Document Revisions

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DRAFT Guideline on User Requirements for VDES

# Introduction

## Purpose of the document

This document provides the user requirements for the development of the VHF Data Exchange System (VDES). It is a primary input to the technical development of the primary specification of the VDES and provides criteria against which the system will be evaluated.

This document is intended to assist in the development and promotion of the VDES.

## Overview

AIS is well recognized and accepted as an important tool for safety of navigation and is a carriage requirement for SOLAS vessels (Class-A). However, because of its effective and useful technology, the use of AIS is expanded to vessels not subject to the SOLAS carriage requirement, and to completely different applications. This expanding use of AIS technology has caused significant increase in VHF Data Link (AIS VDL) loading which has become an active concern in IMO and ITU, and it is considered necessary to urgently allocate new frequencies for new and emerging applications in order to mitigate overloading of AIS VDL.

Simultaneously, because of increasing demand on radio spectrum for digital communication such as mobile phone and data, ITU now requests more efficient and effective use of radio spectrum.

The VHF Data Exchange System (VDES) is seen as an effective and efficient use of radio spectrum, building on the capabilities of AIS and addressing the increasing requirements for data through the system. New techniques providing higher data rates than those used for AIS will become a core element of VDES. Furthermore, VDES network protocol should be optimized for data communication so that each VDES message is transmitted with a very high confidence of reception.

In this document, when communications from ship to shore are referenced, this includes ship to satellite to shore and shore to satellite to ship. It is noted that, following WRC-15, the full satellite capability of VDES is still under development and will be reviewed at WRC-19.

## Document structure

This document provides user requirements. Specifically:

* Section 1.4 contains a list of all documents referenced in this document.
* Section 1.5 contains a glossary of pertinent terms and abbreviations.
* Section 2 provides a general description of the VDES
* Section 3 identifies use cases for the VDES.
* Section 4 identifies user requirements for the VDES

## References

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## Definitions, Acronyms and Initialisms

[as per existing documentation]

# General Description

The VDES should improve the safety of life at sea, the safety and efficiency of navigation, and the protection of marine environment and enhance maritime safety and security. These goals will be achieved through efficient and effective use of maritime radiocommunications, incorporating the following functional requirements:

1. as a means of AIS;
2. as a means of radiocommunications equipment through exchange of digital data between ship and ship, ship and shore including satellite via AIS, Application Specific Messages (ASM) and VHF Data Exchange (VDE)

## System concept

The VDES concept was originally proposed to address emerging indications of overload of the VHF Data Link (VDL) of AIS and simultaneously enable a wider seamless data exchange for e-navigation, potentially supporting the modernization of GMDSS. In addition, VDES could support the increasing communications requirements identified through the development of E-Navigation, as documented in the E-Navigation Strategic Implementation Plan (SIP).

The purpose of e-navigation is to enhance berth-to-berth navigation and related services for safety and security at sea and protection of the marine environment. E-navigation seeks to enhance maritime safety through simplification and harmonization of information. In addition, e-navigation seeks to facilitate and increase efficiency of maritime trade and transport by improved information exchange.

The VDES system concept recognises the parallel work being carried out related to e-navigation maritime service portfolios (MSP). Where applicable, these MSP are referenced in this user requirements document.

Table 1 identifies the e-navigation maritime service portfolios (MSP) as defined by IMO e-navigation strategic implementation plan (SIP) (NCSR1/28/Annex 7)

Table 1 Maritime Service Portfolio, IMO e-navigation Strategic Implementation Plan

|  |  |
| --- | --- |
| MSP reference | Service |
| MSP 1 | VTS Information Service (IS); |
| MSP 2 | VTS Navigation Assistance Service (NAS) |
| MSP 3 | VTS Traffic Organization Service (TOS) |
| MSP 4 | Local Port Service (LPS) |
| MSP 5 | Maritime Safety Information (MSI) service |
| MSP 6 | pilotage service |
| MSP 7 | tugs service |
| MSP 8 | vessel shore reporting |
| MSP 9 | Telemedical Maritime Assistance Service (TMAS) |
| MSP 10 | Maritime Assistance Service (MAS) |
| MSP 11 | nautical chart service |
| MSP 12 | nautical publications service |
| MSP 13 | ice navigation service |
| MSP 14 | Meteorological information service |
| MSP 15 | real-time hydrographic and environmental information services |
| MSP 16 | Search and Rescue (SAR) Service |

The system concept, including VDES functions and frequency usage. are illustrated pictorially in Figure 1 (full system) and Figure 2 (system post WRC-15).

Figure 1 – VDES functions and frequency use – full system



Figure 2 – VDES functions and frequency use – as agreed at World Radio Conference 2015 (WRC-15)



## Concept of operations

The key concept of operation of the VDES includes:

1. The VDES shall provide a capability of data exchange between ships and shore users by terrestrial or satellite link.
2. Data exchange from the ship may occur automatically or manually.
3. Data exchange shall use the designated VHF channel(s).
4. Transmission and reception of the data shall occur with the minimum involvement of ship’s personnel.
5. The VDES includes existing AIS applications.
6. The VDES includes existing ASM
7. VDES additional capabilities include support of the VHF Data Exchange (VDE). [include reference to MSP – support MSP]
8. The VDES should support language independent communications (e.g. through the use of a digital data dictionaries[[1]](#footnote-1))
9. The VDES shall implement data integrity monitoring at the VDES link level (e.g. check sum).
10. The VDES shall have a high level of availability
11. The VDES will support machine-to-machine communications.
12. The VDES will enable clear comprehension of the information sent / received through the VDES.

The concept of operations is identified in the images below. Figure 2shows a transition approach using existing AIS units, while image Y shows a single VDES box which includes AIS, ASM and VDE.

*Figure 4 – Concept for VDES with existing AIS unit*



*Figure 5 – Concept for VDES with integrated AIS, VDE and ASM*



## [Configuration interface]

The VDES design shall include machine to machine interface to control the configuration from external systems.

## General

The VDES shall operate with the following core operational characteristics:

1. The system should give its highest priority to the automatic identification system (AIS) position reporting and safety related information.
2. The system installation should be capable of receiving and processing the digital messages and interrogating calls specified by Recommendation ITU-R M.2092.
3. The system installation should be able to operate continuously while under way, moored or at anchor.
4. The system should use, for the terrestrial links, appropriate time-division multiple access (TDMA) techniques, access schemes and data transmission methods in a synchronized manner as specified in the Annexes of Recommendation ITU-R M.2092.
5. The system should be capable of various modes of operation, including the autonomous, assigned and polled modes.
6. The system should prioritize applications and adapt parameters of the transmission (robustness or capacity) while minimizing system complexity.
7. The system should address the use cases identified in the Report ITU-R M.2371 (selection of a channel plan for a VHF data exchange system).
8. [For the VDE, the system should use IP communication protocol as defined in IEC 61162-450. Prioritization of messages should be based on the priority information included in IP packet structure]

## System architecture and construction

The VDES shall comprise:

1. antenna(s), capable of transmitting and receiving data through terrestrial and satellite link;
2. an AIS that complies with the performance standards for AIS as set out in resolution MSC.74(69) ANNEX3, [without the requirement for a built in minimum keyboard display];
3. [Include requirement for display on radar and ECDIS and integrated communications systems (ICS)]
4. a multi-function data communication and timing process that is interoperable with AIS, ASM and VDE;
5. a multi-function transmitter, capable of operating over a range of maritime frequencies for AIS, ASM and VDE
6. multi-function receivers, capable of operating over a range of maritime frequencies, simultaneously for AIS, ASM and VDE;
7. a means to automatically input data from other sources;
8. a means to automatically output data to other devices;
9. a means of ensuring the integrity of the data (e.g. link level check sum);
10. a means to automatically or manually update the device [software] as needed;
11. built in test equipment (BITE).

## Assumptions and dependencies

The VDES shall address the following assumptions and dependencies:

1. VDES shall operate within the existing AIS environment,
2. VDES shall respect and support requirements for GMDSS communications, including SAR, urgency, and safety related messages.
3. VDES units shall have unique identifiers
4. VDES shall respect and support general communications requirements.
5. The VDES shall operate in a manner that ensures there is no unnecessary repetition of messaging.
6. The VDES shall operate in a manner that:
   1. Does not prevent the operation of VHF radiotelephony
   2. Does not prevent the operation of VHF DSC
   3. Respects operational and functional requirements of AIS in support of safety of navigation
   4. Gives a higher priority to the transmission of AIS
   5. Is able to automatically schedule transmission of data by a stated level of priority;
   6. Is capable of automatically selecting the most effective operation of ‘autonomous’ or ‘controlled’ mode by reception of a message from a competent authority[[2]](#footnote-2).
   7. Is able to send an acknowledgement to a message, if required.

# Use Cases

Annex 1 of ITU-R M.2371 presents 6 high level use cases. These use cases are presented within the context of the system concept operational characteristics.

This section sets out 7 use cases, with narrative to provide context for the use case. Each use case is then supported by a number of scenario narratives which demonstrate the requirements for the system.

The use cases are cross referenced to Maritime Safety Portfolios as reference in the IMO e-navigation Strategy Implementation Plan (SIP) as noted in Table 2.

Table 2 VDES Use Cases cross-referenced to IMO SIP MSP

| Use Case | MSP Reference |
| --- | --- |
| UC-1 – SAR Communications | MSP 9 - Telemedical Maritime Assistance Service (TMAS)  MSP 16 - Search and Rescue (SAR) Service |
| UC-2 – Maritime Safety Information | MSP 5 - Maritime Safety Information (MSI) service  MSP 13 - Ice navigation service  MSP 14 - Meteorological information service  MSP 15 - Real-time hydrographic and environmental information services |
| UC-3 – Ship Reporting | MSP 8 - Vessel shore reporting  MSP 15 - Real-time hydrographic and environmental information services |
| UC-4 – Vessel Traffic Services | MSP 1 - VTS Information Service (IS)  MSP 2 - VTS Navigation Assistance Service (NAS)  MSP 3 - VTS Traffic Organization Service (TOS);  MSP 4 - Local Port Service (LPS)  MSP 6 - Pilotage service  MSP 7 - Tugs service |
| UC-5 – Charts and Publications | MSP 11 - Nautical chart service  MSP 12 - Nautical publications service  MSP 15 - Real-time hydrographic and environmental information services |
| Use Case 6 – Route Exchange (UC-6) | MSP 1 - VTS Information Service (IS)  MSP 2 - VTS Navigation Assistance Service (NAS)  MSP 3 - VTS Traffic Organization Service (TOS);  MSP 4 - Local Port Service (LPS)  MSP 5 - Maritime Safety Information (MSI) service  MSP 6 - Pilotage service  MSP 7 - Tugs service  MSP 8 - Vessel shore reporting  MSP 10 - Maritime Assistance Service (MAS)  MSP 11 - Nautical chart service  MSP 12 - Nautical publications service  MSP 13 - Ice navigation service  MSP 14 - Meteorological information service  MSP 15 - Real-time hydrographic and environmental information services  MSP 16 - Search and Rescue (SAR) Service |
| Use Case 7 – Logistics (UC-7) | MSP 7 - Tugs service |

## Use Case 1 – SAR communications (UC-1)

SAR Communications are defined in existing documentation (ref SOLAS IV, SAR 79, IAMSAR Manual, NAVTEX manual and SafetyNet manual).

VDES is a technology that supplements AIS communications, and as such may be used for data communication of Maritime Safety Information (MSI) and supplementary distress communications.

When available, the VDES satellite component (VDE-SAT) may be an effective means to extend the VDES to areas outside of coastal VHF coverage. The VDES-SAT may deliver information in a broadcast, multicast or unicast mode to a broad area, addressing many ships using only minimal radio spectrum resources. The VDE-SAT will provide a communication channel that is complementary to GMDSS and the terrestrial components of the VDES system (i.e. coordinated with terrestrial VDES, application specific messages (ASM) and AIS functionalities and their supporting systems).

As a communications medium, VDES may be used to relay shore-to-ship distress alerts and locating signals (i.e SARTs). VDES has also potential to supplement other GMDSS functional requirements which require further development through the GMDSS review process.

In this use case the mix of current communications and developing communications techniques can enhance and improve the sharing of information in prosecution of a SAR incident. This would include text in free form / standard formats; transfer of waypoints / route information[[3]](#footnote-3) for display on on-board equipment; transfer of GIS information / search patterns; images; etc.

The VDES can be used in SAR planning, execution and decision making.

### Scenario - Distress Communications – Mayday Relay (UC-1.1)

#### Narrative for Scenario:

* A distress alert is initiated.
* GMDSS stations receive the alert and forward it to a Rescue Coordination Centre (RCC).
* The distress alert is acknowledged by the responsible RCC for the incident.
* The RCC forwards information of the incident to vessels in the area (which could include VDES as a supplement to the existing GMDSS communication means).
* Information may also be provided using existing formats.
* Using VDES, information provided may be integrated with and portrayed on external systems onboard (i.e Radar, ECDIS) to facilitate vessel(s) acting on the information. (i.e. course to intercept, ETA on-scene, vessels notified, on-scene conditions, common operating picture, etc.)
* Information can be provided to the vessel based on its route

#### Requirements:

* Interface –an external application layer provides the ability for an operator to input information.
* Communications – the VDES has the ability to broadcast information from RCC to vessels in the area (shore to all ships in a defined area).
* For example - digital information / search pattern.
* Communications – the VDES has the ability to receive response information from ships in the distress area (ship to shore)
* Communications – the VDES has the ability to transmit information from RCC to vessels in the area (shore to specific ships in a defined area).
* Communications – the VDES [an external application] shall verify the validity of the station sending the information (shore authority / other entity)
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

### Scenario - SAR Operations – initiate search / response (UC-1.2)

#### Narrative for Scenario

SAR Mission Co-ordinator (SMC) develops response to SAR using resources, search plan, etc.

* SMC identifies and advises on-scene commander (OSC) and response units.
* Information to prosecute SAR operation is transmitted to OSC and SAR response units (SRU) (information on resources, plan, waypoints for search pattern, SRU responsibilities, etc.).
* VDES is used to provide common operating picture and information provided in standard templates and formats.
* Information exchange may be integrated with and portrayed on external systems onboard (i.e. Radar, ECDIS).
* Information may be provided using existing formats.

#### Requirements:

* Interface –an external application layer provides the ability for an operator to input information.
* Communications – the VDES shall have the ability to transmit information to the on-scene commander (OSC) (shore to ship)
* Communications – the VDES shall have the ability to transmit information to the response units (shore to ship)
* Information may include text, images, waypoints, search patterns, etc.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Interface – the VDES shall accept templates.
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

### Scenario - SAR Operations – information exchange (UC-1.3)

#### Narrative for Scenario

During a SAR mission, the OSC and SRU provide regular updates on the search / response to the SMC. In addition, the OSC and SRU share information between each other to facilitate the response.

* The VDES is used to exchange information of the SAR plan, SAR execution and other pertinent information to facilitate SAR operations.
* Information exchange may be integrated with and portrayed on external systems both ashore and onboard such as: RCC GIS, decision planning and support systems, Radar, ECDIS)
* Information may be provided using existing formats.
* Information can be provided to the vessel based on its route.

#### Requirements:

* Interface –an external application layer provides the ability for an operator to input information.
* Communications – the VDES shall transmit information from the on-scene commander (OSC) (ship to shore)
* Communications – the VDES has the ability to transmit information from the response units (ship to shore)
* Communications – the VDES has the ability to transmit information from OSC to response units (ship to ship)
* Communications – the VDES has the ability to transmit information from the response units to the OSC (ship to ship)
* Information may include, for example, text, images, waypoints, search patterns, radar track relay.
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats Interface
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals)
* Interface – the VDES shall accept input from external systems on the vessel
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)

### Scenario - Tele-medical (UC-1.4)

#### Narrative for Scenario

* Person injured or sick onboard a vessel or platform which requires the need to communicate with a doctor ashore for medical assistance and prognosis.
* Conversation with doctor could be by voice, with transfer of images / photos / indication from medical equipment on patient condition.
* Doctor providing assistance could use VDES to transfer advice, images or other information.
* In case of language difficulties, VDES could assist with machine to machine communications and/or language independent communication.
* The doctor providing tele-medical advice ascertains the severity of the injured or sick seafarer on board and to decide possible medical evacuation (MEDEVAC)
* Information exchange may be integrated with and portrayed on external systems onboard or ashore (medical facility)
* Information may be provided using existing formats.

#### Requirements:

* Interface –an external application layer provides the ability for an operator to input information.
* Communications – the VDES shall have the ability to transmit data simultaneously, including with voice transmissions on non-VDES channels or by other means.
* Communications – the VDES shall have the ability to enable near real-time, two way communications.
* Text and images. Video transmission may be available using other transport medium.
* Interface – the VDES shall accept input from external systems
* Medical related systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Interface – the VDES shall provide out to external systems
* Medical related systems
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals)

### Scenario - Medevac (UC-1.5)

#### Narrative for Scenario

* A MEDEVAC is necessary to evacuate a severely injured or sick person.
* VDES may be used to exchange pertinent medical information from the ship to the SRU and destination medical facility.
* SAR Mission Co-ordinator (SMC) develops response to prosecute the MEDEVAC and could use VDES to provide the plan to the ship and responding unit. The plan would include details of the patient, MEDEVAC instructions, MEDEVAC location – ship and shore, etc.
* Information on the status of the patient could be transferred during the MEDEVAC, both voice and from medical equipment on the SRU.

#### Requirements:

* Communications – the VDES shall have the ability to transmit information regarding the Medevac (ship to shore)
* , text, images.
* Communications – the VDES shall have the ability to transmit information regarding the Medevac (shore to ship)
* , text, images.

* Communications – the VDES shall have the ability to transmit information from the ship to the MEDEVAC unit (ship to MEDEVAC unit – i.e. helicopter, small vessel / tender)
* , text, images.
* Communications – the VDES shall have the ability to transmit information from the Medevac unit to the ship (MEDEVAC unit – i.e. helicopter, small vessel / tender to ship)
* text, images
* Communications – the VDES shall have the ability to transmit information from the Medevac unit to the shore (MEDEVAC unit – i.e. helicopter, small vessel / tender to shore)
* text, images
* Communications – the VDES shall have the ability to transmit information from the Medevac unit to the shore (shore to MEDEVAC unit – i.e. helicopter, small vessel / tender)
* text, images
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals
* Interface – the VDES shall accept input from external systems
* Medical related systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)

## Use Case 2 – Safety Related Information (UC-2)

Information regarding safety of navigation and protection of the environment can be transmitted through the VDES.

This includes Maritime Safety Information (MSI) as defined in IMO SOLAS V, regulation 4 (navigational warnings), SOLAS V, regulation 5 (meteorological services and warnings) SOLAS V, regulation 9 (hydrographic services) and SOLAS V, regulation 31 (Danger Messages). Other references include MSC.1/Circ.1287 rev1; MSC.1/Circ.1288; (additional reference COMSAR Cir.15) the IMO Worldwide Radionavigation System IMO resolution A.706(17) (as amended) sets out the Worldwide Radionavigation System (WWRNS).

Near real-time information on meteorological and hydrographical information may be provided.

In this use case information shall be transmitted in standardised formats that can take advantage of the VDES capabilities (for example - IHO S-124 formats).

The requirement includes the ability to send information to a predetermined area (i.e. NAVAREA and METAREA) or an area of particular interest defined by administration.

### Scenario - Meteorological Services and Warnings / Navigational Warnings (UC-2.1)

#### Narrative for Scenario

* A good understanding of how the weather can be expected to develop along ship’s planned route is important to help ensure safe passage at sea.
* Updated meteorological information allows ships to avoid areas with severe weather conditions.
* Information exchange may be integrated with and portrayed on external systems onboard (i.e. Radar, ECDIS).
* Information can be provided to the vessel based on its route.

#### Requirements:

* Communications - an external application layer provides the ability to provide weather information to a specified vessel (shore to specific ship, or group of ships).
* Communications – an external application layer provides the ability to forward weather information to vessels in the area (shore to all ships in a defined area).
* Communications - an external application layer provides the ability to provide weather information to a shore authority (ship to shore).
* Communications - an external application layer provides the ability to provide weather information to ships in the area (ship to ship).
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Interface – the VDES shall output information in a format compatible with external systems.
* Radar, ECDIS,

### Scenario - Weather Observations (UC-2.2)

#### Narrative for Scenario

* Ships may participate in the provision of weather observations, as noted in MSC.1 Circ. 1293. This is a voluntary observing ship (VOS) scheme with information provided to the World Meteorological Organisation.
* Information may be provided using existing formats, in a template manner. Data for the template could be sourced directly from on-board sensors.

#### Information may be provided from the vessel based on its route. Requirements:

* Communications - an external application layer provides weather information to a shore authority (ship to shore).
* Communications - an external application layer provides weather information to ships in the area (ship to ship).
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)

### Scenario - Ice maps (UC-2.3)

#### Narrative for Scenario

* Information on sea ice conditions around a vessel is important to help ensure safe passage at sea. Knowledge of areas with sea ice along a ship’s planned route allows ships to find the most efficient route at an early stage. Together with prognoses for expected ice movements, ice charts allow mariners to plan ahead and significantly reduce the chance vessels becoming ice locked.
* Information exchange may be integrated with and portrayed on external systems on-board (i.e. Radar, ECDIS).
* Information may be provided using existing formats.
* Information may be provided to the vessel based on its route.
* Information on latest version of ice maps may be provided from mobile station to mobile station.

#### Requirements:

* Communications - an external application layer provides ice information from another ship (ship to ship)
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – an external application layer provides the ability to receive ice information from a shore authority (shore to ship)
* Communications – an external application layer provides the ability to forward ice information from a ship to a shore authority (ship to shore)
* Communications – an external application layer provides the ability to forward ice information to vessels in the area (shore to ships in a defined area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Interface – the VDES shall output information in a format compatible with external systems.

### Scenario - Notices to Mariners (UC-2.4)

#### Narrative for Scenario

* Notices to mariners is a means to disseminate navigational safety information (as part of maritime safety information).
* SOLAS V, Regulation 9 (Hydrographic Services) notes that administrations should undertake to arrange the dissemination and keeping up to date of all nautical information necessary for safe navigation (e.g. predictive and real-time tides and currents).
* There may be different levels of notices to mariners – published; broadcast; urgent – with different transmission priority requirements.
* As information changes with respect to the status of the waterway - for example a new cable is laid, buoy location, buoy is noted as off position or unlit, information could be transmitted via the VDES vessels in a specified area. This information may be provided to the vessel based on its route
* Information may be provided from mobile station to mobile station.
* Information exchange may be integrated with and portrayed on external systems on-board (i.e. Radar, ECDIS).
* Information may be provided using existing formats.

#### Requirements:

* Communications - an external application layer provides the ability to provide notice to mariner information from a shore authority (shore to ship)
* Communications - an external application layer provides the ability to provide notice to mariner information from another ship (ship to ship).
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES has the ability to accept input from external systems.
* Communications – an external application layer provides the ability to transmit notice to mariner information to vessels in an area (shore to ships in a defined area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals

### Scenario - GNSS Augmentation (UC-2.5)

#### Narrative for Scenario

* SOLAS Chapter V, Regulation 19 notes that all ships, irrespective of size shall have a receiver for a global navigation satellite system or a terrestrial radio navigation system, or other means, suitable for use at all times throughout the intended voyage to establish and update the ship's position by automatic means. IMO Resolutions A.915(22) and A.953(23) provide the requirements for Maritime Radionavigation Systems.
* Distribution of GNSS augmentation corrections via VDES allows GNSS users to get timing, integrity data and improved position accuracy. This may be useful and valuable for maritime users in some situations. Examples of such situations include during close-quarter precision navigation.
* Information on corrections needs to be near-real time
* Information may be provided using existing formats.
* Information may be provided to the vessel based on its route.

#### Requirements:

* Communications - an external application layer provides the ability to provide GNSS augmentation correction information from a shore authority (shore to ship)
* Interface – the VDES shall accept input from external systems
* Communications – an external application layer provides the ability to broadcast GNSS augmentation correction information to vessels in an area (shore to ships in a defined area).
* Interface – the VDES shall output information in a format compatible with external systems for display of information.

### Scenario - Crowd sourced information (UC-2.6)

#### Narrative for Scenario

* Information from users or ship systems may enhance and/or validate meteorological hydrological and hydrographic information that is made available to other vessels in the area and authorities.
* Observations from ships; authorities or administrations could be provided to a crowd source ‘centre’ to be analysed. Information could then be provided to: other ships in the area; the maritime cloud; authorities or administrations (e.g. sensor data);
* Information may originate from the vessel itself, from another vessel in the area or from a shore authority.
* Information exchange may be integrated with and portrayed on external systems on-board (i.e. Radar, ECDIS).
* Information may be provided using existing formats.
* Information may be provided to the vessel based on its route.

#### Requirements:

* Communications - an external application layer provides the ability to provide information from a shore authority (shore to ship)
* Communications - an external application layer provides the ability to provide information from another ship (ship to ship).
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – an external application layer provides the ability to transmit information from a ship to the shore (i.e. a crowd source centre) (ship to shore)
* Communications – an external application layer provides the ability to broadcast information to vessels in an area (shore to ships in a defined area or ship to ships in an area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals.

## Use Case 3 – Ship Reporting (UC-3)

Ship reporting can include mandatory and voluntary reports required for a number of purposes by vessels to various shore authorities. Information on ship reporting is provided in IMO SOLAS V, regulation 11 (ship reporting systems), 19-1 (LRIT), regulation 31 (danger messages), regulation 32 (information required in danger messages), MARPOL [ref] and SAR Convention, Chapter 5. Additional information on ship reporting is contained in Resolution A.851(20) and FAL.5/Circ.36.

Information forwarded through VDES may transfer the reports for integration into national and/or regional systems could be sent by VDES. (i.e. SafeSeaNet, VTS). Information may also be sent to the ship agent or owner or a service provider.

### Scenario - Submit arrival notice (UC-3.1)

#### Narrative for Scenario

* A notice of arrival report is based on known content and could be set in a template form. The aspects of the template report, such as information on the ship particulars, would be pre-populated.
* Where possible, additional information related to the voyage, such as destination, ETA destination, last port(s) could be populated from other systems that contain such information.
* Other information that may be provided includes ISPS reports; ship crew information; information specifically required by the shore authority. This may be submitted using data populated automatically from other systems or may require manual input by the mariner.
* Response may be provided from shore to the ship
* Information exchange may be integrated with and portrayed on external systems.
* Information may be provided using existing formats (i.e. IMO Resolution A.851(20)).
* The vessel may be interrogated for information on request, based on its route, operating area or position.

#### Requirements:

* Communications – the VDES has the ability to forward information (ship to shore)
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats.
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES has the ability to forward information from a ship to a shore authority (ship to shore)
* Communications – the VDES has the ability to forward information to vessels in an area (shore to ships in a defined area or ship to ships in an area).

### Scenario - Submit updated information (UC-3.2)

#### Narrative for Scenario

* As the voyage continues, updated information will be provided. This can include updated estimated time of arrival; change in condition of the vessel; change in route of the vessel.
* This is a user defined report, which could be based on a set template for ‘updated information’ or free-text report.
* Response may be provided from shore to the ship
* Information exchange may be integrated with and portrayed on external systems.
* Information may be provided using existing formats (i.e. IMO Resolution A.851(20)).
* The vessel may be interrogated for information on request, based on its route, operating area or position.

#### Requirements:

* Communications - The VDES has the ability to provide updated information from a shore authority (shore to ship)
* Communications - The VDES has the ability to provide updated information from another ship (ship to ship).
* Interface –an external application layer provides the ability for an operator to input information.
* Interface - an external application layer accepts input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

### Scenario - Provide initial report to shore (prior to departure) (UC-3.3)

#### Narrative for Scenario

* Prior to departure specific, standard information is required. This may include information required for clearance to depart.
* Reports would be pre-populated from available information where possible. Specific information may be required to be entered manually.
* Response / approval to depart may be provided from shore to the ship.
* Information exchange may be integrated with and portrayed on external systems on-board (i.e. Radar, ECDIS).
* Information may be provided using existing formats.

#### Requirements:

* Communications - The VDES has the ability to provide response to a report from a shore authority (shore to ship)
* Communications - The VDES has the ability to provide a report to a shore authority (ship to shore).
* Interface – an external application layer provides the ability for an operator to input information.
* Interface – an external application layer provides the ability to accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

### Scenario - Secure ship reporting (UC-3.4)

#### Narrative for Scenario

* A vessel is transiting an area of concern (i.e. piracy) and switches off its AIS. Information is transmitted through a secure communications link.
* Switch from standard AIS reporting to secure ship reporting could be automatic based on known area of concern or manual based on a developing situation, and advises shore authority.
* Vessels in a fleet could all be required to report through a specified means to secure the transmission (for example an encryption method).

#### Requirements:

* Communications - The VDES has the ability to provide a report to a shore authority (ship to shore).
* Communications - The VDES has the ability to provide response to a report from a shore authority (shore to ship)
* Interface – The VDES may provide the ability to secure the content of the message.
* Interface – an external application layer may provide the ability to secure the content of the message.
* Interface – an external application layer provides the ability for an operator to input information.
* Interface – an external application layer provides the ability to accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

### Scenario - Danger Message (UC-3.5)

#### Narrative for Scenario

* Master of a vessel is required to report dangerous conditions (SOLAS V, regulation 31 and 32), such as: dangerous ice, derelicts, dangers to navigation, tropical storm, severe weather, ice accretion, etc.
* Certain information is required in these messages such as: time / date (UTC); position; type of danger; and pertinent weather conditions.
* Necessary steps shall be taken to ensure that this information is forwarded to shore authorities and ships in the areas.
* All messages shall be transmitted as ‘safety’ messages.
* These messages are noted as being Free of cost to ships (SOLAS V, Regulation 31)
* Information may originate from the vessel itself, or from another vessel in the area.
* Information exchange may be integrated with and portrayed on external systems on-board (i.e. Radar, ECDIS).
* Information may be provided using existing formats.
* Information may be provided to the vessel based on its route.

#### Requirements:

* Communications - The VDES has the ability to transmit to a shore authority (ship to shore).
* Communications - The VDES has the ability to provide response to a report from a shore authority (shore to ship)
* Interface – an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals.

## Use Case 4 – Vessel Traffic Services (UC-4)

Vessel Traffic Services is included in SOLAS Chapter V, Regulation 12, with further information in IMO Resolution A.857(20). Three key services provided by VTS are:

Information Service

Navigational Assistance Service

Traffic organisation Service.

An Information Service involves maintaining a traffic image and allows interaction with traffic and response to developing traffic situations. An Information Service should provide essential and timely information to assist the on-board decision-making process.

Information required by the VTS can be both standardised (supported by templates) or specific to a situation.

VTS involves maintaining a vessel traffic image, and relies on vessel tracking from sensors such as radar, AIS, CCTV, other VTS centres. The vessel traffic image may be supplement with crowd sourced information from vessels data (sensor data from ships provided to the shore to expand the traffic image range).

VTS also requires interaction with traffic to respond to developing traffic situations.

VTS relies on the ability to provide essential and timely information; monitor the actions of vessels in the VTS area, including monitoring routes and changes in route; interacting with other VTS centres in the region; interact with other port agencies (allied services).

Ports may also provide a specific Local Port Service (LPS) where it is deemed through a risk assessment that a VTS is not required.

### Scenario - Waterway Monitoring (UC-4.1)

#### Narrative for Scenario

* VTS may use VDES for monitoring and providing other services.
* VDES may be used to monitor vessels and autonomously provide information to these vessels based on predetermined parameters as defined by the shore authority.
* VDES may enable sharing of information on synthetic VTS targets from the VTS to vessels transiting the VTS area.
* Information exchange may be integrated with and portrayed on external systems.
* Information may be provided using existing formats (i.e. IMO Resolution A.851(20)).
* The vessel may be interrogated for information on request, based on its route, operating area or position.

#### Requirements:

* Communications - The VDES has the ability to provide information from a shore authority (shore to ship)
* Communications – an external application layer has the ability to provide information from a shore authority (shore to ship)
* For example - Information, routes, ‘sharing’ of traffic image
* Communications - The VDES has the ability to provide information from another ship (ship to ship).
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES has the ability to forward information from a ship to a shore authority (ship to shore)
* Communications – the VDES has the ability to forward information to vessels in an area (shore to ships in a defined area or ship to ships in an area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats.
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals.

### Scenario - Information Service (UC-4.2)

#### Narrative for Scenario

* Information Service (INS) is provided by broadcasting information at fixed times and intervals or when deemed necessary by the VTS or at the request of a vessel.
* The information provided may include safety information as previously defined. Additional information could include specific limitations for navigation in the VTS area (i.e. manoeuvrability limitations; draft restrictions; channel closures; diving operations; etc.)
* Information exchange may be integrated with and portrayed on external systems.
* Information may be provided using existing formats (i.e. IMO Resolution A.851(20)).
* The vessel may be interrogated for information on request, based on its route, operating area or position.

#### Requirements:

* Communications - The VDES has the ability to transmit information from a shore authority (shore to ship)
* Communications – an external application layer has the ability to provide information from a shore authority (shore to ship)
* For example - Information on routes, ‘sharing’ of traffic image, UKC information
* Communications - The VDES has the ability to transmit information from another ship (ship to ship).
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES shall have the ability to transmit information from a ship to a shore authority (ship to shore)
* Communications – the VDES shall have the ability to broadcast information to vessels in an area (shore to ships in a defined area or ship to ships in an area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals.

### Scenario - Navigational Assistance Service (UC-4.3)

#### Narrative for Scenario

* The navigational assistance service (NAS) is defined by IMO as **"**a service to assist on-board navigational decision-making and to monitor its effects**"**.
* NAS may be provided on request by a vessel in circumstances such as equipment failure or navigational unfamiliarity.
* NAS may be provided when the VTS observes an unsafe situation developing.
* Information exchange may be integrated with, and portrayed on, external systems.
* Information may be provided using existing formats (i.e. IMO Resolution A.851(20)).
* The vessel may be interrogated for information on request, based on its route, operating area or position.

#### Requirements:

* Communications - The VDES has the ability to transmit information from a shore authority (shore to ship)
* Communications – an external application layer has the ability to transmit information from a shore authority (shore to ship)
* For example - Information on routes, ‘sharing’ of traffic image
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES has the ability to transmit information from a ship to a shore authority (ship to shore)
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals.

### Scenario - Traffic Organisation Service (UC-4.4)

#### Narrative for Scenario

* The traffic organisation service (TOS) is defined by IMO as **"**a service to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the VTS area**"**.
* The purpose of the TOS is to prevent hazardous situations from developing and to ensure safe and efficient navigation through the VTS area.
* Information shall originate from a shore authority.
* Information exchange may be integrated with and portrayed on external systems.
* Information may be provided using existing formats (i.e. IMO Resolution A.851(20)).
* The vessel may be interrogated for information on request, based on its route, operating area or position.

#### Requirements:

* Communications - The VDES has the ability to transmit information from a shore authority (shore to ship)
* Communications – an external application layer has the ability to transmit information from a shore authority (shore to ship)
* For example - Information on routes, ‘sharing’ of traffic image
* Communications - The VDES has the ability to transmit information to another ship (ship to ship).
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES has the ability to transmit information from a ship to a shore authority (ship to shore)
* Communications – the VDES has the ability to broadcast information to vessels in an area (shore to ships in a defined area or ship to ships in an area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals.

## Use Case 5 – Charts and Publications (UC-5)

IMO SOLAS Chapter V, Regulation 27 (nautical charts and nautical publications) notes that charts and publications necessary for the intended voyage shall be adequate and up to date.

The aim of nautical chart and publication services are to safeguard navigation at sea by providing information such as nature and form of the coast, water depth, tides table, obstructions and other dangers to navigation, location and type of aids to navigation.

The nautical chart and publication services ensure the official distribution, update and licensing of electronic charts and publications to vessels and other users.

Nautical publications include list of lights, sailing directions, tide and current tables, etc.

There may be a requirement for a ‘user pay’ aspect for some services (i.e. ENC updates).

### Scenario - Updates linked to a ships’ route (UC-5.1)

#### Narrative for Scenario

* A vessel is proceeding to a specific location. At the time of sailing, the vessel had all required charts and publications for the voyage.
* These charts and publications were the most up to date at the time of sailing, however some information may have changed during the voyage.
* Updated information is provided to the vessel as it continues on its voyage. The information provided is focused on what is different, with only the delta being transmitted.
* Information may originate from another vessel in the area with up dated information or from a shore authority.
* Information exchange may be integrated with and portrayed on external systems.
* The information may be provided to the vessel based on its route, operating area or position.

#### Requirements:

* Communications - The VDES may have the ability to transmit information from a shore authority (shore to ship)
* Communications - The VDES may have the ability to transmit information from another ship (ship to ship).
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES has the ability to transmit information from a ship to a shore authority (ship to shore)
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

## Use Case 6 – Route Exchange (UC-6)

The development of e-navigation has highlighted the opportunity to make effective use of digital data exchange to support safe and efficient vessel movements. Projects such as Mona Lisa, EfficienSea and ACCSEAS have included the development of route exchange. (IEC 61174 edition 4 annex S refers)

Route exchange could enhance safety by providing early indication of changes in route which may be due to fatigue, weather conditions, or condition of the vessel (possible malfunction).

The use of route exchange could assist with fleet management, whereby information on routes can be exchanged with shore personnel as well as other vessels in the fleet.

In addition, the use of route exchange could assist with route and speed optimisation based on weather and currents; just in time arrival and traffic congestion.

VDES has the ability to provide the communications medium for digital data exchange.

### Scenario - Ship to Ship (UC-6.1)

#### Narrative for Scenario

* This scenario is limited to beyond VTS coverage areas. Within a VTS area, route exchange would be through the VTS.
* Ship to ship route exchange would assist vessels on a transit by predicting when interactions may occur.
* Knowledge of ship routes could assist with predicting traffic congestion, where delays may be expected and, where possible, alternate routes to avoid congestion.

#### Requirement

* Communications - The VDES has the ability to transmit information from a ship (ship to ship)
* Communications – an external application layer has the ability to transmit information from a shore authority (shore to ship)
* For example, Waypoints / route information
* Interface – an external application layer provides the ability to accept input from an operator.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals.

### Scenario - Ship to Shore (UC-6.2)

#### Narrative for Scenario

* To inform shipping and other waterway users of possible hazardous situations shore authorities need information about the intentions of the waterway users such as their intended route. Based on this information the authorities could organize traffic and, when needed, recommend other routes/possibilities for a safer passage but also could support the ships with information about the waterway.
* When a routing organization is used similar information may be exchanged.

#### Requirements

* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES has the ability to transmit information from a ship to a shore authority (ship to shore)
* Communications – the VDES has the ability to transmit information a shore authority (shore to ship)
* Acknowledgement, route version, time-stamp
* Communications – the VDES has the ability to broadcast information to vessels in an area (shore to specific ships in a defined area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals.
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

### Scenario - Shore to Ship (UC-6.3)

#### Narrative for Scenario

* Before ships enter a sea area monitored by a shore authority information about this area could be provided to assist in a safe and efficient passage. If the route of the vessel is known information can be tailored to the route. The shore authority could link the vessel planned route with other information received, such as cargo, and adjust the information as may be required.
* Route plans received from ships can be used for detecting possible traffic congestions and risk situations in advance. Shore authorities can also send alternative route recommendations to ships when needed. This allows ships to choose the route that is most suitable for its navigation
* When shore authorities have routes, and ETA's, from several vessels in the area, they can use this information for efficient water space management. In congested waters (i.e. hot spots along the route of a vessel) authorities can use time slot management and time separated routes between ships for reduced collision risks. For traffic organization purposes it should also be possible to send route with recommended ETAs in different waypoints for ship.
* When a shore authority sends a recommended route to a ship the ship would need to acknowledge the revised route. In addition, other ships in the area would need to be advised of the new route.
* When a routing organization is used similar information may be exchanged.

#### Requirements

* Interface – an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES shall have the ability to transmit information from a ship to a shore authority (ship to shore)
* Communications – the VDES shall have the ability to transmit information a shore authority (shore to ship)
* Acknowledgement, route version, time-stamp
* Communications – the VDES shall have the ability to broadcast information to vessels in an area (shore to participating ships in a defined area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals.
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

### Scenario - Navigational Disruption (UC-6.4)

#### Narrative for Scenario

* Some event or circumstance that impacts the normal operation of the waterway requires urgent traffic management to ensure continuity of operations.
* Information on the circumstance, and proposed alternate routing could assist in effective movement of vessels throughout the incident.
* Information provided could enable automated traffic queuing.

#### Requirements:

* Communications - The VDES shall have the ability to prioritise information regarding navigational disruption (urgent traffic management)
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES shall have the ability to transmit information from a ship to a shore authority (ship to shore)
* Communications – the VDES shall have the ability to transmit information a shore authority (shore to ship)
* Acknowledgement, route version, time-stamp
* Communications – the VDES shall have the ability to broadcast information to vessels in an area (shore to ships in a defined area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

## Use Case 7 - Logistics / Services (UC-7)

When sailing from berth to berth before, during and after the voyage there are several logistical aspects that must be addressed. Most of these are done by an agent on the shore but are changed because of different reasons. The means of communicating these logistical aspects would depend on the location of the ship / shore elements involved and could include VDES. In cases where cargo is transferred at sea (transhipment) the location could be out of range of other communications and VDES would be the preferred communication exchange platform.

Information transfer could assist with efficiency of the overall cargo chain (for example MonaLisa sea traffic management concept).

Sharing of route information could assist with allied services related to shipping and ship movements - this could include locks, pilotage, tug allocation, shore resources, and other logistical aspects. This use case represents the business to business aspect.

Logistical elements where VDES may be an appropriate communication method include:

* Transfer of vessel loading plan
* Tug operations
* Pilotage operations
* Stores / supplies / ship bunkers required; waste removal

### Scenario - Logistic services – ship to shore (UC-7.1)

#### Narrative for Scenario

* Ship arriving at a port forwards revised time of arrival and request confirmation for stores, fuel, and access to waste facilities, etc.
* Vessel also requires information on pilots and tugs, other aspects for the transit.
* There could also be additional information requests for the availability of shore side facilities (i.e. hospital, transport facilities).

#### Requirements:

* Communications - The VDES shall have the ability to provide information from a ship (ship to ship)
* Interface –an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES shall have the ability to transmit information from a ship to a shore authority (ship to shore)
* Communications – the VDES shall have the ability to transmit information a shore authority (shore to ship)
* Communications – the VDES shall have the ability to transmit information to vessels in an area (shore to specified ships in a defined area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

### Scenario - Logistic services – shore to ship (UC-7.2)

#### Narrative for Scenario

* As the ship arrives, the shore will provide confirmation offloading, loading of the vessel and respond to requests from the ship.

#### Requirements:

* Communications - The VDES shall have the ability to transmit information from a ship to a shore (ship to shore)
* Specific requirements for loading, logistics
* Interface – an external application layer provides the ability for an operator to input information.
* Interface – the VDES shall accept input from external systems
* For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up)
* Communications – the VDES shall have the ability to transmit information to vessels in an area (shore to specific ships in a defined area).
* Interface – an external application layer provides the ability to integrate data into, and transmit, template formats
* Interface – an external application layer provides language independent messaging (e.g. IMO Standard Marine Communication Phrases; IMO List of Signals
* Interface – an external application layer provides the ability to output information in a format compatible with external systems for display of information.

# VHF Data Exchange System Requirements

Based on the use cases and scenarios the following VHF Data Exchange System requirements [confirm requirement wording / validate source references / update comments]

## VHF Data Exchange System Capability Requirements

Table 3 VDES Capability Requirements

| **Req ID** | **Requirement** | **Hierarchy** | **Source** | **Comments** |
| --- | --- | --- | --- | --- |
| VDES-CAP-01 | The VDES shall enable data exchange between ships and shore users by terrestrial or satellite link. | Essential | 2.2 | At an external application layer shall automatically determine the most suitable data exchange process. AIS, ASM, VDE – terrestrial / satellite |
| VDES- CAP -02 | Data exchange by VDES from the ship shall occur automatically. | Essential | 2.2 | Concept is that there is data sent automatically, with no manual intervention. |
| VDES- CAP -03 | Data exchange by VDES from the ship shall occur manually. | Essential | 2.2 | Concept is that there is data that is sent when required by an operator through an external application. |
| VDES- CAP -04 | Data exchange by VDES shall use only the ITU designated VHF channel(s). | Essential | 2.2 |  |
| VDES- CAP-05 | Transmission and reception of the data by the VDES shall occur with the minimum involvement of ship’s personnel. | Important | 2.2 |  |
| VDES- CAP-06 | The VDES shall include the existing AIS and ASM applications. | Essential | 2.2 |  |
| VDES- CAP-07 | VDES additional capabilities shall include support of the VHF Data Exchange (VDE) | Essential | 2.2 |  |
| VDES- CAP-08 | VDE shall implement data integrity monitoring (data link check sum). | Essential | 2.2 | Level of integrity to be determined / driven by the use case requirement and technical capability. |
| VDES- CAP-09 | The VDES shall have a high level of availability. | Important | 2.2, 2.4 | The system installation shall be able to operate continuously (under way, moored or at anchor) |
| VDES- CAP-10 | The VDES shall enable machine to machine communications. | Essential | 2.2 | The VDES shall support machine to machine confirmation of receipt; confirmation of message sent; discard of message if undelivered in a stated time-frame (depending on priority). |

## VDES Operational Requirements

Table 4 VDES Operational Requirements

| **Req ID** | **Requirement** | **Hierarchy** | **Source** | **Comments** |
| --- | --- | --- | --- | --- |
|  |  | Essential | 2.3 | Dependent on HMI rather than the equipment itself.  Application level / development requirement. |
|  |  | Essential | 2.3 | Interface that supports HMI and MMI  Reference to standards includes IMO MSC.1Circ.1523 Guideline on software quality assurance and human-centred design for e-navigation.  Application level / development requirement. |
| VDES-OPS-01 | The VDES interface shall confirm with appropriate international marine interface standards. (IEC 61162 series) | Essential | 2.3 |  |
|  |  | Important | 2.3 | Dependent on HMI rather than the equipment itself.  Application level |
|  |  | Essential | 2.3 | Application level |
|  |  | Essential | 2.3 | Noting the dynamic movements within the ship environment, interaction with the and with the VDES, and with data provided by and to the VDES, shall be efficient, effective and intuitive.  Dependent on HMI rather than the equipment itself.  Application level |
| VDES-OPS-02 | the VDES shall have the ability to broadcast information from Shore to vessels in the area (shore to all ships in a defined area) | Essential |  | From shore could include RCC, VTS, other. Valid for all references to Shore in requirements  Examples of the information to forward include: search pattern; text, images, waypoints, |
| VDES-OPS-03 | the VDES shall have the ability to transmit information from Shore to specified vessels in the area (shore to specified ships in a defined area). | Essential |  |  |
| VDES-OPS-04 | the VDES shall have the ability to transmit information to a specific ship) (shore to specified ship) | Essential |  | For example, on-scene commander (OSC) |
| VDES-OPS-05 | the VDES shall have the ability to receive transmissions from ships in an area (ships in an area to shore) | Essential |  | For example: ships in a search area; ships in a security area; ships in a pollution area. |
| VDES-OPS-06 | the VDES shall have the ability to transmit information from a specific ship (specified ship to shore) | Essential |  |  |
| VDES-OPS-07 | the VDES shall have the ability to transmit information from the response units (ship to shore) | Essential |  |  |
| VDES-OPS-08 | The VDES shall use unique identifiers for each VDES station. [note – AIS part of VDES – already uses MMSI; VDE may use other unique identifier approach] | Essential | 2.6 | Each VDES station may have more than one terminal. Routing of data once received by the VDES station to a terminal is out of scope of this document. |
| VDES-OPS-09 | The VDES shall verify the validity of the source of the information. [need to discuss further – concept of security] | Desirable |  | authority / ship / other entity  Discussion on level of complexity – is this possible? maritime cloud discussion  Application level? (VDE) |
|  |  | Desirable |  | Message Type – the VDES station has the authority and ability to transmit / receive the message. (reference internet of things / maritime cloud discussion)  Application level |
|  |  | Desirable |  | Discussion on level of complexity – is this possible? maritime cloud discussion  Application level |
|  | . | Essential |  | Discussion on ‘encryption’ vs ‘secure’ – preference in group was ‘secure’ Application level |
| VDES-OPS-09 | The VDES shall support data automated, delayed and scheduled transmission in long and short time-frames. | Essential |  | Depending on the operational requirement. Discussion on scheduling of transmissions – down to slot level? |
| VDES-OPS-10 | The VDES (VDE) shall support priority of transmission. | Essential |  | Priority of communications – Distress, Urgency, Safety (AIS fits under Safety), General communications. |

## VDES Technical Requirements

Table 5 VDES Technical Requirements

| **Req ID** | **Requirement** | **Hierarchy** | **Source** | **Comments** |
| --- | --- | --- | --- | --- |
|  |  | Essential | 2.4 | Application |
|  |  | Desirable | 2.4 | Application |
| VDES-TEC-01 | The system shall use, time-division multiple access (TDMA) techniques, access schemes and data transmission methods in a synchronized manner as specified in Recommendation ITU-R M.2092 | Essential | 2.4 |  |
|  |  | Essential | 2.4 | Application layer |
|  |  | Desirable | 2.4 | Flexibility to prioritize and adapt parameters of the transmission (robustness or capacity) while minimizing system complexity.  Application |
| VDES-TEC-02 | The VDES shall support all communications directions. | Essential |  | Shore-ship; ship-shore; ship-ship. (note – shore reference includes shore terrestrial and satellite VDES terminals). |
| VDES-TEC-03 | The VDES shall support a means to automatically input data from other sources (external systems). | Essential |  | For example - base information on the vessel (e.g. MMSI, IMO number); position data, integrity and timing data from World Wide Radionavigation System (including GNSS, GNSS augmentation and terrestrial back-up) |
|  |  | Important | 3.1.1 | the VDES has the ability to accept input from an operator  Application layer |
| VDES-TEC-04 | The VDES shall support a means forward error correction (FEC) | Essential |  |  |
| VDES-TEC-05 | The VDES shall output information in a format compatible with other systems. | Important |  | enable user to access, select and display the data on a separate system |
|  | . | Essential |  | Area notification  Maritime Cloud (maritime messaging service)  Application |
|  |  | Essential |  | Fleet or group notification  Maritime Cloud (maritime messaging service) Application |
|  |  | Essential |  | point to point  Maritime Cloud (maritime messaging service) Application |
|  |  | Essential |  | General broadcast  Maritime Cloud (maritime messaging service) Application |
| VDES-TEC-06 | The VDES shall support a combination of modulation methods. | Essential |  | Discussion on possible ‘classes’ of VDES. |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

\*\*\*\*\*\*\*\*\*\*\* end draft document \*\*\*\*\*\*\*\*\*\*\*\*\*

1. Data dictionaries to be based on documents such as the Standard Marine Communication Phrases and/or International Code of Signals. [↑](#footnote-ref-1)
2. .1 an “autonomous” mode for operation in all areas. This mode should be capable of being switched to/from alternate modes by a competent authority;

   .2 a “controlled” mode for operation in a period of time when or an area where, a competent authority responsible for radiocommunication or maritime affairs requires, such that the data transmission may be set or controlled by the authority. [↑](#footnote-ref-2)
3. IEC standard 61174 ed 4 includes route exchange. [↑](#footnote-ref-3)