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ORGANIZATION OF THE STREAM OF THE SHIPS MOVEMENT IN THE AREA OF VTS

In areas where ships' traffic is heavy an organization of the stream of their movement is becoming an important issue. Due to the fact that ships go all over the world, this process should be standardized. A standardization of regulations and devices applied in VTS are taken into consideration in the designing process. In the article the author presented essential information for the VTS operator for the correct organization of the stream of the ships traffic. A participation of ships with dangerous cargo was taken into consideration. In the final part a futurist look at the traffic organization of ships was described in a global sense.

ORGANIZACJA STRUMIENIA RUCHU STATKÓW W OBSZARZE DZIAŁANIA VTS

W rejonach zagęszczenia ruchu statków istotnym problemem staje się organizacja strumienia ich ruchu. Z racji tego iż statki uprawiają żeglugę międzynarodową proces ten powinien być ujednolicony. Rzutuje na to standaryzacja przepisów i stosowanych w VTS urządzeń. W artykule autor przedstawił jakie informacje niezbędne są operatorowi VTS dla prawidłowej organizacji strumienia ruchu statków. Uwzględniono uczestnictwo statków z ładunkami niebezpiecznymi. W końcowej części przedstawiono futurystyczne spojrzenie na organizację ruchu statków w wymiarze globalnym.

1. INTRODUCTION

The increased number of vessels employed in sea transport cause the higher risk of the collisions, grounding, beaching. These dangers are most frequently observed in port approaches, narrow passages, areas with large amounts of navigational dangers. Depending on the size of ports we deal with different intensity of ships' traffic. All these factors cause that sea areas become very sensitive. That is why there is need for special traffic organization to control the safety of the traffic of ships and for service. This is called Vessel Traffic Service – VTS. Such Service came into existence with the thought about the traffic organization on every basins of world's sea area, where the probability of the dangerous

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situation occurrence is very great. Depending on needs and the traffic intensity of ships the VTS system can cover the following:

- the port and the approach towards it,
- approach towards a few ports,
- transit area.

Such area can be monitored by one centre or be divided into smaller sub centers controlled by responsible operators. Implementation of this system increased the level of safety of navigation in these areas thanks to effective planning of the organization of the stream of traffic of ships. The correct organization of the traffic stream contributes not only to the improvement of the safety of navigation but also to more efficient work of ports. Another advantage is reduced cost of operating both ships and ports. A good VTS management may highly reduce the number of vessel awaiting at roadsteads. Additionally, implementation of VTS systems resulted in a significant improvement in the environmental protection. It is necessary to realize that the liquidation of effects of an average size oil-tanker disaster is more expensive than building costs of a dozen or so VTS systems. The development of Polish ports and increasing traffic at their approach resulted in implementing the system of the control of the traffic of ships in these areas. Logistic planning of the ships' arrival and departure from ports enabled this solution, as well as, it contributed to shortening the time of ships expecting on the roadstead. Thanks to that it is possible to fully exploit their handling potential. An example of this is the visit of the huge Maersk Taikung container ship in the port of Gdańsk, where the existing VTS system made the safe operation of the biggest ships which can enter Polish ports possible.



Fig.1. Maersk Taikung in Port of Gdańsk. Reference [1]

VTS systems can provide service of different type and for different purposes. This depends mainly on the size and kind of the basin, on the ships' type and on the ships' traffic intensity. For instance system "VTS Zatoka" on the Gulf of Gdańsk is a good example of a simple system, not covering large area and not with a lot of traffic. Another type of VTS

system can be observed in the port of Rotterdam, where there is very heavy traffic, the number of vessels is far greater and the area covered by the system is larger. These factors make the above system far more complicated.

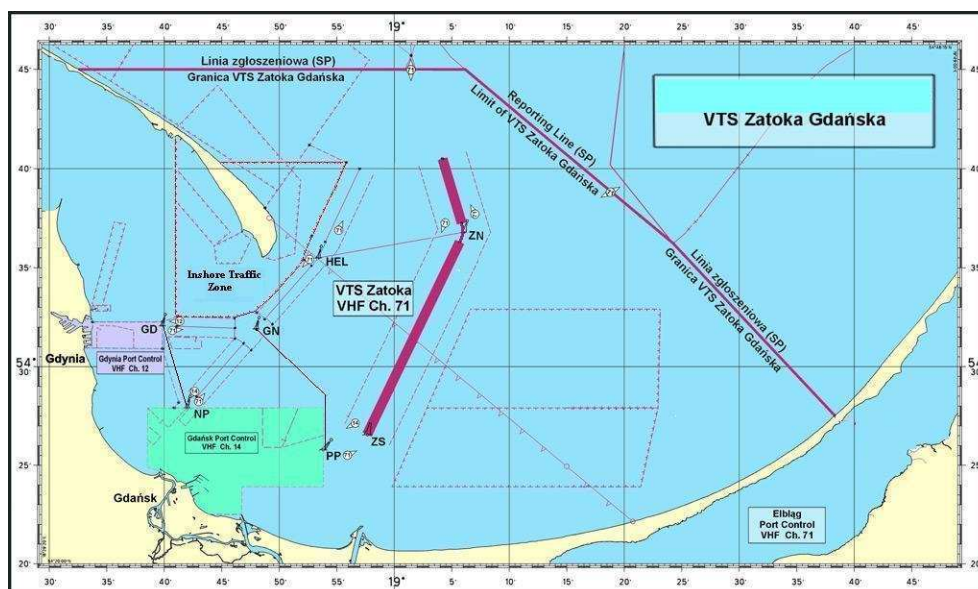


Fig.2. The Gulf of Gdańsk VTS area [2]

In order to illustrate the use of VTS system an example of the service employed in the port of Rotterdam was taken. This port provides a lot of different situations with a wide variety of ships' types, size, and cargo. This system deals also with a lot of situations where the participating vessels are in different navigational status. In this way we can compare operation of such ships as fishing cutters, warships, big containers, supertankers, big passenger vessels, coasters, as well as special duty vessels. A diversity of trans-shipped cargoes (liquid, dry bulk, containers of different type, dangerous cargo) is another important aspect deciding about the choice of this port.

The organization of the stream of the traffic of ships is the most important element of the work of the VTS operator. The VTS operator is not always supplied with sufficient information or data regarding the particular vessel. His duty is to collect a set of all indispensable information and then to use it for managing in order to control and to operate the vessels within the system. The basic aim of such activities is to supervise the proper sequence and safe passage of all vessels in the VTS area. On the other hand, the VTS operator has to bear it in mind that he can only advise or suggest some action and not give orders. The final decision is always made by the Master.



Fig.3.VTS center in Gdynia [2]

2. ELEMENTS OF THE ORGANIZATION OF THE STREAM OF THE SHIPS TRAFFIC

Organizing the effective stream of the ships' traffic in a given area is not a simple matter. Not only International Guides or legal documents issued by IMO or IALA, as well as, standards worked out by leading VTS must be taken into account but also a number of factors and limitations imposed by local authorities and by a given situation itself. The VTS operator has to cope with all these problems.

The Author in the 80-ies of last century entered the port of Montreal and he had the chance to cooperate with VTS on the St. Lawrence Bay and River. Then the VTS system was a novelty. Although the system employed simple equipment such as a net of radars and VHF still it was very efficient and reliable thanks to clear reporting system, its simplicity and competency of the VTS operators and. Another, quite recent, situation experienced by the Author which goes back to 2009 (one of German ports), presents a completely different situation. The VTS system in one of German ports is equipped in the most modern electronic system, the operators are certified and work following the international and local regulations. If they were to deal with a few vessels they managed the situation in a safe way but when the number of vessels increased (the whole event happened during sailing vessels parade) they were not able to operate and manage the ships in a safe manner. Few collisions and dangerous situations took place.

Planning the stream of the traffic of ships should be standardized; differences can exist in individual VTS resulting from local conditions. Operators have methods worked out and procedures for the organization of passing the ship. However untypical situations or some emergency as well as routine often cause that in the area of action of systems collisions or dangerous situations happen.

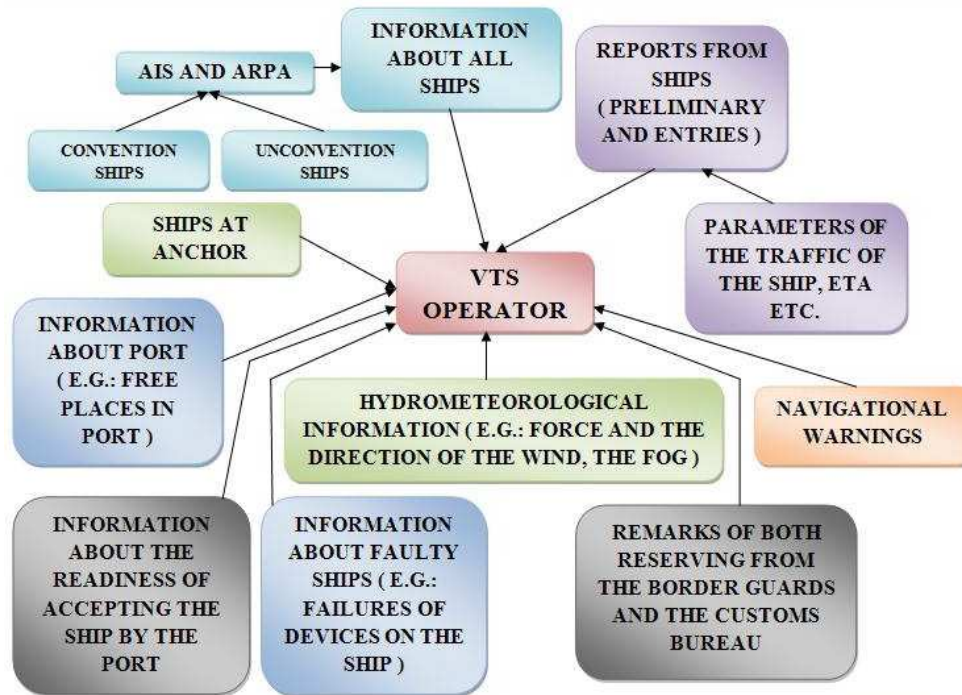


Fig.4. Information necessary (in VTS centre) to organize the stream of ships flow

2.1 Information concerning the ships' traffic

The knowledge about ships in the area covered by the VTS system is an essential element in the process of the organization of the ships' stream. Such information as the course, the speed, the expected time of arrival at the port (ETA) is essential for operators to establish an order, a sequence in which vessels move into and out of port. Also information about ships which are to anchor is essential as the operators must indicate the right place for them to monitor the position of anchoring ships.

All details about any ship flow to the VTS centre in the form of reports which are compulsory for vessels wishing to enter and for vessels moving in the area covered by the VTS system. The ship must report its ETA according to the procedure before entering area being under the VTS control. It enables the VTS operators accurate planning of the traffic of a given ship in given area. Information regarding ships which are not coming into the port but only are in a transit, is also essential. All these facts and data make it possible to identify objects and to follow their movement on electronic charts in VTS centers.

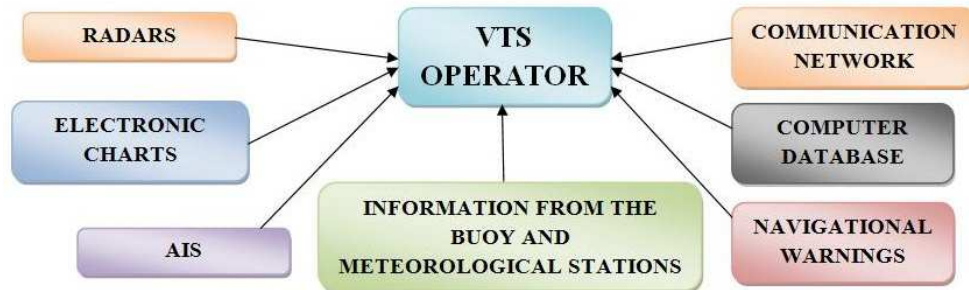


Fig.5. VTS equipment supporting VTS operator decisions

2.2. Information about privileged vessels and vessels carrying dangerous cargoes

The hierarchy of ships coming into port is a very important matter. The operators should know which ship is to come into the port first, and which can wait on the roadstead. In this way they will get information about privileged ships, e.g. passenger which has the priority for entering the port should be served first. Also data regarding carriage of dangerous cargo by sea should be gathered by the VTS system. It constitutes particularly valuable information because the operator knows exactly what cargo is carried on each vessel and what precautions have to be undertaken when the vessel enters the trans-shipment terminal. It is also connected with rendering appropriate tug assistance and pilot services.

2.3. Demand of the port

Port as one of the links in distribution of products of different kind has also its priorities bound by agreements with consignees or with forwarders, or with warehouses. One should take them into consideration at planning entries of ships to the port. Ships with special valuable cargoes have priority for the port. Using up stocks of raw material in the port and causing that the consignees have to wait for delivery, makes the port lose its profits. Therefore, while planning the organization of the ships' traffic, it is necessary to bear in mind the data concerning the demand of the port for given type cargoes. It will enable a smooth port operation and not allow unnecessary financial losses.

2.4. Anchorage

Ships which arrive at the roadstead must have position provided on the anchorage. VTS Operators should know the number of ships at that particular moment on the anchorage and about the room accessible for ships about to anchor. The information concerning the movement of ships on the anchorage should also be reported to the VTS operators as this will let them monitor the situation in this area constantly and assure a safe stopping place for vessels.

2.5. Navigational warnings

The VTS system in the area covered by such a system should know if a given area has navigable waters. They access data from hydro meteorological centers. The operator must have the knowledge about the state of the seamarks and landmarks, especially those

regarding approaches. They also should know about any works conducted within the area covered by VTS. This information constitutes the essential help in planning the traffic for ships in a given area. All these data should be passed to other vessels in messages via the VTS system or by VHF radiotelephony or in special NAVTEX warnings.

2.6. Size of the ship with respect to the depth of water

The development of the sea transport and the reduction to minimum of costs of individual units of the transported goods led to construction of ships with greater and greater carrying abilities. The size of the ship affects its draft when loaded to capacity. Trying to meet needs special approaching paths were created adapted for big vessels. The VTS system operator on duty must take such information into account in order to direct the ship toward the right fairway and grant it the priority. There are tides which should not be neglected as they enable the ship to enter the port with safe under keel clearance only in some hours. The operator must take all these factors into consideration when organizing the ship's passage in the area covered by VTS.

2.7. Qualifications of officers

Classifications of officers of ships entering the area covered by the VTS system are extremely important element of the entire process of leading them within the area of the system. Education of crew members being officers onboard the ship will often leave a lot to wish. The influence on it has low level of training at many centers and different level of knowledge of English (Standard Marine Communication Phrases). Another factor is the experience of the Master and Officers employed onboard the vessel. The VTS Operator must assess the level of the crew quickly. Good communication between ship and the operator of the VTS system is crucial in directing the ship to the port safely. The VTS Operator's instruction or advice improperly understood can lead to a sea collision or result in ship's grounding.

2.8. Technical condition of the ship and its devices

Requirements of classification societies and international regulations determine that every ship which moves on the sea meets special requirements concerning its technical condition as well as its devices must be in good order for carrying safe navigation. It can happen that a ship has valid certificates nonetheless its equipment is not in good order and safe navigation cannot be provided. Such knowledge is essential for the operator supervising areas with heavy traffic. Special safety procedures were introduced to check the technical condition of a vessel in these areas. Special check lists were introduced which are checked before pilot embarks the ship and must be signed by him. Such a form contains data concerning testing and the condition of ship's devices are used while coming or leaving port. The condition of ship's hull and ship's devices is also visually checked. If there is something that evokes some doubts either to pilot or VTS operator then the vessel does not get permission from the VTS system to come into port and must go to the anchorage in order to carry out detailed inspection or to repair the malfunctioning devices. The technical condition of the ship and devices installed on it has significant influence on the safety and it must be taken into consideration at the organization of the stream of the ships' traffic.

2.9. Pilotage

The availability of pilot services is an important factor without which the ship's coming into some ports is impossible. In some ports pilots do not render 24-hour service as they work for some hours. In some ports these services are available only during the day or only on some days of the week. Whether a pilot comes on board or not depends also on hydro meteorological conditions. In some ports during bad weather pilot services are unavailable or pilots add some more requirements for ships led out. Port in Bremenhaven is a very good example. In poor hydro meteorological conditions pilots in this port carry out pilotage from the VTS centre on the basis of data obtained from radars located in the Centre. Only, when the ship is sheltered against waves, then the pilot embarks. Undoubtedly, this solution is stressful for inexperienced captains who for the first time enter this port. Ships during bad weather are directed in the port on the basis of instructions given by the pilot from the VTS centre through the radio VHF radio.

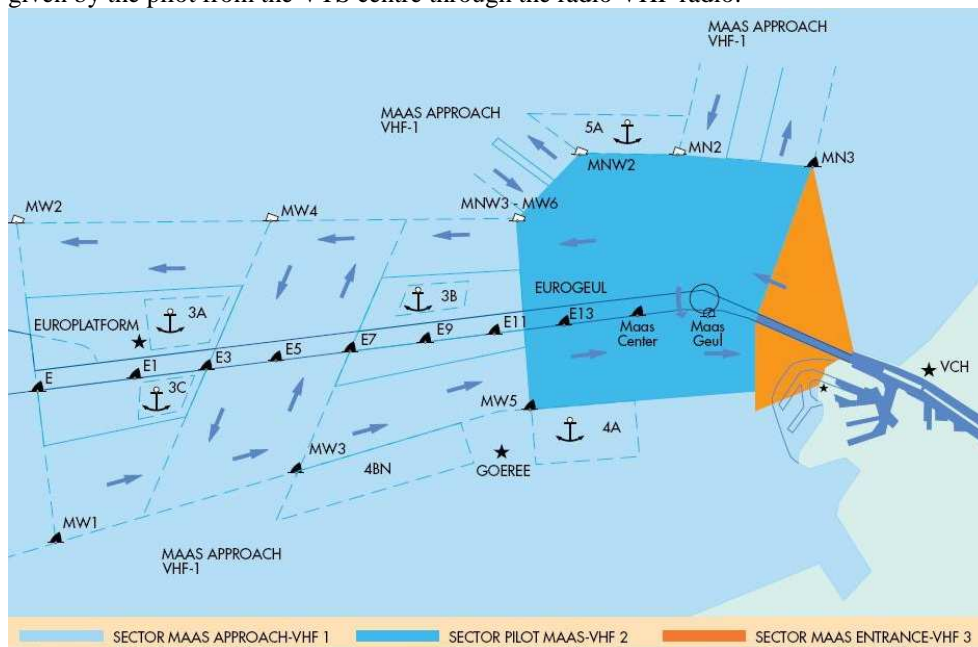


Fig.6. Shipping Information VTMS [3]

2.10. AIS

The system of automatic identification of ships is a very helpful tool for VTS operators. However quite often the information broadcast with the help of AIS differs from real data. In the VTS centre the operator must compare details about ships received with the help of RADAR, with the help of ARPA with those obtained with AIS. Thanks to that it is possible to identify ships which send false data. Thanks to such system of gathering information the VTS operator knows on which AIS indications he can rely, especially when vessels are maneuvering. When a VTS operator selects vessels whose data obtained both with the help of ARPA and AIS are the same then he can define the parameters of their movement with great accuracy. They obtain the same information from two independent

sources. Undoubtedly, this is real help in collision situations, where even in case of failure of one device; the ship's entering can be continued.

2.11. Communication

A flow of information between the VTS centre and individual ships is unusually important for the organization of the stream of the traffic of ships. To the quality of this communication is influenced by quality of devices on both sides as well as knowledge of language of persons communicating. The language used at sea is English particularly the SMCP Standard Marine Communication Phrases.

The level of knowledge of the English language of ships' crew as well as by VTS operators flow has influence on the flow of essential information concerning the safety of a given ship. It is worthwhile adding that the nationality of officers has influence on the level of language. Some nationalities speak English in a way that is difficult to understand and sometimes it may result in misunderstandings. Many ship-owners introduce special language tests for officers in order to be sure that their crew is able to understand all announcements given in the English.

2.12. VTS equipment

Planning the organization of the stream of the ships traffic takes place in VTS centers. Having the equipment of appropriate class is an essential matter. This equipment should be reliable and have the emergency power supply in case of any breakdown. RADAR (ARPA) should be the most modern and provide great effectiveness of detecting vessels. There should also be an extensive database with information delivered by vessels operating in the area covered by VTS system. Such a base should contain the information concerning the number of ships:

- at the moment present in the area covered by VTS,
- making their way towards area covered by VTS,
- on the anchorage,
- privileged.

The information collected in the database should be available to operators of the system after clicking on a given echo which was shown on the electronic chart. Here a first-class computer hardware plays an important role and so that the information between individual computers is sent efficiently and quickly. Appropriate hardware and also software should enable processing of received data and showing them in the form of user-friendly announcements, easy to understand by the VTS operator.

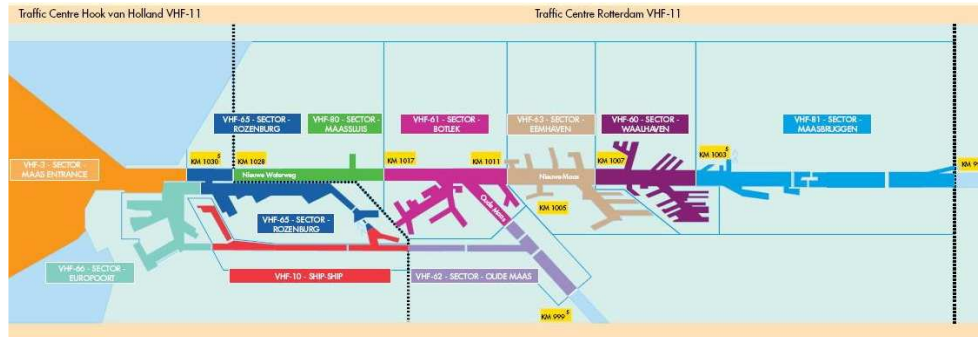


Fig.7. traffic Centre Rotterdam VHF11 [3]

2.13. Transfer of information

Another very important matter is the transfer of information to other services and organizations such as the Customs, Navy, Coastguard, and similar. It facilitates the port service and operation to a great extent. Thanks to this system port authorities and services can plan inspections and surveys to be carried out on board the vessels without causing any delays or stoppages of loading or discharging cargo, or leaving or entering ports.

2.14. Qualifications of the VTS staff

The VTS personnel are one of the most significant links in the proper functioning of the system as they make decisions and control the ships' traffic within a given area covered by the VTS system. The education of the staff has a very important role in assuring safety and in proper planning of ships' traffic flow. A person who is a VTS operator should be properly educated to perform their duties. First of all, they should graduate from a maritime university, pass appropriate English language exams proving good command of this language. They should also be familiar with limits and restrictions, as well as hydro-meteorological conditions present all over the year, in the area covered by the VTS system. Such personnel should also know the local conditions and the regulations to be observed both local, national and the international ones. All this knowledge will help and enable the operator making accurate analysis of the situation observed and as a result taking the right decisions regarding the management of ships' traffic in area covered by the VTS system. It is also crucial that the VTS personnel knows exactly how to operate the equipment, knows the restrictions it may create and problems which may arise at the stage of planning and monitoring the stream of ships' traffic. The VTS operators' competence and qualifications should be appropriately proved by international certificates indicating their level of education, knowledge and training necessary to manage and monitor the vessels' traffic.

3. RESTRICTIONS IN PLANNING THE STREAM OF SHIPS' TRAFFIC

During ships' traffic organization in the area covered by VTS system operators must realize limitations which are connected with it. The main problem is that the VTS operator cannot order the Master of a vessel any maneuver. The orders sent to vessels from the VTS station are solely advice or suggestion on actions to be undertaken by a vessel. The final

decision has to be made by the Master of the vessel who is fully responsible for the ship's safety. However, in practice it turns out that the VTS operators, in some cases, order the Masters to take some actions under threat of imposing financial punishment on the vessel. The VTS operator can also miss some alternation of the ship's course which may lead to collision situation or to ship's running aground. Sea transportation is trying to follow the way orders are given in air transport where the operator gives the plane pilots precise orders to be obeyed if they want to land on a given airport. Applying different technical improvements is also similar to aviation. AIS is a very good example of a device which can facilitate the organization and monitoring of the stream of ships' traffic. However, the basic problem it evokes is the reliability of information received with this device. We can see that the problem has been overcome in air transport and the operators can rely on the data delivered by these devices. In sea transportation it will take quite a lot of time before this problem is solved and before the data taken from AIS could be used in ship's maneuvering. At the moment this device can only be used to support the decision made by the watch officer. However, the modus operandi should mainly be based on data obtained from RADAR (ARPA) as at present they are the only reliable source of electronic information.

4. FUTURE

Planning the organization of the stream of the ships' traffic is extremely important when the number of vessels employed in sea transportation is still increasing and more and more dangers to navigation can be observed. In the future it will not be limited to VTS system only but it will cover the entire world. AIS will become a system to provide data to global centers of traffic organization via satellite system. Appropriate coordination units will be founded in different sea areas. They will be connected to create one net designed to send information regarding ships' data from one center to another. Following the aviation example traffic 'corridors' will be established with traffic lanes which will help to decrease the number of collisions involving vessels on opposite courses to minimum. The vessels will move like cars on a road. It is only the matter of time to come to such solution. Nowadays nothing is being done in this matter as it involves vast sums of money and lack of interest on the side of the owners. In the future this situation must change because the costs incurred will result in the improvement of safety at sea.

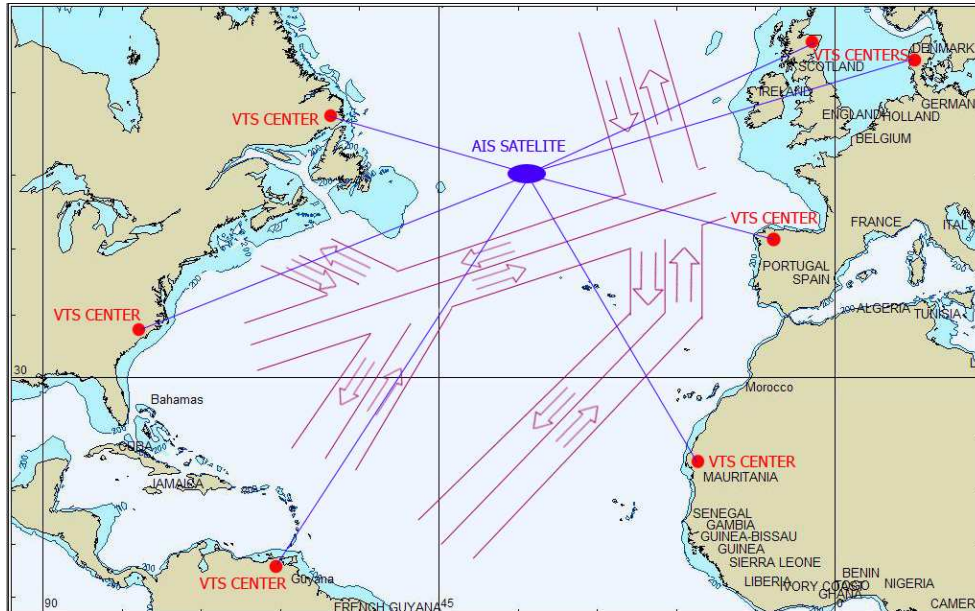


Fig.8. An example of the future traffic centers and corridors for the ships flow through Atlantic Ocean

5. CONCLUSION

The proper organization of the ships flow is very important for the operator of VTS. It is quite easy to organize the stream when ships' traffic is low and when vessels do not carry dangerous cargoes. From year to year there is more and more traffic in the VTS area; vessels are larger, carry more dangerous cargoes and sail at higher speed. The ports operate faster and vessels stay in the port short time. More passenger vessels operate at higher speed. There are still a lot of vessels operating with VTS without AIS. Sometimes communication between vessels is complicated. According to actual regulations, VTS operator could not give any orders to ship's captain and officers. He could only advise, inform or assist. Even with this disadvantages operator should be able to organize traffic in a safe way. On the other hand, new technologies support operators' activity. New generation of RADARS, electronic charts, AIS, computer with database, communication equipment support VTS operators in decision making process. Development of the technologies will give new possibilities of traffic organization in the future. More accurate dates regarding ships movement, where situations will give also new possibilities, but this will require new regulations, which will allow more precise cooperation between operators and ships.

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