THE IMPORTANCE and CONTRIBUTIONS of THE VTS TOWARDS THE ESTABLISHMENT of THE GLOBAL SAFETY MANAGEMENT SYSTEM for THE SAFETY of THE MARITIME TRANSPORTATION

B. Sitki USTAOGLU
ITU Maritime Faculty
Tuzla, Istanbul 81716, TURKIYE
ustaoglu@itu.edu.tr

and

Masao FURUSHO
Kobe University of Mercantile Marine
5—1—1, Fukae Minami,
Higashinada, Kobe,658—0022, JAPAN
furusho@cc. kshosen.ac.jp

ABSTRACT

Although maritime transportation has a much longer history comparing to the air transportation because of the advantages induced various reasons of the air transportation recent technological and applicable developments are imported to the maritime transportation industry from the air transportation.

Shore based traffic control applied to the maritime transportation units —*inter alia* — is one of those despite the fact that there are certain differences on the application, legal bases etc. However the control of the maritime traffic from shore tends to increase world wide although there are considerable variations on the legal, technical and form of application bases from one authority to another unlikely to those observed in the air transportation industry.
The authors argue that the VTS applications are invaluable aids for the safe navigation and consequently for the safety of the maritime transportation if they are properly manned and operated without doubt. However to enhance safety traffic conditions at sea and consequently minimize the risks threaten the maritime transportation some advanced applications can be carried out on the shore based maritime traffic control.

1. Introduction

Despite considerable developments on technology and safety measures, in parallel to the safety and effectiveness of marine transport are still a matter of serious concern on the global basis. Particularly by pressure of economic imperatives the increase of size and speed of the commercial ships has been observed as one of the most efficacious factors. Some of the other factors such as decrease of quality of the seafarers, increase of the total world merchant fleet and consequently the increase of marine traffic density, etc. In addition to these process in commercial maritime transportation sector recent decades have been the period of important diversification of marine activities as well. With the new innovation on the underwater technology, exploration of petroleum products and other mining of mineral resources from the sea bed, installation and maintenance of pipelines, underwater cabling activities and similar construction work have been carried out in an inclining tendency (Degre, 1995). All of these are important factors that are increasing the casualty risk in all navigable waters and apparently in confined waterways or port approaches in particular.

On the other hand, since the size of the cargo vessels have extremely enlarged in particularly those that are carrying dangerous or hazardous cargo in bulk or other forms of transport the threat for the marine environment has become at an unacceptable level. Therefore besides some serious measures taken by international or regional basis in multilateral or unilateral norms in the form of international conventions or amendments to the existing conventions, agreements, memorandum of understandings or acts; control and monitoring of marine traffic techniques were

developed and founded in areas where the traffic concentration is higher such as port approaches, natural channels, straits or other places where the deep see and local traffic are met.

1970s are the years that Vessel Traffic Services (VTS) had become a common element in major ports or waterways throughout the world. However although some countries stop running some of the systems due to budget problems later on it is observed that afterwards the severe oil pollution incidents as a consequence of the recent casualties these countries established more sophisticated VTS around their coasts. New York VTS and New Orleans VTS can be given as a sample of this case. New York VTS was commissioned in 1978, became fully operational in 1985 and closed in 1988 due to budget constraints however reopened in 1990. Similarly, New Orleans VTS was commissioned in 1977 and closed in 1988 due to same grounds (Babu and Ketkar, 1996). New Orleans VTS was also decided to be reopened in late 90s and was under construction when one of the co-authors of this paper had visited it in 1999.

1.1. Overview of the VTS Developments

Although it is known that some form of traffic control has existed since sixth century in Grand Canal in China, first radar set installed in the Port of Liverpool especially to assist pilot cutters in restricted visibility in 1948 which is admitted as the pioneer of the modern VTS. This was followed by Long Beach, California after one year with installation of VHF radio set in 1951 (Satow, 1990). In same period Halifax and Le Havre were the other ports carried out similar trials (Hughes, 2000) followed by Rotterdam in 1956. Then shore based radar chains became a common tool in most other major European and North American ports and harbors in 1960s followed by Japan in early 1970s.

Nowadays one form of VTS is all around the globe despite the fact that there is no determined standards. These services can be seen in all continents and most of the littoral countries. Some of these are China, Egypt, Hong Kong, South Africa, all European countries including those of Baltic Sea, Atlantic and Mediterranean littorals, most of Mediterranean countries, countries around the Arab Peninsula, some of the Black Sea littorals such as Romania, Ukraine. Only In the United States of America there are as many as 23 operational VTS areas (Babu and Ketkar, 1996). 12 in Canada (Martin and Bushell, 2000) and 20 in China (Gonchen and others, 2000).

1.2. Functions of the VTS

VTS is defined in the IMO guidelines[1] as ... is a service implemented by a Competent Authority, designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area . As it is mentioned in the definition, VTS is a service rather than a system. However the service may be given through a well organized system.

Having considered the definition it is clearly deduced that a VTS service should comprise at least an information service. Nevertheless it may also include other functions such as navigational assistance or traffic organization or a combination of both. In other words; it may range from the provision of simple information messages to extensive management of traffic within a port or waterway.

One of the services provided by a VTS is information service. Information service is the case that VTS is enabling essential or necessary information provided to the users i.e. those on-board subject to make navigational decision. Second service provided by a VTS is navigational assistance. Navigational assistance is a higher level service comparing the previous one and it is the case that VTS is involving decision making process regarding the ship s navigation and providing navigational advice to those on-board and consequently monitor its effects. Other service provided by VTS is traffic organization service. Traffic organization is a service to prevent the development of dangerous maritime traffic situations of an early stage and in fact it regulates the traffic within the VTS area.

One might think that these all three functions are resembling and in practice very much similar. Certainly it is not the case. There are serious differences on the legal and liability basis and the competent authorities as well VTS authorities must be very careful when planning a new VTS or carrying out the service.

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[1] Resolution A. 857(20) Adopted on 27 November 1997.

However regardless of the type of service provided the common achievements of a successful VTS in general terms can be summarized as follows:

- Improvement of Safety of Traffic; by foresighted prevention of situations of likely to be endangering either the vessel concerned or any other encounters in the vicinity or the environment. This capability very much depends on the quality of the service provided which has direct link with the quality of all of the components of the VTS. The VTS components or the basic elements of the system can be categorized as four; hardware, staff, training and procedures(Kop, 1990) or in another categorization was made considering the training and staff in one category and hence; people, hardware and procedures(Wiersma and others, 2000). Thereby safer traffic flow can be achieved through the service provided either as an information service, traffic organization service or navigational assistance service or combination of them. In addition to that VTS can supply a supporting service to all allied services and other interested parties by exchanging information, using common databases and making action agreements.[2] On the other hand, in case of an unexpected emergency situation such as a casualty (e.g. collision or stranding) by organizing the other traffic in a confined waterway the an exacerbated situation can be avoided.
- Improvement of Efficiency of Traffic; by achieving an appropriate planning and execution delays can be avoided and optimum traffic flow can be obtained. This capability also depends on the quality of the VTS elements as well as VTS objectives. Similarly through the service provided this benefit can be shared by the service providers, allied services and the users.
- Improvement of Safety of Environment; by achieving safer navigable waters VTS does serve to reduce the environmental risks simultaneously in fact. Nevertheless, there are some other facilities provided by the VTS for the environmental protection in the following areas:
  - Optimized traffic flow and additional navigational assistance (if provided) for ships carrying dangerous and/or noxious cargo can decrease the possibility of casualties involved these type of vessels,
  - Providing prompt information to the competent authorities about movements of ships carrying hazardous/dangerous/noxious cargo onboard hence enabling them check the further planning i.e. port control or others if necessary,
  - In case of emergency of a pollution incident early detection can be performed and co-operation can be done with the emergency clean-up services and other official bodies. Consequently by regulating the traffic further problems can be prevented in advance.
  - By continuous monitoring illegal and deliberate spills and other source of pollution events can be prevented.

2. Various Types of Vessel Traffic Services and Their Comparisons: What s In A Name?

Definition of the VTS was given above as quoted from IMO VTS Guidelines. However, there are dozens of Vessel Traffic Services around globe and almost as many names as the number of the services one observes. In the previous paragraph common benefits of the Vessel Traffic Services were discussed. Then, what would be the difference of the VTS and VTIS or VTMIS?

Before going into details of above mentioned technical words regarding the services provided by the VTS authority, VTS as a base, fundamental wording embracing all types of these services should be categorized in terms of geographical location of where it is based. This categorization can be named as main type which is divided into three; coastal, estuarial and Harbor (Hughes, 2000). As a matter of fact these main categories are one of the most effective specifying factors for a competent authority to decide what type of VTS that the authority should establish. For instance, coastal type VTS is usually used for surveillance purposes established in sensitive areas to make sure the vessels passing through are complying with the traffic separation schemes. English Channel VTS, Morocco (Strait of Gibraltar) VTS and Turkish Straits VTS (still under construction) can be given as sample of coastal VTS. Great Belt VTS, two different VTSs one of which run by Swedish Administration where the other by Danish Administration in the Flint Channel area are other examples of coastal surveillance. It can be stated that major objective of the coastal VTS is safety of maritime traffic and protection of the marine environment. Traffic efficiency may or may not be of major concern.

Estuarial type VTS is usually found in rivers or estuaries and carry out its duties to ensure safe transit of marine traffic in the area concerned. Since these areas are usually on the approaches of ports performing the optimum and efficient traffic organization to achieve maximum possible traffic flow provided that the safety conditions observed

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[2] IALA VTS Manual, 1993 Edition.

are among the objectives of the VTS as well as providing safer navigational conditions and better environmental protection.

Harbor type VTS is for vessels entering or leaving the port. Main concern is usually traffic efficiency despite other important factors are also aimed. Port of Dover or Portsmouth are examples for harbor type VTS (Hughes, 2000).

It can be stated that despite the relatively long history, VTS has come upon maritime sector in a rather *ad hoc* way. Since the VTS developed step by step rather in a scattered way all over depending on the individual trials in a number of different ports or out of traffic separation scheme neither training standards nor legal framework could have been set up. However it is on the contrary, in air transportation sector Air Traffic Control (ATC) was formulated as part of the overall development of a specific transportation and then easily set up necessary legal terms in a widely accepted international convention[3](Gold, 1990). In other words, maritime transportation is always under influence of long historical and traditional background therefore implementation of changes — no matter how good they are — takes considerable time. VTS is a typical case ofhis phenomena.

Apart from early applications despite the fact that Vessel Traffic Services have been existing quite a number of different regions and/or different countries since early 1960 first action by the IMO was carried out in 1968 when Resolution A.158(ESIV) was adopted (Kop, 1990). This was followed by 1985 IMO VTS Guidelines[4] and an updated version Guidelines in 1997[5]. However there are still no common standards on many aspects on VTS applications. Today, one can observe different names for various VTS applications around the world which some of them giving the same service. Vessel Traffic Service (VTS) is the only acronym that has been officially defined by the IMO. However one can see various acronyms such as Vessel Traffic Information Services/System (VTIS), Vessel Traffic Management Services/System (VTMS), Vessel Traffic Management and Information Services/System (VTMIS), Vessel Traffic Control (VTC), Marine Traffic Control (MTC). Although there are some functional differences between these services, these are mainly due to the political regime of the VTS area or capability of VTS elements, aims and objectives of the Competent Authority etc. For instance; There are 12 high level VTS centers in operation covering 14 zones (Vancouver, Tofino, Prince Rupert, Sarnia, Montreal, Quebec, Les Escoumins, Saint John, Halifax, Placentia Bay, Port-aux-Basques and St. John s) and the major impetus for the creation of Canadian VTS systems is declared as Oil spills and the threat of oil spills (Martin and Bushell, 2000). On the other hand another example is Hong Kong VTS, which was installed in 1989 and the main objective was handling the busy vessel traffic in an efficient way. The other major functions are facilitate the safe and expeditious execution of port calls of commercial vessels, maintenance of port call records, automation of related invoicing procedures and supply of information to pilots, government agencies, port users and the general public (Fan and Pang 2000).

It may be observed that despite the fact that the first generation of Vessel Traffic Services were rather found for optimizing the traffic flow or in other words economy dominated where the recent VTS types were established rather for environmental protection. And this is natural considering the recent environmental campaigns and increase of public concern for the environment.

3. Expectations From VTS Towards the Future

Although there are some scanty applications in particular on legal basis there is no doubt that Vessel Traffic Services will play more pro-active role on the maritime transportation in near future. Automatic Identification System(AIS) as a VTS tool will significantly increase the VTS capability. It can obviously be stated that the AIS implementation will open a new era on the VTS history. One might even question whether shore based pilotage would be possible through VTS by having the AIS facilities. However since this debate is completely out of the coverage of this paper therefore it would be better to leave this question for a further discussion.

IAS will provide (transmit) three message types which will be transmitted over VHF/FM maritime radio bands. These message types are (Harre, 2000):

§ Static Messages; IMO number, call sign and name, length and beam, type, location of the position fixing antenna on the ship.

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[3] Chicago Convention on International Civil Aviation, 1944 and relevant protocols.

[4] Resolution A.578(14).

[5] Resolution A.857(20).

§ Dynamic Messages; ship s position with accuracy indication and integrity status, time course over ground, speed over ground, heading, rate of turn, navigational status, angels of heel, pitch and roll (optional),
§ Voyage related messages; ship s draught, hazardous cargo type, destination and estimated time of arrival (at master s discretion) and route plan in form of way points.

The authors of this paper support the general concept on shore based surveillance services and pilotage services. Pilotage and shore based surveillance services are two main real time information and assistance to the shipmaster nowadays combining each other can not be considered as an alternative to one another. Having long historical background and tradition pilotage is still the first priority navigational assistance to the shipmaster having considered the special circumstances of the ship maneuvering characteristics. And this is a commonly admitted principle of ultimate decision regarding the ship maneuvering should remain with those on board i.e. master or pilot . In fact VTS is mainly a support service to provide information (or sometimes advice/assistance) for those on board who are not able to have the overall picture and an additional watch-eyes to ensure that everything is going on well in a sensitive area.

VTS will play more important role for the overall safety measures not only in a regional geographical area but also in the globe by sharing data obtained by each regional/local VTS between the regional systems. This concept has been considering throughout some international (particularly European) projects since as early as late 1980s[6]. Over the past decade much research work has been carried out by the European Commission with respect to vessel traffic services. Throughout these projects it became evident that information available to VTS could be used for further application. This could be shipping agents, Port State Control bodies, security units, other official bodies or commercial enterprises or basically all parties concerned with maritime transport management. This concept was Regional Vessel Traffic Services (RVTS). In 1995 a number of projects were initiated relating with the VTS including two large projects. One of them named COMFORTABLE concerned with the development of new tools for VTS use to help operators recognize and assess traffic situations. The other was POSEIDON concerned with integrated VTS, monitoring of sea environment and inter-active data on-line networks. The latter one has significant importance and is subject to play serious pro-active role for the global safety measures in case it is enlarged to embrace more global geography.

Within the EU Maritime Safety Policies recently in particularly afterwards of the Erika casualty in the North Brittany Costs of France in 1999 EP was decided to strength the safety measures for both own flag vessels as well as for foreign flag vessels. Among others the issues on telematics applications for transport in Europe. A part of a global telematics system for trans-European transport networks; some important maritime issues were included and traffic control/management and information centers were emphasized.

When these new policies realized it will obviously be a new era on the global safety measures with the support of AIS in shipping. AIS is being considered not only for short range data transfer but also for long range data transfer. Therefore it can be used as a tool for not only data transfer to the vessels in the vicinity (VHF range) as well as to the VTS. It is a tool which can be used for global ship monitoring as a long range transciever either will be work on Inmarsat-C or MF/HF DSC radio[7].

4. Conclusion

As it was deduced from the recent projects carried out in the European Community and the new technologies just integrated to the communication systems of the mobile units in the International Maritime Transportation VTS concept is fronting completely a new era. However, the idea of Traffic Control, Management and Information Network should amplified in such that it will embrace all compatible Vessel Traffic Services. This is will be a Global VTS network which can possibly facilitate all functions listed below:

§ There will be a united memorandum of understanding (MOU) combining all regional MOUs and enabling them act in a concordant manner. And by doing so, all Ports State Control activities will be able to standardized, supportive to each other,
§ A global oil pollution monitoring system will be established. Thereby not only regional protection but also a global marine environment protection will be enabled,

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[6] Cost-301 Project; European Concerted Action on Shore-based Maritime Navigation Aids Sytems.
[7] Guidelines for installation of shipborne AIS.

- § This process will improve the security measures which became a major concern for some of the countries afterwards the inauspicious event of September 11th of last year,
- § It will enable a global monitoring facility for observing the rogue vessels those who do not comply with the COLREG not only in areas under a specific VTS coverage but also in wider navigable area.
- § Support Search and Rescue organizations and SAR activities,
- § Support maritime Security Guards against illegal activities such as smuggling, piracy etc.
- § Enabling advanced planning for port managers,
- § Enabling advanced planning for traffic controllers/managers (VTS) etc.,

References:

Satow, P. F. C. (1990): Vessel Traffic Systems- A Background To Its Introduction, *The Nautical Institute On Pilotage and Shiphandling*, 202-203.

Martin, S. And Bushell, G. (2000): Ocean Risks and Criteria Analyses-ORCA, *VTS 2000 Symposium, Singapore*, **Session 3**, **Paper 2**, 1-19.

Fan, H. C. and Pang, S.K.K (2000): Replacement and Upgrading Syudy For the Vessel Traffic Service System For Hong Kong, VTS 2000 Symposium, Singapore, **Session 3, Paper 3**, 1-8.

Degre, T. (1995): The Management of Marine Traffic, A Survey of Current and Possible Future Measures, *J. Navigation*, **48**, 53-69.

Babu, A. J.G. and Ketkar, K.W. (1996): Strategic Planning of Vessel Traffic Services Using ABC Analysis and Optimization, *J. Navigation*, **49**, 235-252.

Hughes, T. (2000): Vessel Traffic Services (V.T.S.) — Training and Qualification Standards,*VTS 2000 Symposium, Singapore*, **Session 6**, **Paper 3**, 1-18.

Gonchen, L, Yu, L. And Baocheng, D. (2000): The Review and Future of VTS in China, *VTS 2000 Symposium, Singapore*, **Session 5**, **Paper 4**, 1-7.

Kop, G. (1990): General Principles of VTS and the IMO Guidelines, *The Nautical Institute On Pilotage and Shiphandling*, 205-208.

Wiersma, E., Butter, R and Padje, W. V (2000): A Human Factors Approach to Assessing VTS Operator Performance, *VTS 2000 Symposium, Singapore*, **Session 5**, **Paper 1**, 1-11.

Gold, E. (1990): Legal and Liability Aspect of VTS Systems — Who Is To Blame When Things Go Wrong,*The Nautical Institute On Pilotage and Shiphandling*, 216-221.

Harre, I. (2002): AIS Adding New Quality to VTS Systems, *J. Navigation*, **53**, 527-539.