Service Specification for VTS - Vessel Route Exchange

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# Introduction

This document was produced as part of the work of IALA joint VTS-ENAV task group on development of technical service specifications for VTS. The document is structured according to the IALA Guideline *G1128 The Specification of e-Navigation Technical Services* [1].

## Purpose of the Document

The purpose of this service specification is to provide a holistic overview of the digital service of VTS - Vessel Route Exchange and its building blocks in a technology-independent way, according to the guidelines given in G1128 Error: Reference source not found. It describes a well-defined baseline of the service by clearly identifying the service version.

The aim is to document the key aspects of the VTS – Vessel Route Exchange at the logical level:

* the operational and business context of the service
  + requirements for the service (e.g., information exchange requirements)
  + involved nodes: which operational components provide/consume the service
  + operational activities supported by the service
  + relation of the service to other services
* the service description
  + service use cases
  + service operational sequence
  + logical operations
  + logical data model
  + dynamic behaviour

## Intended Readership

This service specification is intended to be read by service architects, system engineers and developers in charge of designing and developing an instance of the VTS – Vessel Route Exchange.

Furthermore, this service specification is intended to be read by enterprise architects, service architects, information architects, system engineers and developers in pursuing architecting, designing and development activities of other related services.

## Inputs from Other Sources

When developing this service input from S-421 [reference] has been taken into consideration.

# Service Identification

The purpose of this chapter is to provide a unique identification of the service and describe where the service is in terms of the engineering lifecycle.

|  |  |
| --- | --- |
| Name | VTS – Vessel Route Exchange Technical Service |
| ID | urn:mrn:iala:techsvc:ss:vts:res:0.1 |
| Version | 0.1 |
| Description | The VTS – Vessel Route Exchange Service specification describes a standardized service implementing the communication between ship and VTS the exchange of routes. |
| Keywords | VTS, MS1, Route Exchange, Ship Traffic Management, S-421, S-212 |
| Architect(s) |  |
| Status | draft |

# Operational Context

According to *IMO resolution A.1158(32) Guidelines for Vessel Traffic Services* one of the purposes of a VTS is to monitor and manage ship traffic to ensure the safety and efficiency of ship movements.

IALA Guideline *G1089 Provision of a VTS* states that the monitoring and management may include among other things forward planning and prioritization of ship movements to prevent congestion or dangerous situations and improve overall efficiency, establishing a system of traffic clearances and organizing space allocation.

One of the main tasks for VTS is to monitor and manage vessel traffic, including establishing a system for traffic clearances. Traffic clearances may be required in situations when a vessel is:

* entering or prior to entering a VTS area;
* departing from a berth or an anchorage within a VTS area;
* entering or prior to entering a fairway within a VTS area;
* deviations with (improved) planned intentions within a VTS area; or
* prior to commencing a manoeuvre that may be detrimental to safe navigation.

The Maritime Service description for MS1 Vessel Traffic Services describes user needs for digital information services for the exchange of VTS information by electronic means between a VTS and vessel. Vessels using MS1 can receive information related to the management of ship traffic in a digital format that can be displayed in the navigational equipment on board (i.e the ECDIS). Digital information exchange may apply to elements of vessel traffic management that are not time critical.

Traffic clearance is a VTS authorization under conditions specified. The granting, or not granting, of permission to enter, depart or proceed refers to the process of ensuring that there is sufficient space and time for vessels to navigate safely through an area as well as consider other vessels, obstructions, regulatory and environmental factors. Based on the information available, the VTS assesses that it is safe and gives approval for the ship to proceed e.g. from or to a berth or anchorage, subject to the discretion of the Master.

The process of granting permissions includes the use of communication systems to inform mariners about the location and movements of other vessels and potential hazards.

Modern technologies enhance the method of communication in a digital way. Digital communication has advances compared with traditional voice communication. Digital communications enable us to communicate quickly and effectively without the risk for misunderstanding. Digital communication can be used with human interference, but also can be used in automated processes without human interference.

To provide digital communication in globally harmonized way a common understanding of the operational procedures and standardised technical services are necessary.

A more digitally-envisioned operational system for granting permissions will provide several valuable benefits to improve communication and with that safety, efficiency, and sustainability. Digital systems will enhance situational awareness for the vessel and provide real-time information and help to ensure that all parties timely have the necessary information to make informed decisions and take appropriate actions. Traffic Clearance Service paves the way for more automated services and decision support tools.

For effective Traffic Clearance Service, VTS requires the knowledge of vessels intentions. The primary means to share vessels ETA and ETD would be the sharing of vessels route plans, which always includes a schedule. If the vessel is not capable of sharing a route plan, the alternative mean would be sharing only ETA and ETD and destination of vessel. It should be ensured that the times in the different systems are aligned.

This service specification does not define the on-board systems used in for Traffic Clearance Service. When implementing the Traffic Clearance Service the on-board system which the service will be deployed on should also be planned.

It should be noted that if ECDIS will be used as an on-board system, it should be compatible with the performance standards for ECDIS. ECDIS PS does not support the exchange of ETA/ETD timestamps, which limits the use of only timestamp-based systems to back bridge systems on-board.

This service should be used directly from ship board systems.

This service is based on standardized structured data format that will enable the exchange of information related to traffic clearances in the VTS area.

## Use cases for VTS – Vessel Route Exchange

[general description/overview of the use cases]

Afbeelding met tekst, Post-it-briefje, diagram, Plan

Automatisch gegenereerde beschrijving

**Use case 1**

Use-case (name): 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.

Actors: VTS System, ECDIS, Mariner, Route Exchange Service

Frequency of Use: Once per route (from anchorage/berth to anchorage/berth)

Pre-conditions: Route is planned

Nominal sequence scenario:

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 Service” before departure, but the route must be shared at latest according to local rules
4. The Route Exchange Service checks that at least following information is included in the route

* Ship Identification Information
* Waypoints
* Schedule

1. The Route Exchange Service sends the route to the VTS System
2. The Route Exchange Service sends “received” acknowledgement automatically
3. VTS System displays the route as needed to the VTS personnel

Post-conditions: VTS receives vessel´s initial route

Afbeelding met tekst, diagram, lijn, Lettertype

Automatisch gegenereerde beschrijving

**Use case 2**

Use-case (name): VTS gives route recommendation to vessel

Description: VTS gives route recommendation to vessel

Actors: VTS System, VTS personnel, Mariner, ECDIS

Frequency of Use: Current limited use, grow significantly over time

Pre-conditions: Route is crosschecked by VTS system and VTS personnel and route requires changes

Nominal sequence scenario:

1. VTS personnel creates the recommendation for vessel
   * VTS system can assist VTS personnel to create the route recommendation
2. VTS system sends back the recommended route to ECDIS (planning station)
   * Route can contain changes to waypoints and/or schedule
3. Vessel sends “route received” acknowledgement automatically
4. One of the following
   1. Vessel does not agree with changes (go to use case XXXXXX)
   2. Vessel implements the changes

Post-conditions: Vessel implements changes to route

Afbeelding met tekst, diagram, Parallel, schermopname

Automatisch gegenereerde beschrijving

* **Use case 3**

Use-case (name): Updates are restricted to geometry

Description: VTS system requires updates for whole route or restricted by geometry

Actors: VTS System, ECDIS

Frequency of Use: Maximum few times per route

Pre-conditions: The initial route has already been sent and approved (use case 1)

Nominal sequence scenario:

* 1. VTS system informs ECDIS what data is expected when route changes

**Afbeelding met tekst, schermopname, lijn, Lettertype

Automatisch gegenereerde beschrijving**

**Use case 4**

Use-case (name): Vessel´s route changes

Description: Vessel wants to change its waypoints and/or schedule

Actors: VTS System, VTS personnel, Mariner, ECDIS

Frequency of Use: When ever necessary according to local rules

Pre-conditions: The initial route has already been sent and approved (use case 1)

Nominal sequence scenario:

1. Mariner makes changes to waypoints and/or schedule
2. ECDIS sends updated information to VTS system (use case 3)
3. VTS system sends “received” acknowledgement automatically

Post-conditions: VTS receives vessel´s updated route

Afbeelding met tekst, schermopname, diagram, lijn

Automatisch gegenereerde beschrijving

**Use case 5**

Use-case (name): Vessel does not arrived to VTS as planned

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

Actors: VTS System, VTS personnel, Mariner, ECDIS

Frequency of Use: When route is change so that vessel does not enter geometry area

Pre-conditions: The initial route has already been sent and approved (use case 1) and vessel is outside of the geometry area

Nominal sequence scenario:

1. Mariner makes changes the route where no waypoints are located inside geometry area
2. ECDIS sends cancellation to VTS system
3. VTS system sends “received” acknowledgement automatically

Post-conditions: Route is terminated in VTS system

Afbeelding met tekst, lijn, diagram, schermopname

Automatisch gegenereerde beschrijving

**Use case 6**

Use-case (name): VTS approves the route

Description: VTS personnel approves without changes

Actors: VTS System, VTS personnel, Mariner, ECDIS

Frequency of Use: At least once per route

* Pre-conditions: Route is crosschecked by VTS system and VTS personnel and route does not require changes

Nominal sequence scenario:

1. VTS personnel marks the route “ok” on the VTS system
2. VTS system sends approved to ECDIS
3. ECDIS displays the route approval to mariner

Afbeelding met tekst, diagram, lijn, Lettertype

Automatisch gegenereerde beschrijving

**Use case 7**

Use-case (name): Service discovery

Description: A vessel can discover the available route exchange services with their geometry

Actors: ECDIS, Maritime Service Registry

Frequency of Use: At least once per route

Pre-conditions: XXXXXXXXXXX

Nominal sequence scenario:

1. Service is registered in the Maritime Service Registry
2. ECDIS searches for route exchange services based on route geometry
3. Maritime Service Registry sends list of available services along route

Afbeelding met tekst, schermopname, diagram, Lettertype

Automatisch gegenereerde beschrijving

Figure 3 gives an overview of the dataflows for the VTS – Vessel Route Exchange Service.

[dataflow schema to be added]

Figure 3: Route Exchange dataflow

## Functional and Non-functional Requirements

### Functional requirements

|  |  |
| --- | --- |
| **Requirement Id** | RESF001 |
| **Requirement Name** | Receive route from vessel |
| **Requirement Text** | A vessel must be able to send its route to the service. The service must have the ability to forward the received route to the VTS System.  A route should contain at least the vessel identification, waypoints and schedule |
| **Rationale** | Sending the route of the vessel to the service is a core requirement of the service. |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement Id** | RESF002 |
| **Requirement Name** | Send route recommendation to vessel from VTS |
| **Requirement Text** | The service must facilitate the sending of a route recommendation from VTS to the vessel. The recommendation may be a part of a rejection of a route received from a vessel or standalone. |
| **Rationale** | When VTS personnel are either reviewing a received route from a vessel or trying to organize traffic and need to suggest a route to a vessel the service must be able to send a route recommendation to the vessel. |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement Id** | RESF003 |
| **Requirement Name** | Send approval of route from VTS to vessel |
| **Requirement Text** | The service must facilitate the sending of an approval of a route from VTS to the vessel. This will be done by a S-212 route approval message. |
| **Rationale** | The current S-421 data model does not support to send only a short approval message. For now the complete route as received by the vessel should be included in the approval communication. This implies that a lot of data communication is wasted on sending the approved route back to the vessel. The service must not send a dummy route instead of the received route by the vessel, because this may cause confusion for the mariner and/or the ECDIS. |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement Id** | RESF004 |
| **Requirement Name** | Provide area of interest of VTS to vessel |
| **Requirement Text** | The service must provide its area of interest in the geometry used when registering to a service registry. |
| **Rationale** | The geometry is used to find the available route exchange services along the route of the vessel. The geometry can also be used by the vessel to filter the data sent from the vessel if so requested by the VTS. |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement Id** | RESF005 |
| **Requirement Name** | Request route changes to only cover area of interest |
| **Requirement Text** | The vessel should have an interface that the service can call to request all changes to routes sent by the vessel, to only contain the information that is limited to the area of interest of the VTS.  This interface can also be used to turn off filtering.  The default behaviour is to send the full route. |
| **Rationale** | Route files might be rather large and require some compute power to process, it is therefore recommended to limit the amount of data that should be exchanged regarding the route.  If the vessel does not support the filter for the area of interest, every change to the route will imply that the whole route will be sent |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement Id** | RESF006 |
| **Requirement Name** | Service integration with VTS System |
| **Requirement Text** | The service must integrate with the VTS System so that the information received from vessels can be utilized by the VTS System. |
| **Rationale** | The exact details of how this requirement are fulfilled are left to each implementer as they depend on the functionalities of the VTS System itself. In some cases, it may be better for the VTS System to poll the service, in other cases an event may be triggered, or a simple API call on the VTS System may be used. From the perspective of this specification the implementation details of how the service integrates with the VTS System can be left open. |
| **Author** |  |

### Non-functional requirements

|  |  |
| --- | --- |
| **Requirement Id** | TCSNF001 |
| **Requirement Name** | Authenticity |
| **Requirement Text** | The recipient of information must be able to verify the authenticity of the received datasets. The technical designs must describe how this is managed. |
| **Rationale** |  |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement Id** | TCSNF002 |
| **Requirement Name** | Integrity |
| **Requirement Text** | It must be clear to both service provider and consumer whether changes have been made to the information after the dataset was created. All messages must be signed with the correct certificates so that the contents of a message can be validated. The technical designs must describe how this is managed. |
| **Rationale** |  |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement Id** | TCSNF003 |
| **Requirement Name** | Availability |
| **Requirement Text** | The service must always be available with the ability defined by Owner of the service to deliver traffic clearance information to its consumers. The technical designs must describe how this is managed. |
| **Rationale** | The service must be available based on the VTS Service hours. |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement Id** | TCSNF004 |
| **Requirement Name** | Performance – timeliness |
| **Requirement Text** | The service must provide a technical response to an incoming request instantly. This response is by necessity a technical delivery acknowledgement and not a business process response. This applies both to requests coming from vessels and VTS System. The technical designs must describe how this is managed. |
| **Rationale** | Especially from a vessel’s point of view it is important to get an acknowledgement that the service has received a request so that the vessel’s system does not need to try resending the request. |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement Id** | TCSNF005 |
| **Requirement Name** | Reliability |
| **Requirement Text** | The service must provide a retry mechanism to ensure that messages are delivered to the vessel or VTS System even if the first request fails. The technical designs must describe how this is managed. |
| **Rationale** | As the service is effectively a proxy between the VTS System and vessel’s systems it is vital that message delivery to the real consumer is ensured by retrying sending the message.  This is of increased importance when the vessel is behind an unreliable network connection or the actual data carrier changes during messaging. |
| **Author** |  |

## Other Constraints

### Relevant Industrial Standards

|  |  |  |  |
| --- | --- | --- | --- |
| **Nr.** | **Standard** | **Version** | **Reference** |
| 1. | IALA Guideline G1128 | ED 1.5  (draft) | The Specification of E-navigation Technical Services |
| 2. | IALA Guideline G1143 | ED 3.1 June 2021 | Unique identifiers for maritime resources (MRN) |
| 3. | IHO Standard S-100 | ED 5.0.0 December 2022 | IHO Universal Hydrographic Data Model <https://iho.int/uploads/user/pubs/standards/s-100/S-100_5.0.0_Final_Clean_Web.pdf> |
| 4. | S-212 | 0.7 (draft) |  |
| 5. | IEC S-421 | ED 1.0 | Route Plan based on S-100 (IEC 63173) |

### Operational Nodes

The following table describes the operational nodes of the service.

|  |  |
| --- | --- |
| Operational Node | Remarks |
| Vessel | *Participating ship* that is required to participate with vessel traffic services and is sailing in a VTS area where there is coverage of technical service. |
| VTS centre | *VTS centre* responsible for a one or several *VTS Areas* for which the *VTS provider* is authorized to deliver vessel traffic services. A VTS centre is responsible for VTS traffic clearance service within its coverage area. |

# Service Overview

## Logical Operations

The following logical operations must be provided in the designs that follow this specification:

|  |  |  |  |
| --- | --- | --- | --- |
| **Operation** | **Description** | **Required** | |
| **Vessel** | **VTS** |
| Send message | An operation to send a message. Message may be an initial plan, proposal, or a disapproval. | x | x |
| Receive message | An operation that allows the receiving of messages. When message is received, and acknowledgement must be sent. | x | x |
| Receive acknowledgement | An operation that allows the reception of an acknowledgement. | x | x |

**As an example**, in a typical HTTP REST-based approach the send message is the HTTP request that sends the message to the recipients HTTP endpoint which serves as the receive operation. The receive acknowledgement can just as easily be the content of the HTTP response that the recipient sends in response to the request. This requires that both the vessel and ship has an HTTP server that has defined endpoints for all operations and can communicate the URLs of these endpoints to each other.

## Logical Parameters

As the logical operations are very abstract the logical parameters and response contents will be described later in the document. Actual parameter structures, response structures or error handling is not specified. These will be defined in more detail in the technical design documents.

# Service Data Model

The service must consume a data model that is a direct subset of S-212.

For complete and updated documentation of the S-212 data model refer to the latest S-212 Product Specification which can be found at IALA S-200 Data modelling web site <https://www.iala-aism.org/technical/data-modelling/iala-s-200-development-status/s-212/>

The data transfer between service and consumers MUST always conform to the model displayed below. Fields that are optional are identified with MAY and SHOULD in the descriptions below.

This data model does not define the envelopes in which the data is sent between the ship and VTS system or the technical interface parameters. This data model does not consider response acknowledgement messages as they are technology dependent. This only defines the subset of S-212 that must be supported by the service.

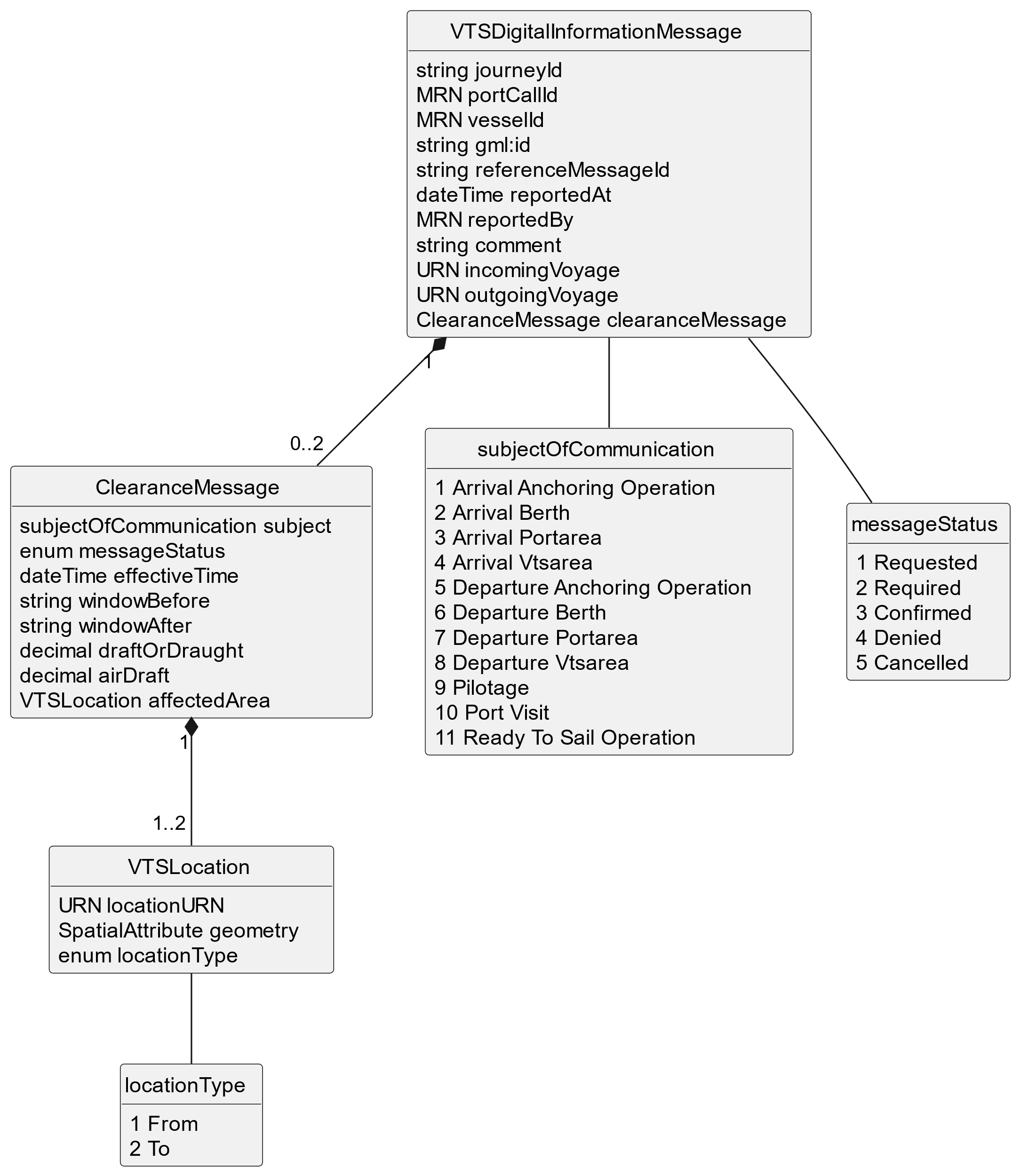


Figure 4: Traffic clearance data model diagram

The description of the data model is as follows:

* Must be one of:
  + portCallId – MRN and preferred if known.
  + journeyId – Only to be used if portCallId is not available. A uuid or similar unique identifier is preferred.
* vesselId – vessel MRN, IMO SHOULD is preferred, but MMSI or any other suitable identifying MRN MAY also be used.
* gml:id – UUIDv4 to uniquely identify the message across systems.
* referenceMessageId – UUIDv4, MUST be used in all messages following the first message and must refer to the message being replied to.
* reportedAt – SHOULD be used as timestamp of message creation. Implementations MAY decline any messages that do not contain this information.
* reportedBy – SHOULD be used to identify the MRN or other identity of the person sending the message, for audit trails etc. Implementations MAY decline any messages that do not contain this information.
* comment – MAY be used to pass additional information as part of the message for human consumption.
* incomingVoyage / outgoingVoyage – SHOULD be used to identify route that is shared or to ensure that all communication on a single arrival / departure is easily connected to a specific journey. When passing through a VTS area incomingVoyage is preferred. MRN is to be preferred, but validation will accept any valid URI.
* clearanceMessage – must occur at least once or at most twice to allow for cancellations and transitions
  + subject – Must be one of: Arrival Anchoring Operation, Arrival Berth, Arrival Portarea, Arrival Vtsarea, Departure Anchoring Operation, Departure Berth, Departure Portarea, Departure Vtsarea, Pilotage, Port Visit, Ready to Sail Operation
  + effectiveTime – timestamp of the ETA/ETD being communicated.
  + windowBefore / windowAfter – MAY be used to give relative offset of the window requested / given. In hh:mm format.
  + draftOrDraught – The vertical distance, at any section of a vessel from the surface of the water to the bottom of the keel. Especially useful for anchorage operations.
  + airDraft – the vertical distance from the highest section of the vessel to the surface of the water.
  + messageStatus ­– MUST be one of Cancelled, Confirmed, Denied, Requested, or Required
  + affectedArea – 1…2 instances of VTSLocation where
    - one of
      * geometry – allows the following geometry types: GM\_Point, GM\_Polygon, S100\_ArcByCentrePoint, S100\_CircleByCentrePoint
      * locationURN – preferably a MRN but may be any valid URN
    - locationType – semantically correct option from enumeration. If two values instances of VTSLocation are present the locationType must be different in both instances.

# Service Dynamic Behaviour

This section describes the interactive behaviour of the traffic clearances between ship and shore.

Before the exchange of information is initiated, the message recipient retrieves the identity of the service sender from the service infrastructure and performs an authentication procedure. If not authenticated, the service request is rejected. The specific authentication procedure is out of scope of the service specification and is described in the technical designs of this service. Thus, the following diagrams do not describe these steps.

The following diagrams contain variations of the use cases described above and do not cover every single option of looping through multiple steps of negotiation for the different operations that are supported. They are intended to capture and describe the required changes in the messages that support all of the functionalities that the use cases require.

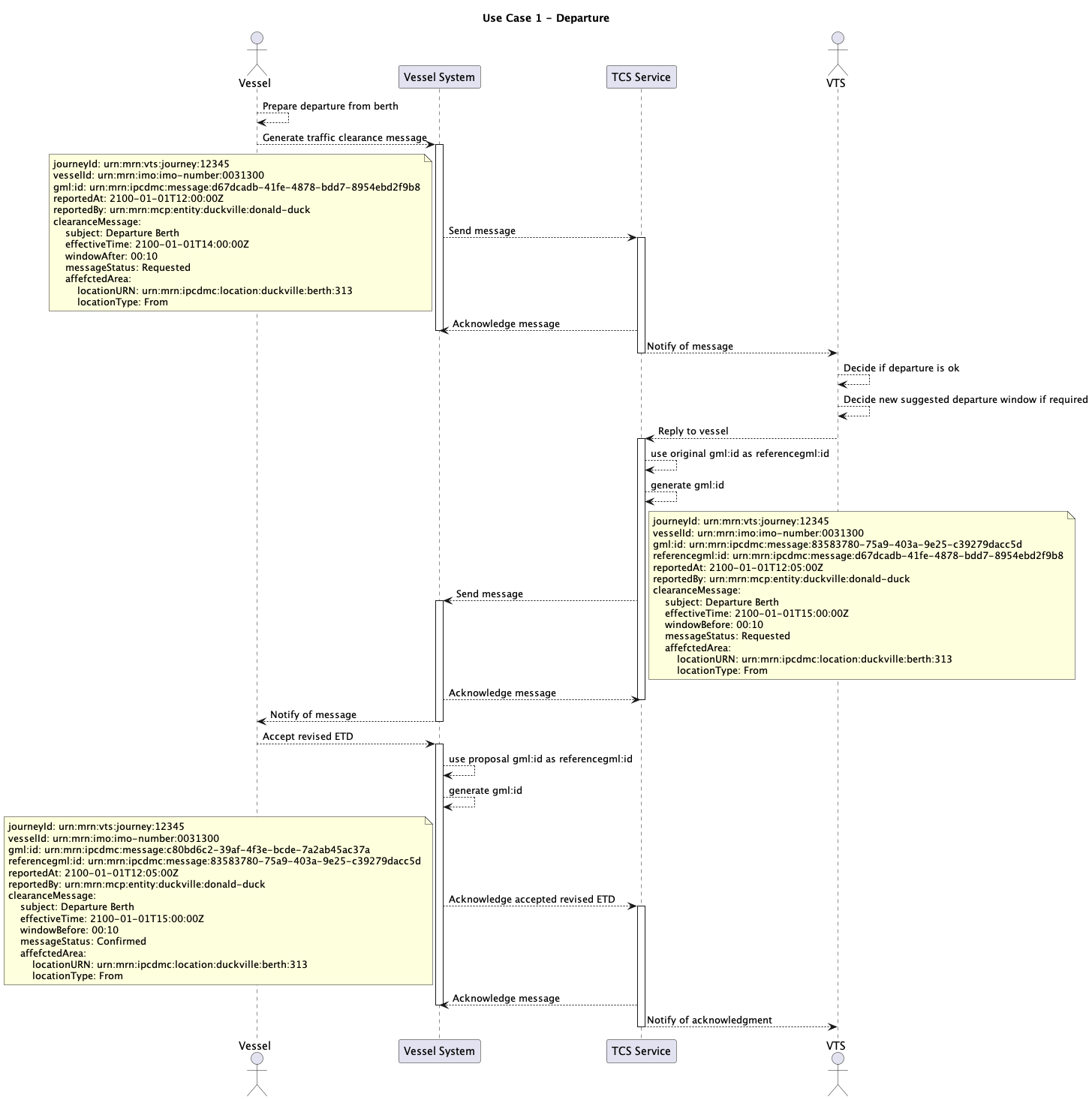


Figure 5 Use Case 1 sequence diagram

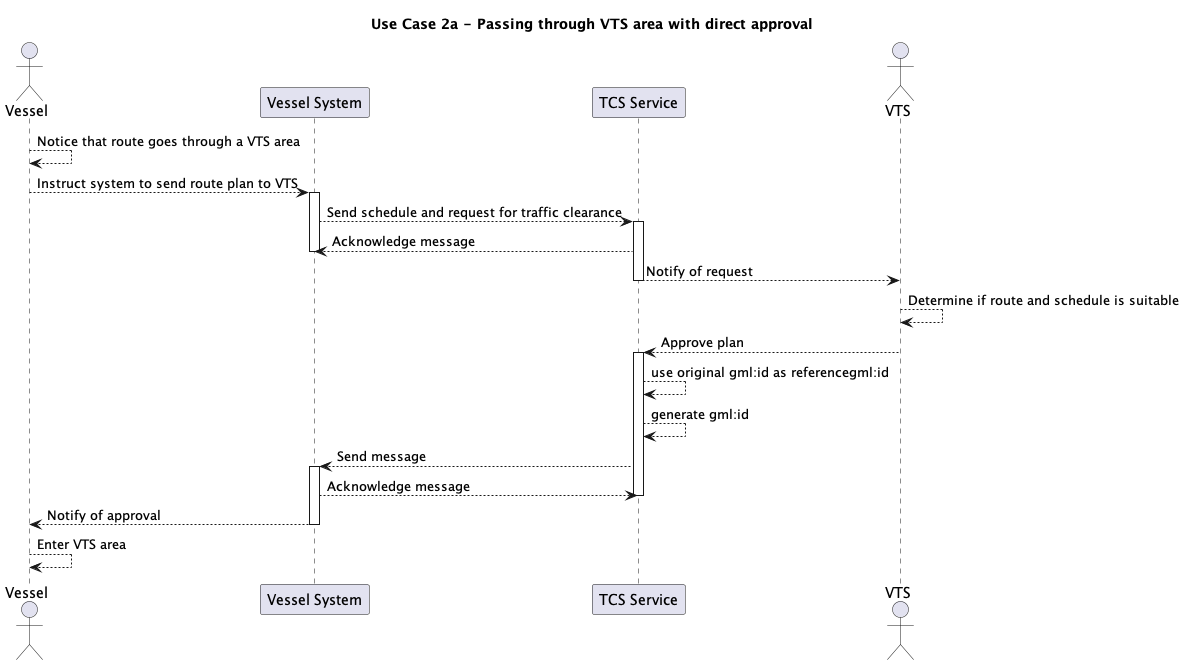


Figure 6 Use Case 2 variation 1 sequence diagram

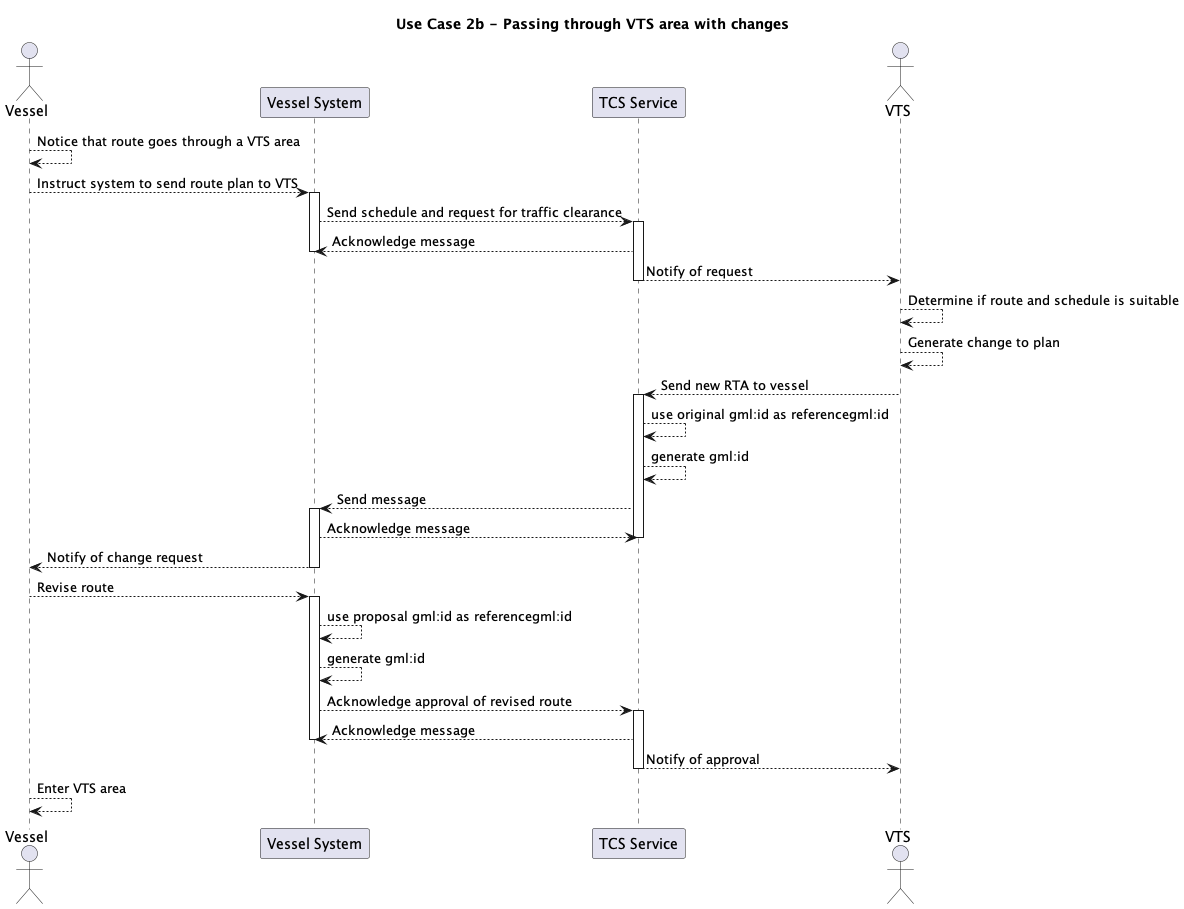


Figure 7 Use Case 2 variation 2 sequence diagram

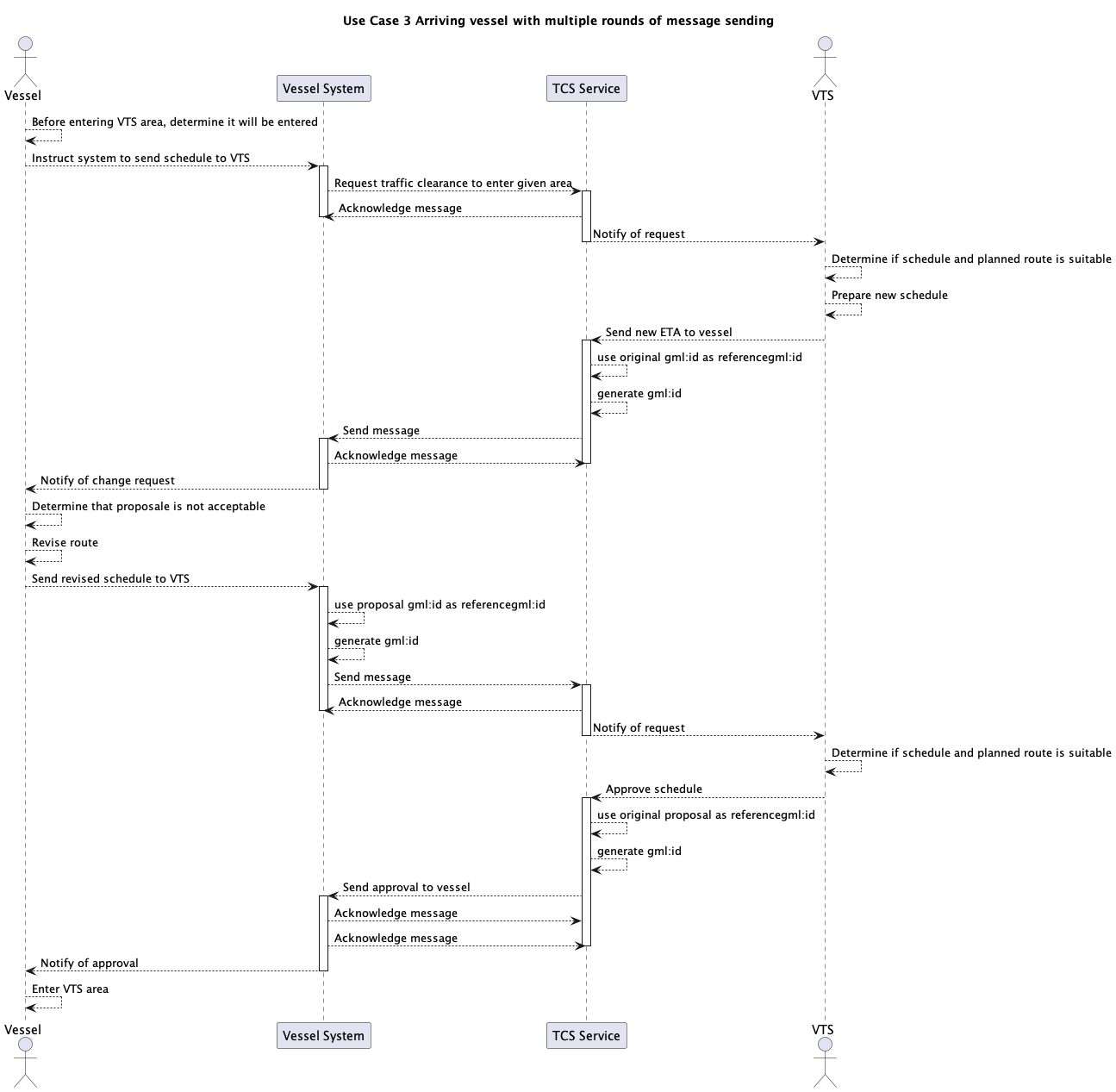


Figure 8 Use Case 3 sequence diagram

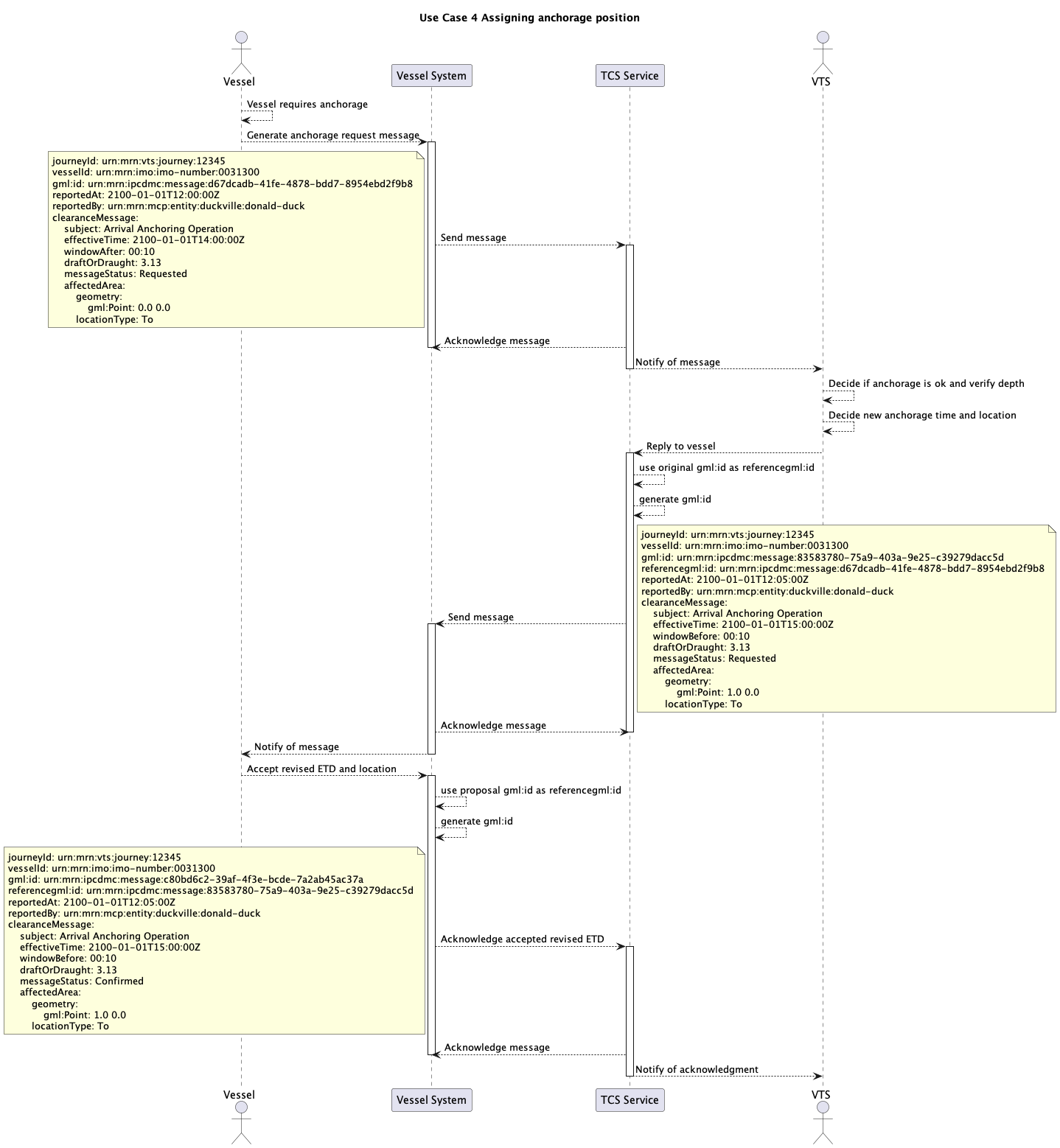


Figure 9 Use Case 4 sequence diagram

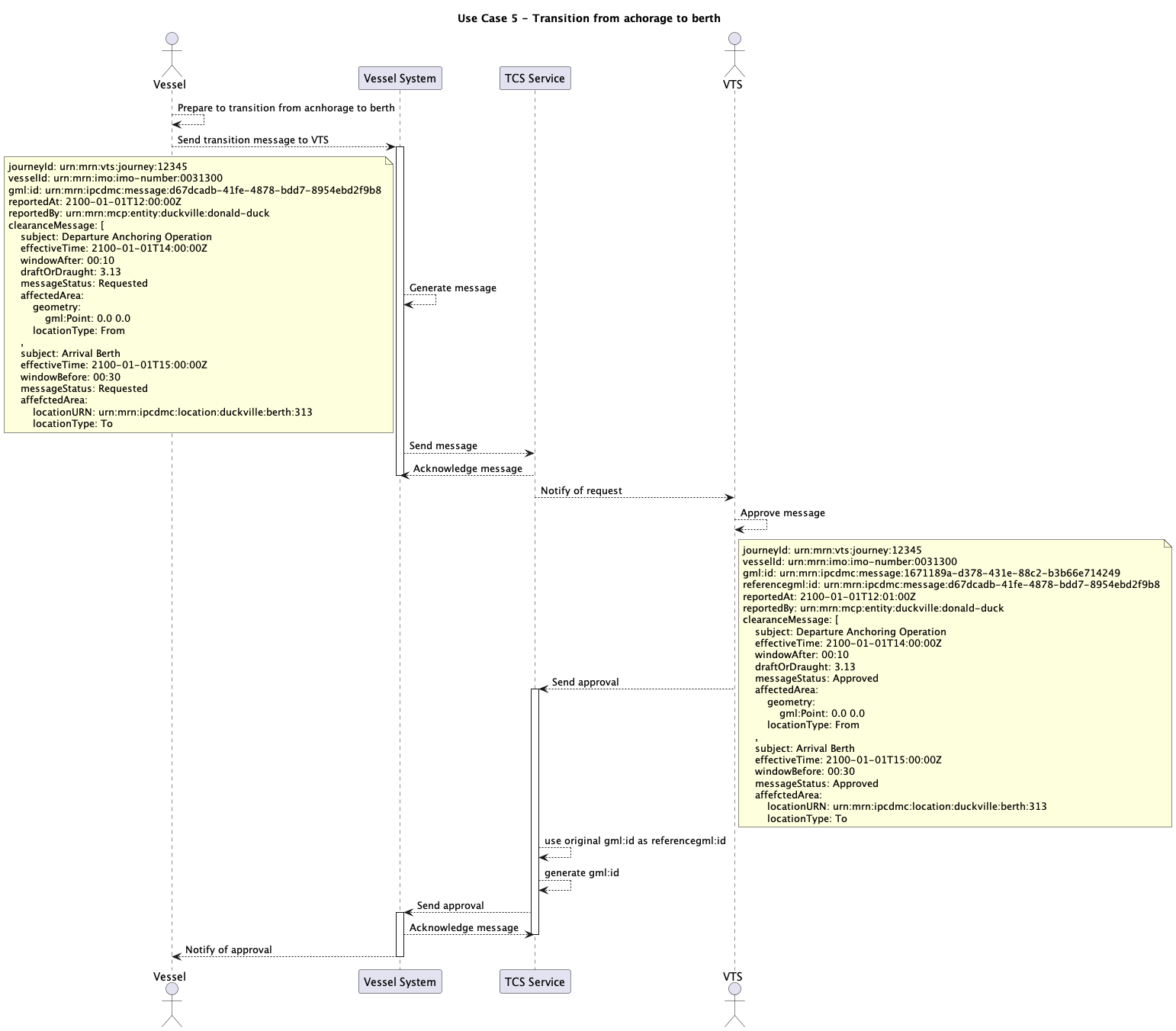


Figure 10 Use Case 5 sequence diagram

Note that the following use case may be initiated by either the ship or VTS. The following diagram focuses on illustrating the message structures in this use case.

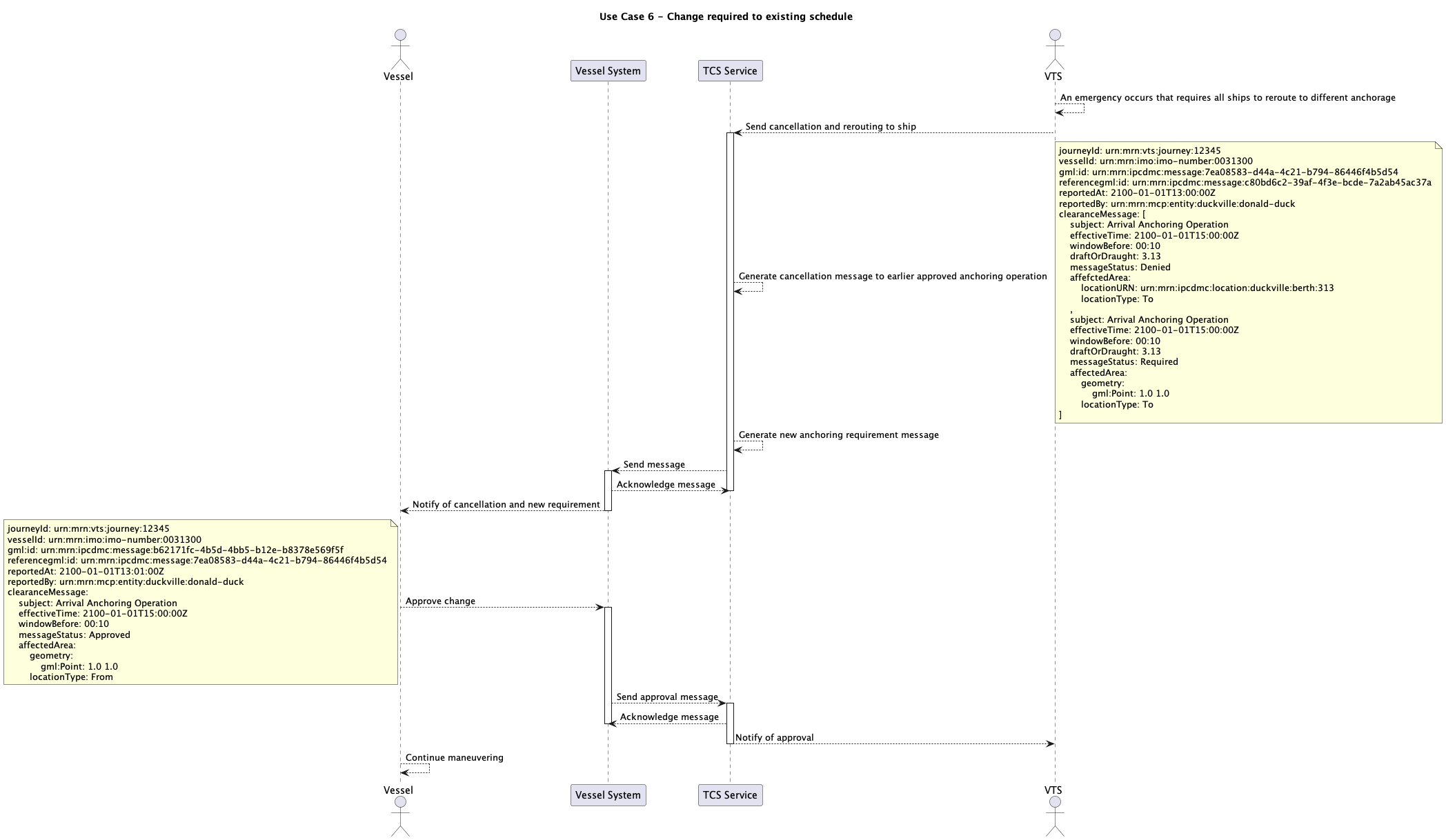


Figure 11 Use Case 6 sequence diagram

# References

| Nr. |  | Reference |
| --- | --- | --- |
| 1. IALA Guideline G1128 |  | THE SPECIFICATION OF E-NAVIGATION TECHNICAL SERVICES |
| 1. IMO FAL.5 /Circ.52 |  | Guidelines for Harmonized Communication and Electronic Exchange of Operational Data for Port Calls |
| 1. IALA Recommendation R1023 |  | MARITIME RESOURCE NAMES |
| 1. IHO Standard S-100 |  | IHO Universal Hydrographic Data Model  <https://iho.int/uploads/user/pubs/standards/s-100/S-100_5.0.0_Final_Clean_Web.pdf> |
| 1. IALA data model S-212 |  | IALA VTS Digital Information Service Product Specification |

# Acronyms and Terminology

## Acronyms

|  |  |
| --- | --- |
| Term | Definition |
| API | Application Programming Interface |
| MRN | Maritime Resource Name |
| RTA/RTD | Requested time of arrival/departure |
| URI | Uniform Resource Identifier |
| UUID | Universally Unique Identifier v4 |
| XML | Extendible Mark-up Language |
| XSD | XML Schema Definition |

## Terminology

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| Term | Definition |
| Operational Node | A logical entity that performs activities. Note: nodes are specified independently of any physical realisation.  Examples of operational nodes in the maritime context are: Maritime Control Center, Maritime Authority, Ship, Port, Weather Information Provider, … |
| Service | The provision of something (a non-physical object), by one, for the use of one or more others, regulated by formal definitions and mutual agreements. Services involve interactions between providers and consumers, which may be performed in a digital form (data exchanges) or through voice communication or written processes and procedures. |
| Service Consumer | A service consumer uses service instances provided by service providers. All users within the maritime domain can be service customers, e.g., ships and their crew, authorities, VTS centres, organizations (e.g., meteorological), commercial service providers, etc. |
| Service Data Model | Formal description of one dedicated service at logical level. The service data model is part of the service specification. Is typically defined in UML and/or XSD. If an external data model exists (e.g., a standard data model), then the service data model shall refer to it: each data item of the service data model shall be mapped to a data item defined in the external data model. |
| Service Interface | The communication mechanism of the service, i.e., interaction mechanism between service provider and service consumer. A service interface is characterised by a message exchange pattern and consists of service operations that are either allocated to the provider or the consumer of the service. |
| Service Operation | Functions or procedure which enables programmatic communication with a service via a service interface. |
| Service Physical Data Model | Describes the realisation of a dedicated service data model in a dedicated technology. This includes a detailed description of the data S-212 to be exchanged using the chosen technology. The actual format of the service physical data model depends on the chosen technology. Examples may be WSDL and XSD files (e.g., for SOAP services) or swagger (Open API) specifications (e.g., for REST services). If an external data model exists (e.g., a standard data model), then the service physical data model shall refer to it: each data item of the service physical data model shall be mapped to a data item defined in the external data model.  In order to prove correct implementation of the service specification, there shall exist a mapping between the service physical data model and the service data model. This means, each data item used in the service physical data model shall be mapped to a corresponding data item of the service data model. (In case of existing mappings to a common external (standard) data model from both the service data model and the service physical data model, such a mapping is implicitly given.) |
| Service Provider | A service provider provides instances of services according to a service specification and service instance description. All users within the maritime domain can be service providers, e.g., authorities, VTS centres, organizations (e.g., meteorological), commercial service providers, etc. |