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RESEARCH ARTICLE

The use of vessel traffic separation schemes (VTS) for the safety of shipping

El uso de dispositivos de separación del tráfico marítimo (DST) para la seguridad de la navegación

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Abstract

Maritime traffic is international and has had clear rules in place for more than 50 years. The 1972 RIPA Convention provides a common and comprehensive framework which is accepted and respected by seagoing vessels, both in national and international waters. This regulation always requires careful analysis and study, both by the crews in charge of the ship and by the maritime traffic control authorities, to exploit its full potential for organising and maintaining safety on their coasts. Within this scheme, DSTs are valid management tools. This article details the functionalities of this technology and the advantages of its implementation, not only in passages with very high traffic density, but also in every sector of the coastline, where vessels transit and may encounter other vessels moving in opposite directions.

Resumen

El tráfico marítimo tiene carácter internacional y cuenta con normas claras establecidas desde hace más de 50 años. El Convenio sobre el RIPA de 1972 brinda un marco común y amplio que es aceptado y respetado por los buques de navegación marítima, tanto en aguas nacionales como internacionales. Este reglamento siempre requiere de un minucioso análisis y estudio, por parte, tanto de los tripulantes a cargo del buque como de las autoridades del control del tráfico marítimo, a fin de aprovechar todo su potencial de organización y mantenimiento de la seguridad en sus costas. Dentro de este esquema, los DST son instrumentos válidos de ordenación. Este artículo detalla las funcionalidades de esta tecnología y en el porqué de las ventajas de su implementación, no solo en los pasajes de muy alta densidad de tráfico, sino también en cada sector de la costa, por el que los buques transitan y pueden encontrarse con otras embarcaciones circulando en direcciones opuestas.

Introduction

There is no doubt about the wisdom in drafting the COLREGs as one of IMO's key conventions and the validity of its recommendations regarding the prevention of collisions between vessels, including the continuous assessment of navigational circumstances to estimate safe passage distances among those sharing the same areas of navigation.

From my first encounter with this international regulation during my nautical training, I have been intrigued by the concept of Vessel Traffic Separation (VTS) devices. These are defined navigation areas at sea, established by coastal authorities of each State to regulate the direction of vessels transiting, departing, or heading to their ports. They aim to reduce collision risks caused by indiscriminate use of maritime space and serve to channel vessel traffic in conflict-prone areas.

While practicing my profession as a merchant ship captain on long-haul voyages, I could appreciate the convenience of having these aids as traffic organizers, especially in areas that were less familiar to me. Immediately, I tried to understand why our country did not have this tool, a question that still lingers.

Additionally, IMO has issued clear design guidelines for States to respond to the recommendation of establishing VTS in their waters in favor of maritime safety and better control of maritime traffic.

The establishment of VTS not only requires a comprehensive study of the geographical area and the traffic within it but also an understanding of the practices and customs of vessels calling, transiting the coast, entering, or departing ports in the region. Following this analysis, a report must be submitted to IMO for recognition and validation of each VTS in accordance with international standards.

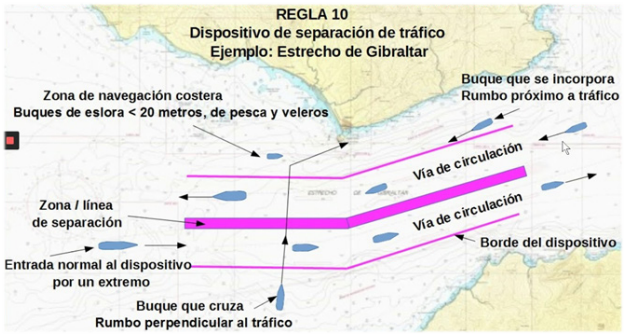
Advancements in onboard technologies now enable vessels to continuously determine their position anywhere and at any time. This capability allows them to navigate within the boundaries of the corresponding traffic lanes without the need for additional marking or beacons[1].

Therefore, the implementation of each VTS, its publication on nautical charts, and other navigation aids essentially involve a decision by the respective authorities.

The current proposal for the port of Mar del Plata in Argentina is merely a graphical exercise in the application of VTS in that area. It is not the result of a comprehensive study as mentioned previously.

1. Buoyage can include, in addition to lighthouses and buoys, static or dynamic virtual aids as needed for the area.

Figure 1: Traffic Separation Device in the Strait of Gibraltar



Source: www.navegantesoceanicos.com

> ***"The establishment of VTS involves not only a thorough study of the geographical area and the traffic within it but also an understanding of the practices and customs of vessels calling, transiting the coast, entering, or departing ports."***

Maritime Traffic Separation Devices (TSDs)

Rule 10 of COLREGs describes the obligations of vessels navigating using the device or in proximity to one.

While the text of this convention does not include illustrations, it is common to accompany it with graphical examples of devices in use to understand this rule better. It's important to note that such illustrations, like the one added below (Figure 1), are merely examples of the design possibilities for TSDs, depending on the specific characteristics of the navigational area and the studies conducted by the involved States.

Rule 10 specifies, among other concepts, that vessels using the device must:

- Navigate within the appropriate traffic lane according to their direction of travel.
- Keep clear of separation lines or zones.
- Enter or exit the device through its ends or, if using its lateral limits, do so at the narrowest possible angle relative to the direction of traffic.
- Avoid the adjacent coastal navigation zone, except when heading to or from a port or another place within it, or to avoid an immediate danger.

Similarly, Rule 10 states that vessels not using the device must:

- Keep clear of it with as much clearance as possible.
- Avoid crossing it, or if forced to do so, cross it at right angles to the traffic[2].
- Use the adjacent coastal navigation zone if they are vessels less than 20 meters in length, sailing vessels, or fishing vessels[3].
- Enter the interior of a separation zone only in case of an emergency or for fishing within it.

TSDs as Components of the Operational Context

Maritime navigation takes place in restricted geographic areas as the operational environment. These areas present various geographical scenarios related mainly to the presence of navigable waters, proximity to coasts, and areas with higher navigation risks.

Based on my personal experience, I identify three primary operational scenarios for this mode of transport.

The first scenario is open-sea navigation without obstacles, with sufficient depth, ample maneuvering space, and low traffic density.

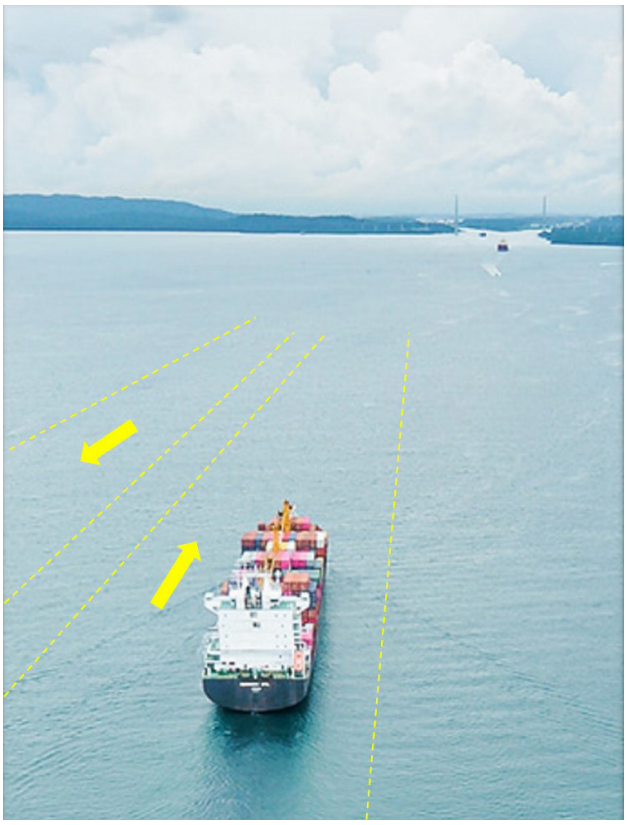
In this context, maritime routes are defined as long trajectories where the primary concern is to avoid adverse hydro-meteorological conditions such as strong winds, high waves, cyclones, etc. In this scenario, there is no need to establish VTSs (Vessel Traffic Separation) zones.

When navigating in "open seas," there is ample space and time to detect other vessels at a great distance and maneuver in advance. Vigilance and the ability to "keep a good lookout" day and night are our primary concerns.

The second scenario is coastal navigation, characterized by shallower depths and higher traffic density.

Approaching the coast after crossing the open ocean or coming from a distant fishing area demands greater attention, with all alerts in place. Vessels require ample space for maneuvering, and when there is an obstacle ahead, inertia doesn't allow for immediate stopping, requiring several ship lengths to do so.

Figure 2: Aerial view of navigation via TSD



Source: https://pancanal.com/es/cuenca-hidrografica/

The third scenario involves navigating in restricted waters with limited space and depth.
In this context, vessels require proper and meticulous marking of the area, indicating navigation channels, and essential traffic organization and control by local authorities. In such cases, VTSs alone are insufficient to manage traffic.

Navigating in restricted waters truly tests a mariner's skills, and we appreciate the presence of buoys, beacons, and other means to recognize the area and navigate safely. In foreign ports, it's often essential (and usually mandatory) to take on a local pilot when navigating restricted waters.

The second scenario is clearly where VTSs play a crucial role, acting as transition zones or interfaces between open-sea navigation and restricted navigation in inland channels.

2. While vessels should strive to respect the traffic using the device, this does not imply that the device alters the maneuvering priorities indicated by COLREGs in its rules on steering and sailing.

3. Vessels dedicated to fishing are defined as such only when they are engaged in fishing operations. When a fishing vessel is in transit without conducting such activities, it is considered a power-driven vessel. Fishing vessels dedicated to fishing can only carry out their fishing operations within a separation zone.

Recommendations to States on the Implementation of VTSs

On November 20, 1985, the IMO approved Resolution A.572 (14) "General Provisions on the Organization of Maritime Traffic."

The goal of this resolution is to "enhance navigation safety in convergence zones and areas with heavy traffic or where vessel freedom of movement is restricted due to space limitations, navigational obstacles, depth limitations, or adverse weather conditions."

To achieve this, each State's traffic organization system should consider the possibility of:

1. Separating opposing traffic streams to reduce the frequency of vessels on collision courses.
2. Reducing collision risks between vessels crossing established traffic lanes and those navigating within these lanes.
3. Simplifying traffic flow characteristics in convergence zones.
4. Organizing safe traffic in areas with high exploration or offshore exploitation activity.
5. Organizing traffic within areas where navigation is dangerous or not advisable for all vessels or certain classes of vessels, or around these areas.
6. Reducing grounding risks by providing vessels with special guidance in areas where water depth is uncertain or critical.
7. Directing traffic away from fishing grounds or organizing it through these areas.

These purposes are directly related to the existence of appropriate VTSs.

Any devices that a coastal State establishes for its waters must be approved in advance by the IMO, the only international body with recognized competence to establish and recommend internationally relevant measures related to the organization of maritime traffic.

Appropriate Use of VTSs by Sailors

The presence of VTSs along the route facilitates our navigation watch duties by providing route guidance in areas of coastal transit, port access, or departure. For example, foreign vessels entering a port in another country, unfamiliar with local traffic, find VTSs very useful for providing them with traffic guidance before reaching the pilot station or outer anchorage. Likewise, domestic vessels experience reduced risk of collisions in these areas and can enter or leave the port with greater safety.

For this to happen, like any onboard regulation, it is essential for the crew responsible for navigating the vessel, i.e., the navigation watch, to be knowledgeable and practically trained in the use of traffic separation devices.

As a personal experience, I have felt the relief of navigating merchant vessels through VSTs in densely trafficked areas like the entrance to the Mediterranean Sea or the English Channel, among others. These traffic lanes are the best allies for navigating without conflicts alongside vessels of all nationalities.

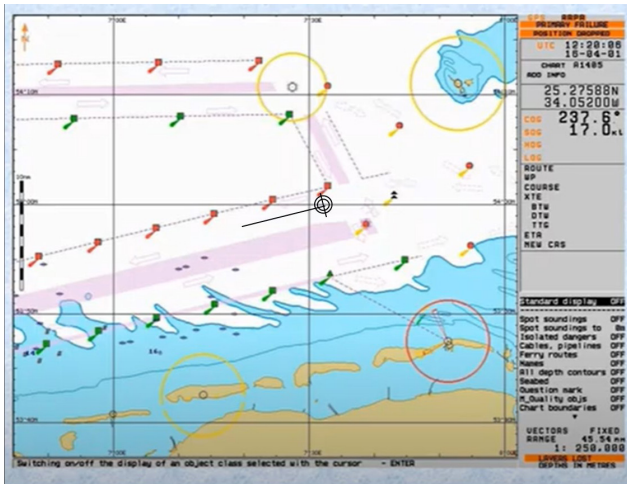
As for the means of orientation on board and maintaining a constant location to confirm the use of the correct traffic lane, following the issuance of Resolution A.572, complementing Rule 10 of COLREGs, new technological advances in electronic equipment assisting navigators have emerged, in addition to the use of radar and Automatic Radar Plotting Aids (ARPA) already associated with it.

Currently, the continuous position of the vessel is ensured using the Global Positioning System (GPS), and this position is directly displayed on the Electronic Chart Display and Information System (ECDIS) screen, alongside the image of theVTS zone.

This continuous positioning method has reduced the need to install additional physical marking near each separation device. Originally, it was essential to ensure tracking of the course of each vessel within it.

Additionally, the Automatic Identification System (AIS) has rapidly extended its use. This means that from each vessel in the area and from coastal control stations, it's possible to locate and identify other vessels that

Figure 3: SIVCE, Vessel Navigating through a VTS (Vessel Traffic Separation) Zone



are visually detected or tracked by radar, facilitating communications.

Regarding wireless communications between vessels and with coastal stations, while COLREGs did not explicitly incorporate the use of Very High Frequency (VHF) radio into collision prevention rules, it is undeniable that radio communication using VHF takes place during each approach between vessels to coordinate passages[4].

From the perspective of Vessel Traffic Management, technology has expanded its monitoring range beyond the reach of land-based radars. Simultaneously, the development of the Global Maritime Distress and Safety System (GMDSS) has provided secure communication equipment and protocols for both emergency and routine situations at sea.

"The presence of VTS along the route facilitates our navigation watch duties, as it establishes course guidelines in areas near coastal transit, port access, or departure."

VTS in the Port of Mar del Plata Area

The Port of Mar del Plata is located on the Buenos Aires Atlantic coast, running there in a north-south direction. Vessels arrive from the north, coming from the Río de la Plata, and from the south, arriving from the Patagonian ports and their fishing grounds.

Vessels arriving or departing to the north find a more direct access route, as the entrance alignment to the port between the north and south breakwaters is 028°/208°, similar to the coastal heading. However, they need to navigate properly to pass at a safe distance from Cabo Corrientes and then take an approach course to the breakwaters that avoids the sandbank at the end of the south breakwater. Additionally, the anchorage for deep-draft vessels is located on that same route, northeast of the latitude of Cabo Corrientes and 2 nautical miles from it.

Therefore, it may be useful to organize traffic from the north with a separation zone. This would help delineate the navigation routes to the port and the open coastal area for smaller vessels.

> **VTS 1:** Separation zone device, heading 050°/230°, width of navigation lanes 370 meters (0.2 nautical miles), length 3300 meters (1.8 nautical miles).

The Port of Mar del Plata shelters medium and small-sized vessels, particularly dedicated to fishing. These vessels typically operate east and south of the port. The final approach route and departure route from the mouth of the port follow a heading of 090°/270°, once the area of the sandbank at the end of the south breakwater is cleared, heading toward Cabo Corrientes.

Due to this, there is a suggestion for a second, smaller separation zone device for this traffic.

> **VTS 2:** Separation zone device, heading 090°/270°, width of navigation lanes 278 meters (0.15 nautical miles), length 2000 meters (1.08 nautical miles).

Traffic heading to or arriving from the south of the port encounters the Banco Pescadores, the greatest natural navigation risk in the area. A larger separation zone device with a safety distance and a separation zone is proposed for this traffic.

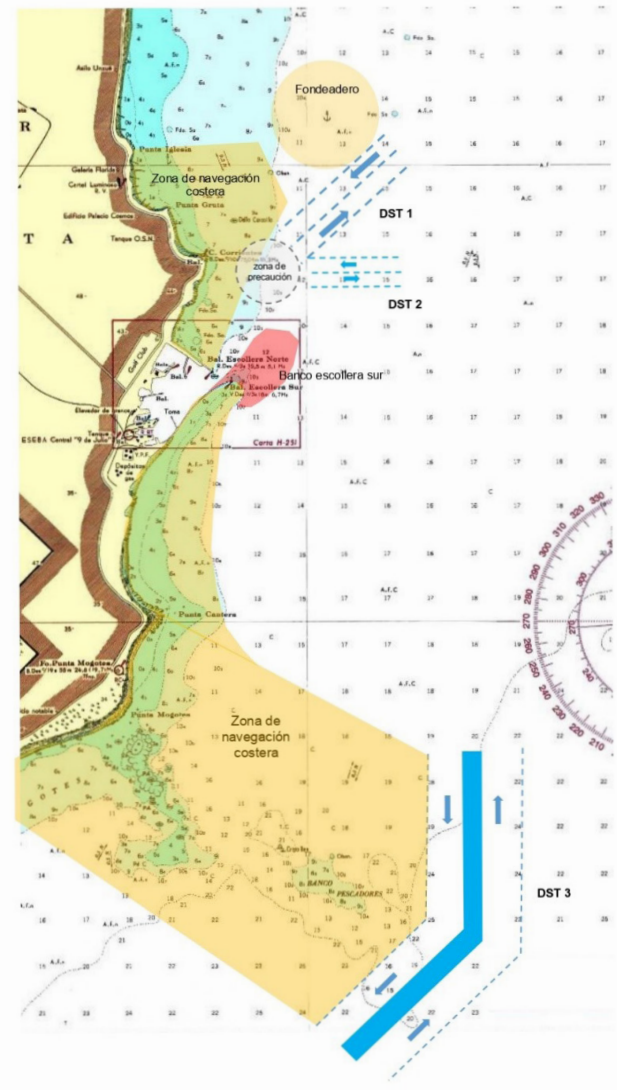
> **VTS 3:** Separation zone device, headings 000°/180° and 047°/227°, width of navigation lanes 740 meters (0.4 nautical miles), total length 7408 meters (4 nautical miles), width of separation zone 370 meters (0.2 nautical miles).

This scheme is complemented by coastal navigation zones dedicated to coastal recreational traffic, recreation, tourist excursions, minor fishing, and more, which are very common in front of the urban area.

The area is complex due to the diversity of traffic, as the Port of Mar del Plata accommodates shelter for cargo vessels, fishing vessels, naval vessels, sailboats, sports boats, and recreational boats. Hundreds of vessels enter and exit daily. It is vital to avoid the sandbank that forms at the end of the south breakwater, coordinate the use of the channel between the breakwaters, noting that many of these vessels do not require permission and often cross paths with larger vessels. Especially during strong winds from the east and northeast, maneuvers become riskier as the swell enters the inner harbor. In my experience, when using the port with cargo vessels, fishing vessels, fishing training ships, and finally, with a passenger cruise ship, I consider any additional assistance in the outer harbor to regulate the circulation of each type of vessel to be of great value.

4. Indeed, the use of VHF and other electronic aids, such as ECDIS, is understood to be included in the initial recommendation regarding the use of all available means to avoid a collision situation (COLREGs, Rule 5: Look-out).

Figure 4: VTS in the Mar del Plata Port Area.



CONCLUSIONS

Maritime traffic is of international nature and has clear regulations established for over 50 years. The International Regulations for Preventing Collisions at Sea (COLREGs) Convention of 1972 provides a common and comprehensive framework that is accepted and respected by vessels engaged in maritime navigation, both in national and international waters.

This regulation always requires meticulous analysis and study by both the ship's crew and maritime traffic control authorities to fully harness its potential for organizing and maintaining safety along coasts.

Within this framework, Vessel Traffic Separation (VTS) zones are valid instruments of organization. Their implementation should be considered not only in areas with very high traffic density but also in every coastal sector through which vessels transit and may encounter other vessels traveling in opposite directions.

VTS zones function as preventive measures within this operational context.

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