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| IALA Guideline |

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Delineating VTS area

Functionality and performance specifications

Working paper, output from VTS ##

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# introduction

PURPOSE

IALA document G1150 outlines a series of requirements on how to establish, plan, and implement Vessel Traffic Services. One crucial task in establishing a VTS is the delineation of VTS area and sub-areas. This guideline aims to provide a framework for delineating VTS area and sub-areas focusing on the following aspects:

* Providing detailed factors to be considered when delineating VTS area and sub-areas;
* Offering steps and methods for delineating and changing VTS area and sub-areas; and
* Guiding the subsequent assessment of delineated VTS area and sub-areas.

DEFINITIONs OF VTS sub-area and delineation of VTS area

* **Delineation of VTS area（delineating the VTS area）** means the process of determining the area in which the VTS provider offers vessel traffic services, including but not limited to a series of activities such as evaluating VTS functions and resources, delineating and declaring the VTS area. In addition to specifying the scope of the VTS area, it is also necessary to specify the number and scope of VTS sub-areas.
* **VTS sub-area** means a smaller, relatively independent sector in a delineated VTS area. A VTS area may be subdivided into several sub-areas.

## Importance and Necessity of VTS Area Delineation

Reasonably delineating VTS area and sub-areas plays a very important role in VTS function:

* To improve efficiency of ship navigation and safety effectiveness. Delineating on the basis of scientific analysis and comprehensive assessment can effectively reduce the conflict of navigation and make the navigation of ships safer and more efficient.
* To facilitate ship-to-shore communication efficiency. It makes ship-shore communication smoother and facilitates ships to obtain VTS services better.
* To optimize VTS resources. It helps to realize the rational utilization of the existing space resources, human resources, communication resources and other support resources, especially the coordination between neighboring VTS, and to improve the operation efficiency of VTS system and the collaborative ability of emergency response.

# responsibility

When delineating VTS area and sub-areas, Competent authorities for VTS and VTS providers are advised to assume the following responsibilities:

* **Competent authority for VTS** shall formulate rules and standards related to the delineating the VTS area and sub-areas in its own country in accordance with international conventions, technical standards and national laws and regulations, supervise and manage VTS operations to ensure that VTS area and sub-areas delineation complies with established standards and requirements, including the supervision and management of delineating and changing VTS area and sub-areas.
* **VTS provider** shall formulate and implement the plan of delineating the VTS area and sub-areas, and ensure the normal operation of VTS systems, track and evaluate the operation of the VTS area and sub-areas delineation and make improvement as appropriate.

# Factors and Principles for delineating VTS area and Sub-areas

Factors to be Considered When delineating VTS Area

When delineating a VTS area, various factors should be comprehensively considered to ensure the rationality and effectiveness of the area, including but not limited to:

* Regulatory requirements for VTS safety supervision and service
* Different countries and regions have various domestic and regional regulatory requirements for VTS safety supervision and service. These requirements must be considered to ensure timely and effective supervision and service for vessels within the VTS area.
* Effective coverage of VTS system equipment, systems and facilities
* The performance and working frequency of VTS sensors, such as radar, AIS and VHF, with limited transmission distances directly decide the maximum extendable range of the VTS serviced area.
* It should be ensured that VTS equipment, systems and facilities can effectively monitor all vessels within the delineated VTS area.
* SOLAS Convention requirements for implementing VTS beyond territorial waters
* The use of vessel traffic services can only be mandatory within the territorial waters of the coastal state. This must be fully considered when delineating VTS areas.
* Ship reporting system scope
* The Ship Reporting System (SRS) requires ships to regularly or conditionally report their position, course, speed, and other relevant information to the VTS centres or other competent authorities when entering, passing through, or leaving specific areas. Defining the applicable or triggering scope of the SRS helps to obtain timely dynamic information about ships, improving maritime traffic management efficiency and safety.
* Ship routing system scope
* Ensure that the delineated VTS area including relevant ship routing systems helps optimize channel management and reduce the risk of collisions and other accidents.
* Distribution of habitual shipping routes
* Analyse information such as ship’s navigation tracks and speeds to determine the distribution of habitual shipping routes.
* The coverage of VTS area should include these habitual routes, which helps VTS to organize traffic and improve efficiency and safety of navigation.
* Ship traffic volume
* Higher volume of ship traffic generally means higher risk of collision. Identifying high-volume traffic areas through traffic flow analysis and including them in the VTS area will significantly reduce the risk of collision and improve efficiency of navigation.
* High-Accident areas
* Determine the range of high-accident areas by recording and analysing historical accidents.
* The VTS area coverage should include these high-accident areas and enhance monitoring frequency and service efforts in these areas, which will reduce future accident rates and enhance emergency response capabilities when accidents happen.
* Artificial structures such as bridges, reservoirs, and wind farms
* The distribution of artificial structures like bridges, reservoirs, and wind farms should be fully considered and incorporated into the VTS area to ensure effective supervision of these important areas.
* Geographic distribution of channels, anchorages, and docks etc.
* Channels, anchorages, and docks etc. are important navigation elements.
* Their distribution should be fully considered and included in the VTS area to ensure effective supervision of these important areas.
* Hydrometeorological conditions
* Hydrometeorological conditions within the area should be considered. For example, during the combination of daily high tide and monthly tidal surge, the instantaneous high-speed flow in certain waters may greatly affect ship’s manoeuvring.
* The VTS area should include waters significantly affected by hydrometeorological changes.
* Range of adjacent VTS centres
* If there are two or more adjacent VTS centres, they should properly coordinate their respective VTS area boundaries to avoid cross-border management conflicts.
* The administrative area of a country or a region
* In international navigation waters, VTS area should be reasonably delineated according to the boundaries of territorial seas and jurisdictional waters between neighbouring countries to avoid cross-border conflicts. For jurisdictional waters involving different administrative regions within the country, reasonable division should also be ensured for consistent management.
* Port development plans in the near future
* It should take port development plans in to consideration such as the construction or demolition of docks and offshore wind farms. These changes should be fully considered when delineating a VTS area as they will directly affect ship traffic volume and navigation patterns.
* Particularly sensitive sea areas (PSSA)
* Particularly Sensitive Sea Areas (PSSA) are marine areas that require special protection through IMO action, which have been identified as being of special significance in terms of ecological, socio-economic, scientific characteristics, etc. Particularly sensitive sea areas are particularly vulnerable to shipping activities.
* When delineating the VTS area, it is important to consider whether PSSA should be included in the VTS area to minimize the adverse impact of maritime traffic.
* Outcomes of the IALA Risk Assessment
* Based on the outcomes of the IALA risk assessment, VTS area should be reasonably delineated. If possible, high-risk areas should be included in the VTS area.

Factors to BE ConsiderED When delineating VTS Sub-areas

After the VTS area is delineated, further actions should be taken to divide the area into several sub-areas for the purpose of improving management efficiency and optimizing resource allocation. Scientific VTS area and sub-areas delineation is conducive to dividing complex traffic management tasks into smaller management units, improving the refined management of VTS and the efficiency of handling emergency incidents. Further consideration should be given to the following factors when delineating VTS Sub-areas:

* Scope of VTS area
* The scope of the VTS area and the volume of traffic in the covered area determine whether it is necessary to divide the VTS area into sub-areas.
* Workload of individual sub-area operators
* Sub-areas should be reasonably delineated based on VTS operators' workload to avoid excessive work burden and ensure each VTS operator can efficiently conduct ship management within their sub-areas.
* Available VHF communication resources
* VHF communication resources should be scientifically planned and rationally utilized to avoid or reduce the mutual interference of VHF communication channels and ensure unimpeded communication between ships and VTS centres.
* Areas where ships frequently alter course, manoeuvre, or approach convergence waters, route intersections, and traffic crossings
* These complex waters require more intensive monitoring and management to ensure safety of navigation. Sub-area boundaries should be avoided in these waters.
* High-accident areas
* It should be avoided to divide high-accident areas into different sub-areas as far as possible, which helps to reduce the occurrence of accidents through VTS management, and facilitate the emergency response and coordination when accidents happen.
* Distribution of Port Areas and Docks
* The distribution of docks within the VTS area should be taken into account. Ideally, the same port area should be included within a single sub-area to avoid delineating the same dock group into two sub-areas.
* Geographical Environment
* Fully consider the geographical features of the area, such as islands, reefs, and continental coastlines, if feasible, try to make use of topography to reasonably delineate sub-areas.
* Hydrometeorological Conditions
* Considering hydrometeorological conditions such as tides when delineating sub-areas. Waters with complex local hydrometeorological conditions should be divided into one sub-area as far as possible.

Principles to be Followed When Delineating AND CHANGING VTS area and Sub-areas

In addition to the factors listed in this guideline, the following principles should be adhered to when delineating VTS area and sub-areas:

* Legitimacy and compliance
* Comply with international conventions. For example，the item stated in the SOLAS Convention that: " the use of ship traffic services can only be regarded as a mandatory requirement in the waters belonging to the territorial sea of the coastal State" should be fully taken into account when delineating the VTS area and sub-areas.
* Comply with local laws and regulations. Different requirements made by the appropriate authorities for the implementation of VTS, which should be fully taken into account in the delineation of VTS areas and sub-areas.
* Safety and convenience
* When delineating VTS area and sub-areas, the factors mentioned in section 3.1 and 3.2 should be taken into full consideration. Based on a comprehensive assessment of various influencing factors, the VTS areas and sub-areas should be prudently delineated, and the primary principle to be followed should be safety the first. Whether it is delineated the VTS area or sub-areas, reducing the risk of collision and ensuring effective surveillance and communication coverage should be an important consideration.
* It should be noted that VTS area and sub-areas boundaries should conform to ship's navigation and operation habits as closely as possible, and straight lines or arcs (such as landmark, etc.) should be used as possible to facilitate expression and identification, avoiding excessive points for identification of boundaries (such as wavy or jagged lines, etc.), which may increase the burden of ship identification.
* Efficiency promotion
* When delineating VTS area and sub-areas, the management resources of the VTS centre, such as personnel and equipment, should be reasonably allocated according to factors including the volume of traffic, degree of risk in each sub-area. Allocate more resources to heavy traffic or high-risk sub-areas to improve management efficiency.
* The number of sub-areas should be limited within a reasonable range. On the premise of ensuring the full function of VTS, the ships’ burden including crossing sub-areas and switching VHF channels frequently during navigation should be lightened.
* Coordination and consistency
* In international navigable waters, VTS areas and sub-areas should be reasonably delineated based on the boundaries of territorial seas and the demarcation of jurisdictional waters of neighboring countries to avoid inter-regional conflicts; within the jurisdiction waters of a country, if there are two or more adjacent VTS centers, coordination and connection with adjacent VTS centers should be addressed to avoid administrative overlap in boundary areas; When delineating VTS area into sub-areas, it is crucial to ensure smooth navigation and continuity of VTS management between different sub-areas.
* The opinions and needs of various stakeholders, including local port authorities, shipping companies, pilotage agencies and terminal operators, should be fully considered. Early communication and coordination should be conducted with relevant departments in advance, so that the delineation of VTS area and sub-areas can coordinate the needs and interests of all parties as far as possible.
* Adaptive development
* VTS area and sub-areas should not remain unchanged. When changes appear in the traffic flow of the original VTS area and the workload of the sub-areas, and it is considered that the original delineation of VTS area and sub-areas is unreasonable after evaluation, etc., it is a good performance of the VTS evaluation mechanism to amend VTS area and sub-areas according to local conditions to adapt to the development of the port and changes in the software and hardware of the VTS service provider. However, it should be noted that such changes should be minimized.

# Implementation Process for Delineating AND CHANGING VTS area and Sub-areas

To effectively achieve objectives of VTS construction, the VTS provider should adhere to the following process when delineating and changing VTS area and sub-areas:

DeterminING the need and feasibility of establishing VTS

The VTS provider should, in accordance with IALA Guideline G1150, propose the needs for VTS construction from the benefits, costs, and risks of implementing relevant maritime traffic management measures, and elaborate on the feasibility of constructing VTS in terms of channel risk identification and assessment, operational feasibility, legality, technical capability, budget, and timeline.

ConfirmING the specific scope of the VTS area

The VTS Provider should, taking into account the factors and principles mentioned in Section 3, comprehensively consider the scope of equipment supervision and services, maritime navigation elements, meteorological and sea conditions, local laws and regulations and other factors to delineate VTS areas, ensuring the rationality and effectiveness of service areas.

In the process of delineating VTS area, the VTS provider should flexibly determine the priority and weight of each factor in the overall delineation process by means of environmental research, resource assessment, expert consultation, etc.

In this process, the VTS provider should pay attention to collect and consider prudently the need of local ports, channel management, pilotage, and shipping companies for VTS construction and their suggestions on VTS area delineation.

DETERMINING the number and specific SCOPE of VTS sub-areas

The VTS provider should comprehensively consider the scope of VTS area, workload of individual operator providing service in sub-areas, ship manoeuvring, and geographical environment, etc., to determine the number and specific range of VTS sub-areas, ensuring effective service for all vessels within the VTS area.

The VTS provider should solicit opinions on delineation of VTS sub-areas, mainly from relevant experts in the VTS industry and VTS personnel.

public announcement

The VTS provider should formally announce the delineation of VTS area and sub-areas through navigational notices, newspapers, official websites, and press conferences, etc., to ensure ship management companies, agents, shipowners, pilot stations, port units, docks, and other relevant parties are aware of the latest delineation situation. The relevant information is updated in the VTS User Guide according to IALA Guideline G1144.

Operation and Evaluation

IALA Guideline G1101 provides guidance for competent authorities and VTS providers to fulfil their obligations under SOLAS to establish and operate VTS. To ensure the realization of VTS objectives, VTS providers should conduct regular assessment of the achievement of VTS operational objectives, technical and operational performance, and risk mitigation within the VTS area. When the VTS fail to fully function in the existing VTS area and sub-areas, the VTS provider should promptly make corresponding adjustments and changes in delineating VTS area and sub-areas.

Considerations should be given to change VTS area and Sub-areas when the following situations occurs:

* When there are significant changes in international conventions or domestic laws and regulations affecting the responsibilities or functions of VTS, or when there are new requirements for the delineation of VTS area and sub-areas;
* When port expansion or new construction occurs, the original VTS area cannot fully cover the newly added port waters;
* when the volume of traffic changes significantly due to the construction or demolition of important docks in some waters, changes in ship navigation methods, changes in channel depth, etc.;
* When the coverage range of VTS equipment (radar, VHF, etc.) changes;
* When the workload within a VTS sub-area is too heavy to implement effective monitoring and serve ship traffic;
* When the sub-areas delineation fails to match VHF communication capabilities; and
* Other situations that lead to unreasonable delineation of VTS areas and sub-areas.

When the VTS area and sub-areas are initially delineated, a trial operation period of 3 months to 1 year can be set according to the actual situation.

Process for changing VTS area and sub-areas

When situations described in Section 4.5 arise, changes should be conducted following the undermentioned process:

* Evaluate existing VTS areas and sub-areas to determine the need of change. This can be done through various forms such as surveys and symposiums, fully absorbing professional opinions of stakeholders such as ports, pilot stations, and shipping companies to determine the authenticity and necessity of the change needs.
* Propose change plans and conduct relevant feasibility and impact assessments. Changes to existing VTS area and sub-areas should be judged with a standard of ship safety and navigation efficiency, and comprehensively considering factors affecting VTS area and sub-areas delineation. Organize relevant experts and personnel to participate in the change work, clarify the composition and weight distribution of personnel involved in the change assessment, and formulate a change plan along with relevant feasibility and impact assessments.
* Implement changes according to standard procedures and announce publicly. Refer to section 4.4.

The specific process of delineating and changing VTS area and sub-areas can be seen in the following figure 1.

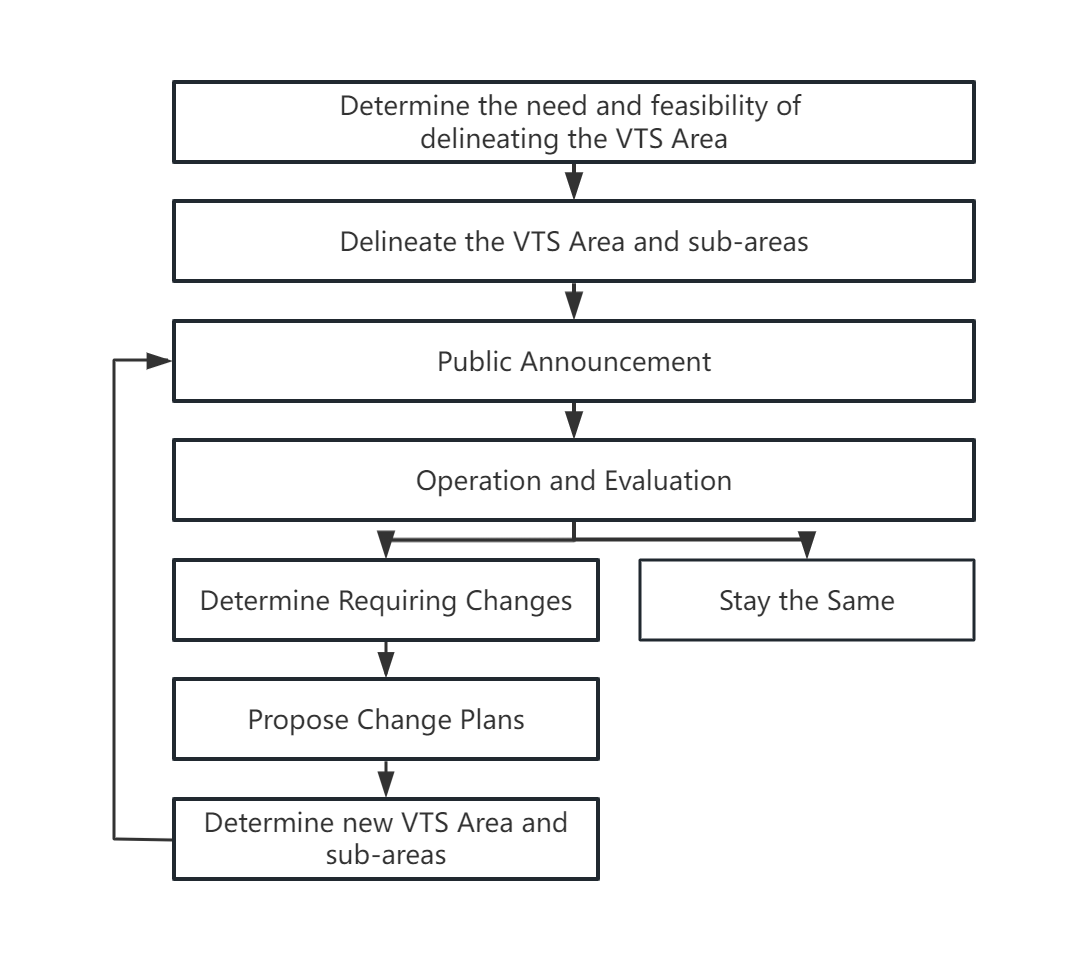


Figure 1. Flowchart for Delineating and Changing VTS area and Sub-areas

# DEFINITION

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

The following definitions are specifically related to this Guideline:

VTS area

VTS area means the delineated, formally declared area for which the VTS provider is authorized to deliver vessel traffic services.

Competent authority

Competent authority means the entity made responsible by the Government for vessel traffic services.

VTS provider

VTS provider means the organization or entity authorized by the Government or competent authority to provide a vessel traffic service.

# abbreviation

IMO International Maritime Organization

VTS Vessel traffic service or vessel traffic services (dependent on context)

IALA The International Association of Marine Aids to Navigation and Lighthouse Authorities

PSSA Particularly Sensitive Sea Areas

# Reference

[1] IMO Resolution A.1158(32) Guidelines for Vessel Traffic Services

[2] IMO Resolution A.572(14) General Provision on Ships’ Routeing

[3] IALA Guideline G1150 Establishing, Planning and Implementing a VTS

[4] IALA Guideline G1018 Risk Management

[5] IALA Guideline G1144 Promulgating the Requirements of A VTS to Mariners – A VTS Users Guide Template

[6] IMO International Convention for the Safety of Life at Sea (SOLAS),1974