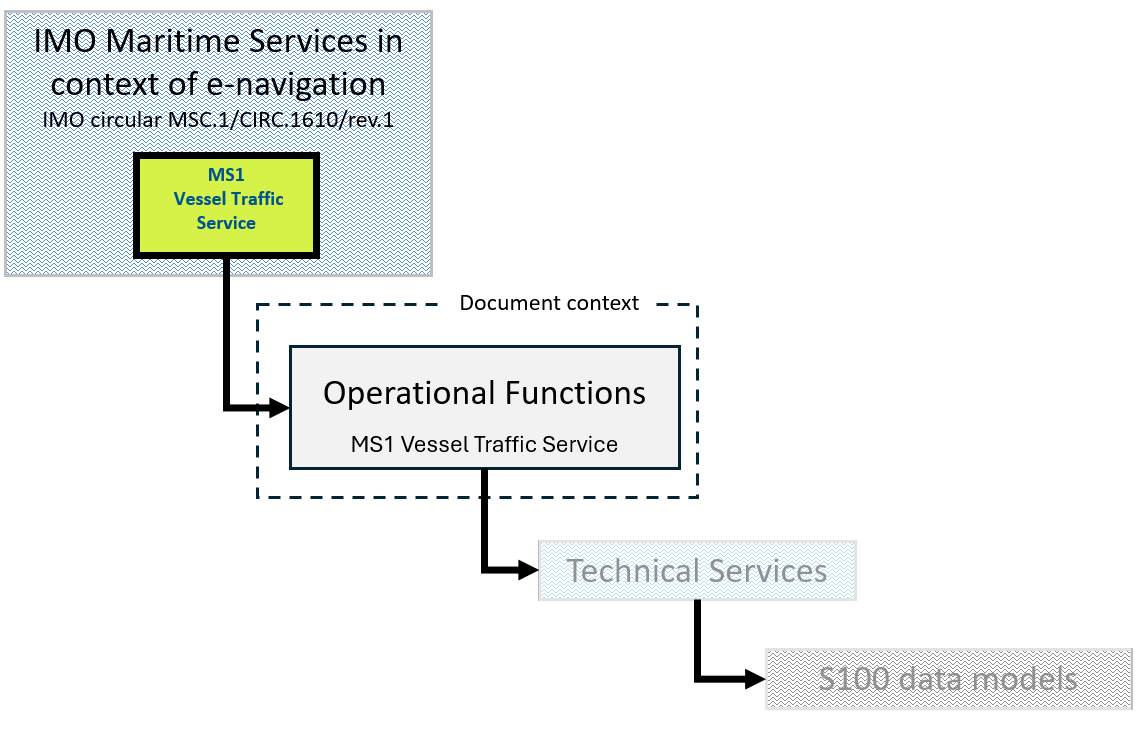


Figure 1 Illustration of different levels of services and functions in relation to the document context

This guideline describes the operational procedures and functions which are specific to Vessel Traffic Service (VTS) as defined in Maritime Service 1 (MS 1) “Description of maritime services in the context of e-navigation (IMO circular MSC.1/CIRC.1610/rev.1). This guideline does not describe the services which might be used by the VTS but belong under the responsibility of other international bodies.

In the following documents essential principles for the safe and efficient digital communication are mentioned and are used as a base for this Guideline:

* IMO Resolution *A.1158(32) Guidelines for vessel traffic services* states:

*“Effective harmonized data exchange and information-sharing is fundamental to the overall operational efficiency and safety. VTS providers are encouraged to make use of automated reporting where possible.”*

* IMO circular *MSC.1/Circ 1595 E-navigation strategy implementation plan – update 1* states:

“As shipping moves into the digital world, e-navigation is expected to provide digital information and infrastructure for the benefit of maritime safety, security and protection of the marine environment, reducing the administrative burden and increasing the efficiency of maritime trade and transport.”

and that of the prioritized e-navigation solutions is:

*“improved communication of VTS Service Portfolio (not limited to VTS stations).”*

* IMO circular MSC.1/CIRC.1610/rev.1 *Descriptions of maritime services in the context of e-navigation* defines the purpose of MS 1 Vessel traffic Services (VTS) states:

*“The purpose of this digital Maritime Service is to support the provision of VTS to participating ships by providing information in a digital format. Information could be presented in appropriate systems on board and ashore in order to create the means to reduce the administrative burden and information overload, reduce miscommunication due to external interference, simplify work procedures, promote sustainable shipping and increase navigational safety*.”

# DOCUMENT PURPOSE

The purpose of this guideline is to define digital communication services from VTS operational perspective and to harmonise digital VTS communications through standard operational procedures and technical services.

The technical services used to deliver digital information to vessels are still under development, the operational requirements described in this document should be used for further development of these technical services. This document includes Annex of VTS digital functions with use cases that should be used as a base for further development.

The Annex “Use Cases for VTS Digital Communications” is a living document due to fast pace of the digitalisation evolving as new technologies emerge, thus supporting the continuous improvement of VTS operational procedures. Operational functions are under development and the elaborated use cases are added to the Annex in the future.

# DOCUMENT STRUCTURE

This document consists of three parts:

* Part A sets out the general principles for digital communications including current technologies used to exchange VTS information
* Part B provides guidance VTS Digital Communication Functions
* Annex provides operational elaborated use cases of VTS Digital Communication Functions

# PART a general principles of vts digital communications

## Managing a mix of voice communication, digital communications, and automated data exchange

The digitalisation of information will diversify the communication means between shore authorities and vessels and will affect VTS procedures regarding exchange of information. While VTS interaction with vessels has traditionally almost exclusively been via VHF voice communications it is expected that digital communications will largely be replaced VHF voice in the future.

VTS has to manage the mix of voice communication, digital communication, and automated data exchange according to current regulations and legislation. VTS has to be made aware of vessel´s digital communication capabilities.

The voice communication focuses on utilizing digital technology for data transmission, while digital data communication encompasses a wider range of methods for exchanging digital information across different platforms.

In addition to voice communications VTS can provide information in a digital format. The use of digital communication could reduce workload by automating repetitive tasks, which could lead to reduction of the VHF traffic, communication barrier and the risk of misunderstandings. Digital communications also have the opportunity to disseminate information as well as consolidate and process the information for better decision support.

Messages can be conveyed to an individual vessel or all vessels. This not only includes person-to-person but also person-to-machine, machine-to-machine and machine-to-person. The change of communication and interaction to digital can also in many situations utilise automated processes.

The introduction of digital communication marks a dualistic operational phase for VTS. The gradual advent of technical services results in potential increase in VTS workload, as the same tasks must be executed using both the new and old methods side by side. Over time digital communication holds the potential to reduce workload by automating repetitive tasks and voice communication.

Voice communications can be also used in addition to digital communications for urgent and time critical messages.

### Information originating from sources outside of VTS

When transitioning to digital communications some of the information provided to vessels today by VTS may be provided directly to vessels from other sources. This can include for example hydrographic and environmental information, information on AtoN’s and Maritime Safety Information (MSI).

### Cyber security

From the VTS point of view the digital data exchange is secure (GL1182) unless the system indicates the data quality is insufficient due to reduced cyber security level. The VTS personnel will revert to voice communication and the conventional way of working. For cases in which cyber security is impaired and not system detectable, VTS personnel should receive training how such cases might be observed and detected.

### Technical failures

In case the digital communication service suffers a technical failure, it is VTS´s responsibility to have alternative procedure in place. One option is to revert to the conventional way of working with voice communication. It is possible that the VTS operators will not be able to revert to the conventional way of working serving the amount of traffic at hand. The other possible option is to have technical requirements to have a redundant digital communication system or a back-up system.

### Human Machine Interface (HMI) Aspects

Digital communication has the potential to streamline the VTS operations for a VTS center. It depends however highly on the specific implementation in the VTS system to which level an individual VTS operator is supported in his task. From a system architecture perspective and system acquisition perspective it might seem a logical solution to have digital communication functionality added as a separate function on the VTS operator working position. The real benefit of digital communication however will only be achieved with an HMI solution which supports the task of the operator optimally with an integrated HMI solution. Especially for VTS centers where the workload of the VTS operators forms a bottleneck in the operation, the HMI design is vital to assure the workload reduces when applying digital communication rather than increases.

## DElivery of the information

The added benefit of digital communication is having the information in standardised structure, ensuring that the same information is available to all actors when required and designed in a way to minimise misinterpretations and to provide common situational awareness. This includes machine-to-machine communications between VTS, vessels and other external sources.

Digital communications should have the same communication procedures as the voice communications. Digital communication should be processed according to IALA GL1132 VTS Voice Communications and Phraseology where applicable.

To achieve closed-loop communication in digital communications different types of responses should be implemented such as:

* Delivered: system acknowledges message reception
* Received: human operator acknowledges message reception
* Approved: human operator approves the content of the message

**4.3 Technical infrastructure**

Digital communications require technical solutions that are different and more complex than technical infrastructure needed for traditional communication methods like VHF voice. Technical infrastructure for digital communications consists of various technical building blocks but also immaterial assets like specifications, data models and harmonized ways to manage technical services and underlying platforms. Figure 2 shows a simplified view of technical services related to VTS digital communications.

Kuva, joka sisältää kohteen kuvakaappaus, teksti, muotoilu

Tekoälyn generoima sisältö voi olla virheellistä.

Figure 2 High level view on the Digital Delivery of VTS Information

The digital communication for VTS should reach beyond single VTS area or be ideally even globally accessible. The technical services that implement digital communications for VTS should be standardized, secure and robust as described in section 4.1. All these can be achieved by establishing technical infrastructure according to Service Oriented Architecture (SOA) principles. The implementation of VTS digital communications requires at least following building blocks:

1. Harmonized way to describe technical services and link them to relevant data models according to IMO resolution MSC.467(101) “Guidance on the definition and harmonization of the format and structure of maritime services in the context of e-navigation’”

2. Unified and global data models that are compliant with IMO’s Common Maritime Data Structure (CMDS)

3. Global and unique identifiers for data and any maritime resource using MRNs

4. Service platform supporting maritime SOA architecture and service provision

5. Data exchange infrastructure to facilitate the real-time and cyber secure data exchange using standardized data transport mechanisms

IALA and other maritime organisations have developed extensive guidance to support implementation of these requirements in harmonized way. The most relevant guidelines and standards for the building blocks mentioned above are as follows:

1. IALA Guideline G1128 The Specification of e-Navigation Technical Services

2. IHO S-100 Universal Hydrographic Data Model and IALA Guidelines G1088 Introduction to Preparing S-100 Product Specifications and G1106 Producing an IALA S100 Product Specification

3. IALA Guideline G1143 Unique Identifiers for Maritime Resources

4. IALA Guidelines G1157 Web Service Based S-100 Data Exchange and G1161 Evaluation of Platforms for the Provision of Maritime Services in the Context of e-Navigation

5. The data exchange itself can be implemented using various industrial standards. The most relevant in the context of VTS digital communications are SECOM (IEC 63173-2), MMS (RTCM standard 13900.0 for Maritime Messaging Service Architecture and Protocol) and VDES VDE (IALA Recommendation R1007 The VHF Data Exchange System (VDES) For Shore Infrastructure)

# Part B VTS DIGITAL services

This paragraph will describe the operational descriptions for potential services identified in the domain of Maritime Services in the context of e-Navigation. The operational functions are not limited, if needed further they can be added.

The description for Maritime Service for VTS lists several different potential operational functions associated with this Maritime Service. These operational functions can be divided into VTS-specific services and services developed within other Maritime Services. This guideline only focuses on the VTS specific operational functions under the remit of IALA; MS 1 VTS. Development of technical services is out of scope of this guideline. Operational functions are divided in services. These services are worked out in use cases that can be found in the Annex.

Kuva, joka sisältää kohteen teksti, kuvakaappaus, ohjelmisto, Tietokonekuvake

Tekoälyn generoima sisältö voi olla virheellistä.

Figure 3 Detailed illustration of different levels of services in relation to the document context

Technical services are needed to coordinate a seamless combination between different product specifications. Information provided using S-100 based product specifications is brought together by technical services to deliver a Maritime Service. IALA G1128 gives guidance on how to make specifications of e-Navigation Technical Services. A Maritime Service can be implemented by one or more e-Navigation Technical Services and one technical service can implement multiple operational functions.

## Publishing information on VTS digital services

The number of digital services can variate between Vessel Traffic Services. Information on the available digital services from each VTS should be available to the mariners. VTS digital services should also be supported by on-board navigation systems.

## VTS Specific operational Services

Kuva, joka sisältää kohteen teksti, kuvakaappaus, ohjelmisto, Verkkosivusto

Tekoälyn generoima sisältö voi olla virheellistä.

Figure 4 Presentation of different services in relation to vessel´s voyage

Currently identified VTS specific Operational functions are:

### ROUTE FUNCTIONS

#### Route Exchange Service

The route and schedule (The current format, IHO S-421, used for route exchange also containing schedule information) is a key element of the vessel's voyage and can be used to optimise safety and processes, as well as for the interaction of participants and stakeholders. The exchange of routes between vessel to vessel and vessel to shore may improve: situational awareness for the purpose to facilitate;

* + reduced number of accidents and incidents (proactively de-conflicting situations when intentions are known and shared);
  + optimised resource utilisation by knowing the intentions of other actors;
  + secured passages by knowing the intentions of other actors;
  + predictability of arrivals and departures by early information sharing enabling better planning for involved actors leading to reduced idle time for resources;
  + Just-In-Time operations by enabling stakeholders and service providers to be efficiently organized for handling vessel movements, port resources, and hinterland connections.
    - VTS reporting of arrival/departure times and the specific route in the VTS area.
    - One of the core means for future MASS and other highly automated vessels to communicate intentions and creating its voyage plan,
    - Contributor of berth to berth navigation and JIT operations.

It its envisioned that a large number of proposed services within not only the VTS domain will need, use, compute, communicate route and schedule information such as Weather routing, Pilot Routes/passage plans, Ice navigation services, Fleet management, Remote operations, Reporting, Coastal surveillance and other use cases.

#### Route Reference Service

With the Route Reference Service VTS and other service providers offer predefined routes and waypoints, in electronic format. Route Reference Service is designed to assist mariners in their voyage planning to define the suitable route on commonly used passages, such as shipping lanes, approaches to ports, and coastal routes.

#### Route Crosscheck service

The purpose of Route Crosscheck Service is to validate a planned or monitored route from the vessel and compare the information with expertise of the VTSO and its information regarding the specific VTS area (traffic separation, depth, speed restriction, etc). When the VTS receives a route from a vessel the VTS should be able to execute a Route cross check. The cross-checking may be done before the vessel’s departure or before arrival at a certain geographical area (for example a VTS area). The cross-check may include Under Keel Clearance, air draft, no violation of no-go areas, Maritime Safety Information and compliance with mandatory routing.

#### Route Monitoring Service

The Route Monitoring Service is used to monitor vessels that stay within the planned schedule and corridor as defined in the route plan. Within this service the VTS may detect vessel´s deviating from their routes or schedules, allowing the VTS operator to intervene promptly in case of potential safety hazards and navigational issues.

### VTS INFORMATION FUNCTIONS

The VTS Reporting service is designed for vessels to report information to the VTS as specified by th**e** VTS. This includes an arrival/departure report, position report and specific information about the vessel which affects ships traffic.

#### Voyage Plan Information Service

A Voyage Plan Information Service is designed to assist vessel operators and mariners in planning and executing voyages safely and efficiently. Within this service the VTS provides comprehensive information to help vessels navigate from berth to berth while considering various factors and potential hazards. The primary purpose is to enhance navigation safety, optimise route planning, and ensure compliance with regulations. This information may include local port information, regulations, restrictions, reporting requirements, fairway information, and VTS area.

#### VTS Information Service

The primary aim of a VTS Information Service is to contribute to the safe navigation of vessels within or outside the VTS area, delivering specific information on navigational situations. This information may include, information on uncharted obstacles, pilot information, general operations, traffic information etc. VTS Information Service may also contain unstructured and structured information. All messages must start with message marker.

Before implementation VTS providers should define which information will be provided via VTS Information Service based on for example risk assessment.

Message may include:

Geometry

Time

Form (eg questions that require structured answer)

Free text

### TRAFFIC FUNCTIONS

#### Traffic Image Service

A Traffic Image Service is designed to share the real-time traffic image between VTS and vessels, providing a vessel with its traffic image and/or receive the traffic image from the vessels in the VTS area for example AIS, radar or CCTV data, to create a shared traffic image within the VTS area.

#### Intended Track Exchange Service

Intended Track Exchange Service is primarily designed for vessels to exchange the track. Vessels can share their actual track and navigational intentions with other vessels and with the VTS for promoting safety by allowing better situational awareness and collision avoidance. This will aid vessels in track planning and decision-making to avoid potential conflicts. Within this service the VTS receives and reviews intended tracks from vessels operating in the VTS-area, allowing the VTS operator to intervene promptly in case of potential safety hazards and navigational issues.

#### Navigation Assistance Service

The Navigation Assistance Service supports the VTS to inform vessels about developing traffic situations, and any other information which requires immediate awareness of the addressed vessel(s). It requires timely delivery and response of information, advice, warnings or instructions allowing vessels to be aware of situation and/or take action to assure safe navigation. It can include both communicating to a single vessel or broadcast messaging to a group of vessels within VTS-area. Due to its navigational safety character of this service, it requires timely and guaranteed message delivery.

### Planning functions

#### Traffic Clearance Service

Traffic clearance refers to the process of ensuring that there is sufficient space and time for vessels to navigate safely through an area, taking into account other vessels, obstructions, regulatory and environmental factors. The Traffic Clearance Service provides vessels with permission to proceed, impose conditions or deny clearance and or assists vessels into anchorage positions. Within this service the VTS coordinates, authorizes, and monitors the approach and passage of vessels through the areas.

#### Slot Management Service

The Slot Management Services is designed to provide time slots for vessels in advance, ensuring safe, efficient, and organised movement within the VTS area. Time slot includes scheduling and allocation for vessel within VTS-area. The service includes assigning specific time slots for vessels' arrival, departure, or transit. The time slot may be based on weather conditions (eg. tide, fog), port/area resources (eg. berth, anchorage), traffic density, infrastructure (eg. bridge, lock) or etc. This integrated approach enables the VTS to manage traffic flow while maintaining safety and operational efficiency.

# DEFINITIONS

The definitions of terms used in this Guideline can be found in the *International Dictionary of Marine Aids to Navigation* (IALA dictionary) at <http://www.iala-aism.org/wiki/dictionary> and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

# abbreviations

This section should be typed with the **Abbreviations** style. The acronym or initialism is typed and then tab is pressed so that the style inserts the appropriate tabs and paragraph spacings e.g.:

NGO Non-governmental organization

VTS Vessel Traffic Services

The list should be typed in alphabetical order. The text automatically aligns as an indented paragraph until carriage return is hit and then the next term can be entered.

# references

References are sources directly referred to in the running text and should be given a sequential number, starting at 1. The reference number should be included as close to the referenced text as possible and included as a number within square brackets.

The reference should be listed in the References section in the following syntax using the **Reference** **list** style:

[Author surname,] <space> [initial.] <space> [year] <space> [title.]

For example:

“Hawking also suggests ways that quantum mechanics can be combined with the theory of special relativity [1]. This text builds on his discussion of the instability of black holes described in *A Brief History of Time* [2].”

should be included in the reference list as follows:

1. Hawking, S. (2001) The Universe in a Nutshell.
2. Hawking, S. (1988) A Brief History of Time.

The **Reference list** style will add a number for the reference as soon as you start typing the text and the paragraph will automatically align with the first line of text. Press return to enter a new reference in the list.

# Further reading

Any texts that are recommended to the reader without direct reference in the text should be listed within this section using the same syntax as the reference list. Sources should be listed using the **Further reading** style.

1. Einstein, A. (1905) Relativity: The Special and General Theory of Relativity
2. Idle, E. (1984) The Galaxy Song

# Index

**No index entries found.**

1. BLA BLA BLA II

~~The following use cases are examples to provide input for the development of technical service specifications (WG2).~~

~~General descriptions on exchange of routes in the S-421 format in described in the Annex of S-421 description in detail.   
  
The below Use Cases include examples of data needed, consult document~~ *~~VTS51-9.1.6.1 - Appendix 1, MS 1 - 3, Information requirements~~* ~~for further possible datasets needed.~~