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| IALA Guideline |

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USE CASES FOR VTS Digital Communications

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Revisions to this document are to be noted in the table prior to the issue of a revised document.

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* 1. ROUTE functions
     1. Route exchange service

The route and schedule (The current format, IHO S421, used for route exchange also containing schedule information) is a key element of the vessel's voyage and can be used to optimize safety and processes, as well as for the interaction of participants and stakeholders. The core element of the voyage plan is a route. 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);
  + optimized resource utilization 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 sailing 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.

To fulfil the use cases in this service, route information from the vessel must include:

* Vessel Identification Information
* Waypoints (WP)
* Schedule / times of WP´s
* Legs including cross track distance limit (XTDL)
* Wheel over point (for further development for IEC)

Kuva, joka sisältää kohteen teksti, kuvakaappaus, Fontti, diagrammi

Tekoälyn generoima sisältö voi olla virheellistä.

Figure X

* + - 1. Use case 1 - Initial Sharing of the route from Vessel to VTS

Description: Vessel shares route with VTS before entering VTS area, leaving from berth/anchorage, departing from port/anchorage.

Typical sequence:

1. The route is planned in the planning station by the mariner
2. Planning station crosschecks the route and upload route to the ECDIS/ECS
3. The ECDIS/ECS should send the route to the “Route Exchange Function” before departure, but the route must be shared at latest according to local rules
4. The Route Exchange Function checks that at least following information is included in the route

* Vessel Identification Information
* Waypoints (WP)
* Schedule / times of WPs
* Legs (including cross track distance limit (XTDL)
* Wheel over point (WOP)

1. The Route Exchange Function sends this planned route to the VTS System
2. The Route Exchange Function sends “received” acknowledgement automatically
3. VTS System can display the route as needed to the VTS personnel
   * + 1. Use case 2 - VTS gives route recommendation to vessel within a geographically defined area

Description: VTS gives route recommendation to vessel for example due to:

* + - A certain part of the route is inaccessible, for example due to navigational danger, environmental conditions, or for monitoring and managing vessel traffic
      * Changing the geography of the route
      * Changing the ETA to a specific waypoint
    - Enhanced navigational assistance
      * Changing the radius of the turn

Typical sequence:

1. Vessel has already sent route to VTS
2. VTS personnel creates the recommendation for vessel
   * VTS system can assist VTS personnel to create the route recommendation
3. VTS system sends back the recommended route to ECDIS (planning station)
   * Route can contain changes to waypoints and/or schedule
4. Vessel sends “route received” acknowledgement automatically
5. One of the following
   1. Vessel does not agree with changes
   2. Vessel process the route and sends it to VTS
6. The Route Exchange Service sends “received” acknowledgement automatically
7. VTS System can display the route as needed to the VTS personnel
   * + 1. Use case 3 - VTS requests route from vessel

Description:VTS has not received route from vessel and requests route from vessel for situational awareness and/or traffic management.

Typical sequence:

1. VTS request route from vessel
2. Vessel sends route as requested
3. The Route Exchange Service sends “received” acknowledgement automatically
4. VTS System can display the route as needed to the VTS personnel with ability to highlight any changes
   * + 1. Use case 4 - Vessel´s route changes

Description: Vessel wants to change its route

Typical sequence:

1. Vessel has already sent route to VTS
2. Mariner makes changes to its route
3. ECDIS sends updated information to VTS as monitored route
   * If VTS has requested updates according to use case 3 that request must be honored
4. VTS system sends “received” acknowledgement automatically
5. VTS System can display the route as needed to the VTS personnel with ability to highlight the changes
   * + 1. Use case 5 - Vessel does not arrive to VTS area as planned

Description: Vessel changes route and does not arrive to VTS area as part of its voyage (use case 1)

Typical sequence:

1. Vessel has already sent route to VTS
2. Mariner makes changes the route where no waypoints are located inside geometry area
3. Vessel sends cancellation to VTS system by means as route cancelled message
4. VTS system sends “received” acknowledgement automatically
5. VTS System can display the route as needed to the VTS personnel with ability to highlight the changes/cancellation
   * + 1. Use case 6 - VTS acknowledges the route

Description: VTS acknowledges vessel’s route without changes

Typical sequence:

1. Vessel has already sent route to VTS
2. VTS system sends the route to Route Crosscheck Function if available to checks the route
3. Route Crosscheck Service checks the route and marks it as compliant
   * If the route is not compliant go to use case 2 or 8
4. VTS personnel takes in consideration the monitoring and managing vessel traffic and marks the route “ok” on the VTS system
   * If the route is not suitable go to use case 2
5. VTS system sends VTS acknowledge message to ECDIS
6. ECDIS can display the VTS acknowledged status of the monitored route to mariner
   * + 1. Use case 7 - VTS personnel acknowledges the route

Description: VTS personnel acknowledges vessel’s route without changes

Typical sequence:

1. Vessel has already sent route to VTS
2. VTS personnel checks the route and marks the route “ok” on the VTS system
   * VTS personnel also takes in consideration the monitoring and managing vessel traffic
   * If the route is not suitable go to use case 2 or 8
3. VTS system sends VTS acknowledge message to ECDIS
4. ECDIS can display the VTS acknowledged status of the route to mariner
   * + 1. Use Case 8 - VTS sends route back with comments

Description: VTS does not acknowledge vessel´s route and sends it back with comments

Typical sequence:

1. Vessel has already sent route to VTS
2. Route Crosscheck Function or/and VTS personnel checks the route and finds issues with the route
3. VTS personnel decides not to make a recommendation
4. VTS sends part of the route back to the vessel with comments, which can be:
   * Recommendations (route modification readily to be used by the mariner, including human readable explanation why this recommendation is given)
   * Issues (including human readable text to explain the issue)
   * Errors (technical issues of the route, not necessarily human action)
   * Route incomplete (VTS decides there are too many issues to be explained to the mariner, so this route incomplete message is a request to the mariner to re-plan the route)
5. Vessel changes its route [go to use case 4]
   * + 1. Use Case 9 - Vessel gets multiple changes to their route

Description: Vessel sends its route to many VTS areas and gets multiple change recommendations to their route.

Typical sequence:

1. Vessel has already sent route to multiple VTS areas
2. VTS areas can give multiple recommendations to vessel´s route
   * VTS can send recommended route or/and comments (issues, errors)
3. Vessel receives multiple change recommendations to their route and adjust it
   * 1. Route Reference service

With the Route Reference Function VTS and other service providers offer predefined routes and waypoints, in electronic format. Route Reference Function 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.

* + 1. Route Crosscheck service

The purpose of system supported Route Crosscheck Function 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.

* + 1. Route Monitoring Service

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

* 1. VTS INFORMATION functions
     1. VTS Reporting Service

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

* + - 1. USE CASE 1 – VESSEL makes initial contact and receives reporting requirements

Description: Vessel subscribes VTS Reporting Service and receives all reporting requirements

Typical sequence:

1. Vessel subscribes VTS Reporting Service
2. VTS system sends all reporting requirements automatically to vessel
3. Vessel receives all reporting requirements
4. Vessel sends “received” acknowledgement automatically to VTS
   * + 1. USE CASE 2 – VESSEL sends complete report

Description: Vessel sends report

Pre-conditions: Vessel has subscribed VTS Reporting Service and has all reporting requirements

Typical sequence:

1. VTS sends report request to vessel automatically based on position or time
2. Vessel reports requested information to VTS
3. VTS receives the information
4. VTS system validates the information
5. VTS systems sends acknowledgement automatically
   * + 1. USE CASE 3 – VESSEL sends invalid report or no report at all

Description: Vessel sends incomplete report, no report or report with incorrect information

Pre-conditions: Vessel has subscribed VTS Reporting Service and has all reporting requirements

Typical sequence:

1. VTS sends report request to vessel automatically based on position or time
2. Vessel does not report as requested information to VTS
3. VTS system sends the VTS reporting requirements to vessel automatically and requests complete report
4. Vessel reports requested information to VTS
5. VTS receives and validates the information
6. VTS system sends acknowledgement automatically

Post-conditions: If vessel does not send the information as requested other procedures take place.

* + - 1. USE CASE 4 – VESSEL sends updated report

Description: Vessel updates requested report

Pre-conditions: Vessel has subscribed VTS Reporting Service and has already sent the complete report and wants to update information in the report.

Typical sequence:

1. Vessel reports information compliant to reporting requirements
2. VTS receives report
3. VTS system validates the information
   * Information is valid and VTS system sends “acknowledgement” automatically to vessel
   * Information is invalid [go to use case 3 start sequence from step 3]

* + 1. 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 departure point to its destination while considering various factors and potential hazards. The primary purpose is to enhance navigation safety, optimize route planning, and ensure compliance with regulations. This information may include local port information, regulations, restrictions, reporting requirements, fairway information, and VTS area.

* + 1. VTS Information Service

The aim of a VTS Information Service is to contribute to the safe and efficient navigation of vessels by delivering information. Service 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 markers information, question or answer.

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

Message may include:

Geometry

Time

Pictures

Symbols

Form (eg questions that require structured answer)

Free text

Time frame

* + - 1. USE CASE 1 – VTS provides information

Description: VTS sends message to a vessel

Pre-conditions: Vessel has subscribed the VTS Information Service

Typical sequence:

1. VTS sends message to a vessel
2. Vessel sends “received” acknowledgement automatically
   * + 1. USE CASE 2 – VTS provides same information for multiple vessels at once

Description: VTS sends same message to multiple vessels at once

Pre-conditions: Vessels have subscribed the VTS Information Service

Typical sequence:

1. VTS selects a group of vessels
2. VTS sends message to selected vessels
3. Selected vessels send “received” acknowledgement automatically
   * + 1. USE CASE 3 – VTS/VESSEL ASKS QUESTIONS or needs answer THESE NEED TO BE SEPARATED

Description: VTS sends same message to multiple vessels at once

Pre-conditions: Vessels have subscribed the VTS Information Service

Typical sequence:

1. VTS sends message to multiple vessels
2. Vessels send “received” acknowledgement automatically
   1. TRAFFIC IMAGE SERVICES
      1. 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 area, to create a shared traffic image within the VTS area.

* + 1. Intended Track Exchange Service

Intended Track Exchange Service is primarily designed for vessels to exchange the track. Vessels can share their intended tracks 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.

* + 1. 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.

* 1. planning functions
     1. 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.

* + - 1. Use Case 1 - Departing vessels from berth or anchorage

Description: Vessel sends prior to its departure the intended ETD and route through the VTS area to the VTS. The VTS validates the intended ETD and route and approves or sends a denial or a proposal with recommended information on when the vessel can leave the berth/anchorage. The vessel approves the recommended route.

Typical sequence:

1. Vessel wants to leave berth/anchorage
2. The vessel sends message (ETD) through its system to the service and requests traffic clearance to leave berth/anchorage
3. If vessel's schedule is suitable VTS [go to step 7]
4. If vessel's plan (ETD) is not suitable, VTS sends denial or a proposal with recommended information on when vessel can leave the berth/anchorage.
5. Service delivers response to the vessel
6. The vessel acknowledges revised ETD and sends response to the VTS or creates new plan [go to step 2]
7. Berth/anchorage location with ETD are acknowledged by the VTS and sends approval
8. The vessel leaves berth/anchorage
   * + 1. Use Case 2 - Entering or passing through a VTS area

Description: Vessel request for Traffic Clearance entering of passing through a VTS area but has no destination within the VTS area.

Typical sequence:

1. Vessel is about to pass through the VTS area
2. The vessel sends message (ETA) through its system to the service and requests traffic clearance to proceed through the VTS area from the service
3. If vessel's planned route and schedule is suitable, [go to step 7]
4. If vessel's planned route or schedule is not suitable, VTS sends denial or a RTA to the vessel through the service
5. Service delivers response to the vessel
6. The vessel acknowledges revised ETA and sends response to the VTS or creates new plan [go to step 2]
7. Route with ETA are acknowledged by the VTS and sends approval,
8. The vessel enters the VTS area
   * + 1. Use Case 3 - Arriving vessels taking berth

Description: Vessel outside the VTS area request for Traffic Clearance to a berth within the VTS area.

Typical sequence:

1. Vessel is about to enter the VTS area
2. The vessel sends message (ETA at berth location) through its system to the service and requests traffic clearance to proceed to the predefined berth from the service
3. If vessel's planned route and ETA is suitable, then VTS send acknowledgement [go to 7]
4. If vessel's planned route or ETA is not suitable, VTS sends denial or a RTA to the vessel through the service
5. Service delivers response to the vessel
6. The vessel acknowledges revised ETA and sends response to the VTS or creates new plan [go to step 2]
7. Berth location with ETA are acknowledged by the VTS and sends approval
8. The vessel enters the VTS area
   * + 1. Use Case 4 - Arriving vessels heading for anchorage

Description: Vessels from outside the VTS area request for Traffic Clearance to an anchorage within the VTS area.

Typical sequence:

1. Vessel is about to enter the VTS area
2. The vessel sends message (ETA at anchorage location) through its system to the service and requests traffic clearance to proceed to the predefined anchorage from the service
3. If vessel's planned route and ETA is suitable, then VTS send acknowledgement [go to 7]
4. If vessel's planned route or ETA is not suitable, VTS sends denial or a recommended plan to the vessel through the service
5. Service delivers response to the vessel
6. The vessel acknowledges recommended plan and sends response to the VTS or creates new plan [go to step 2]
7. Anchorage location with ETA are acknowledged by the VTS and sends approval
8. The vessel enters the VTS area
   * + 1. Use Case 5 - Transit within a VTS area

Description: Request for traffic clearance while the vessel is already in the VTS area.

Typical sequence:

1. Vessel wants to leave berth or anchorage.
2. The vessel sends message (ETD) through its system to the service and requests traffic clearance to leave berth/anchorage and take other berth or anchorage in the area.
3. If vessel's schedule is suitable VTS, [go to step 7]
4. If vessel's schedule is not suitable VTS sends a denial or proposal which may include additional information on when vessel can leave the berth/anchorage
5. Service delivers response to the vessel
6. The vessel acknowledges revised ETD and sends response to the VTS or creates new plan [go to step 2]
7. ETD and ETA with location are acknowledged by the VTS and sends approval
8. The vessel leaves berth/anchorage
   * + 1. Use Case 6 - External influence to change traffic clearance by VTS

Description: When an approved Traffic Clearance changes due to external causes a new clearance should be agreed.

Typical sequence:

1. Approved plan needs changes due external influences, like weather conditions, delay or occurring hazardous situation
2. VTS or vessel sends request to amend of the approved plan
3. Vessel creates new plan and sends new request via Use case 1-5
   * 1. 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.

* + - 1. USE CASE 1 – VESSEL makes initial contact and receives time slot requirements

Description: Vessel subscribes Slot Management Service and receives requirements

Typical sequence:

1. Vessel subscribes Slot Management Service
2. VTS system sends all planning requirements automatically to vessel
3. Vessel receives requirements
4. Vessel sends “received” acknowledgement automatically to VTS
   * + 1. Use Case 2 – VTS sends time slot for vessel

Description: Prior to the arrival the VTS sends time slot for vessel

Pre-conditions: Vessels have subscribed the VTS Information Service and VTS knows the ETA to certain point/s

Typical sequence:

1. VTS sends time slot for vessel
2. Vessel receives time slot and sends “received” acknowledgement automatically to VTS
   * + 1. Use Case 1 – Publishing the allocation schedules by VTS

Description: When the allocation schedules change, VTS synchronously publishes to the service.

*Note: The unallocated items in the allocation schedules refer to the available resource plans for vessels to request. (The same below)*

Typical sequence:

1. VTS system publishes the latest allocation schedules (full or incremental) to the “Scheduling and Allocation Service”
2. “Scheduling and Allocation Service” acknowledges automatically upon receipt
   * + 1. Use Case 2 – Querying the allocation schedules

Description: The service receives a query message and feedback on the query result.

Typical sequence:

1. “Scheduling and Allocation Service” acknowledges automatically upon receiving the query message
2. “Scheduling and Allocation Service” generates the query result message based on the allocation schedules
3. “Scheduling and Allocation Service” sends the generated message to the initial receiving path
   * + 1. Use Case 4 – Allocating an anchorage

Description: Prior to the arrival of the vessel, the service receives the vessel’s request message of an anchorage, and VTS allocates an anchorage space and a time period for the vessel to use.

Typical sequence:

1. “Scheduling and Allocation Service” acknowledges automatically upon receiving the vessel’s request message of an anchorage (ETA and ETD at anchorage)
2. “Scheduling and Allocation Service” compares:

* If the request is suitable for the published available resource plans [go to step 3]
* If the request is not suitable, the service automatically generates a prompt message [go to step 8]

1. “Scheduling and Allocation Service” sends the request message to VTS system
2. VTS system acknowledges automatically upon receipt
3. VTS system automatically or VTS personnel manually allocates a vacancy with a time period for the vessel to anchor, and updates the allocation schedules of anchorage
4. VTS system publishes the latest allocation schedules of anchorage via use case 1
5. “Scheduling and Allocation Service” generates the allocation message (start and end times of anchorage reservation) based on the latest allocation schedules
6. “Scheduling and Allocation Service” sends the generated message to the initial receiving path
   * + 1. Use Case 5 – Cancelling the allocated schedule from vessel

Description: Due to changes in vessel’s voyage plan or route plan, the service receives the vessel’s cancel message, and VTS cancels the allocated schedule for the vessel.

Typical sequence:

1. “Scheduling and Allocation Service” acknowledges automatically upon receiving the vessel’s cancel message
2. “Scheduling and Allocation Service” sends the request message to VTS system
3. VTS system acknowledges automatically upon receipt
4. VTS system automatically or VTS personnel manually cancels the allocated slot or anchorage for the vessel, and updates the corresponding allocation schedules
5. VTS system publishes the latest allocation schedules via use case 1
6. “Scheduling and Allocation Service” generates the feedback message (cancellation completed) based on the latest allocation schedules
7. “Scheduling and Allocation Service” sends the generated message to the initial receiving path
   * + 1. Use Case 6 – Cancelling the allocated schedule by VTS

Description: Due to special cases, such as receiving a cancellation notice from the relevant department, VTS cancels the allocated schedule for the vessel.

Typical sequence:

1. VTS system automatically or VTS personnel manually cancels the allocated slot or anchorage for the vessel, and updates the corresponding allocation schedules
2. VTS system publishes the latest allocation schedules via use case 1
3. “Scheduling and Allocation Service” generates the notification message (cancelled schedule) based on the latest allocation schedules
4. “Scheduling and Allocation Service” sends the generated message to the vessel
   * + 1. Use Case 8 – Reallocating slots of traffic flow

Description: When external influences are eliminated, VTS unfreezes the allocation schedules and reallocates traffic slots for those waiting vessels.

Typical sequence:

1. VTS system automatically or VTS personnel manually unfreezes the allocation schedules of traffic slots
2. VTS system automatically or VTS personnel manually reallocates passage slots for those waiting vessels, and updates the allocation schedules of traffic slots
3. VTS system publishes the latest allocation schedules of traffic slots via use case 1
4. “Scheduling and Allocation Service” generates the re-allocation messages corresponding to vessels based on the latest allocation schedules
5. “Scheduling and Allocation Service” sends the generated messages to the relevant vessels
   * + 1. Use Case 10 – Modifying the allocated schedule from vessel

Description: Due to changes in vessel’s route schedule, the service receives the vessel’s modification message, and VTS cancels the allocated schedule for the vessel, and then allocates a new traffic slot or an anchorage resource.

Typical sequence:

1. “Scheduling and Allocation Service” acknowledges automatically upon receiving the vessel’s modification message (new ETA/ETA and ETD)
2. “Scheduling and Allocation Service” distributes the modification message, allocates new schedule via use case 3 or use case 4, and cancels the allocated schedule via use case 5.