# Chapter 11 - Technical Equipment of VTS Systems

# 1101 Introduction

The aim of this chapter is to introduce technical equipment of VTS systems which will support the operational requirements referred to in Chapter 5.

# 1102 Definitions and references

**VTS Equipment** – VTS Equipment refers to the individual items of hardware and software which make up the VTS System.

**VTS System** – the VTS System is considered to be the hardware, software and their behavior as a coherent entity. This excludes personnel and procedures.

The following IALA documents should be used as references when setting up a VTS System and dealing with technical equipment:

* + *Recommendation V-119 – on the Implementation of Vessel Traffic Services* – describes the process to decide whether a VTS system is required and, if so, the process to establish such a system.
  + *Recommendation* V-128 - *on Operational and Technical Performance of VTS Systems*.
  + Guideline no. 1111 - *on* *Preparation of Operational and Technical Performance Requirements for VTS Systems*.
  + Guideline no. 1110 – On use of decision support tools for VTS personnel

# VTS system specification and operational requirements

IALA Guideline no. 1111 provides detailed guidance to assist the VTS Authority in preparing the definition, specification, establishment, operation and upgrades of a VTS system. The document addresses the relationship between the operational requirements and VTS system performance requirements and how these reflect into system design and sub-system requirements. In order to achieve an adequate solution, the functional requirements should be derived from the operational requirements.

The implementation of VTS also requires consideration of several other aspects,e.g. locations, sensor and radio coverage, radar target characteristics, sea states, climatic categories, wind conditions, infrastructure, the environment, applicable regulations, approval standards and security.

The VTS Authority should avoid being overly prescriptive, but require that suppliers propose solutions and equipment to meet the specified operational and functional requirements.

The operational and functional requirements should be applicable to all parts of the particular VTS system which typically comprise one or more of the following elements:

* Radio Communication
* Sensors
  + Radar
  + AIS
  + Environmental Monitoring
  + Electro Optical Systems
  + Radio Direction Finder
  + Long Range Sensors
* Data Processing
* VTS Human/Machine Interface
* Decision Support
* External Information Exchange

In general, there is no direct relation between the type of service(s) INS, NAS, TOS, as defined in chapter 5 and the required technical capabilities of the VTS system and its equipment. However, system and equipment should be designed to meet specific operational requirements of each VTS.

The following example illustrates the approach taken to derive VTS equipment from operational requirements

Meteorological Information Service:

* Operational requirement is to be able to inform vessels (INS) in a VTS area of meteorological conditions. The VTSO needs to give a periodical spoken message and in response to a request.
* As a result, VTS functional requirement is at a minimum the provision of radio communication, but also in addition VTS user interface, other means of communication, meteorological sensors as a part of the VTS system and/or interface to external sources such as meteorological office, and possible requirements to automation of these functions.
* Based on that and all other aspects taken into consideration in the tendering process, the VTS vendor proposes the solution and the associated equipment

# 1104 Radio Communication

VHF Radio communication is the primary means through which Vessel Traffic Services are delivered. It provides the VTSO with a means to deliver timely services and a real-time assessment of the situation in the VTS area.

The Maritime VHF band comprises a number of internationally defined channels which are used for voice and data communication. Most of the channels are used for voice communication however, the potential expansion of VHF digital communications is increasing. Digital Selective Call (DSC) and AIS already provide the means to exchange data such as ship identification, positions and short messages. Digital communication has a number of advantages such as more efficient use of available bandwidth and less prone to errors. New developments will provide even more digital functionalities in the future.

# 1105 Sensors

Sensors are the means through which the VTSO can build up situational awareness, which is required to provide Vessel Traffic Services. Sensors collect data, which is then processed to extract necessary information.

Different types of sensors, each with their specific advantages, may be used by VTS Systems. Often a combination of sensors is used to increase the quality/reliability of information delivered to the VTSO, where:

* Radar is based on reflection of radio waves to detect and track objects in the VTS area. As such it contributes to the creation of a reliable traffic image, without any cooperation from targets.
* AIS is based on VHF digital data communication and provides identified position reports that are sent at regular intervals. Other data is also sent but on a less frequent basis, for example call sign, ship characteristics, type of cargo and persons on board.
* Meteorological and hydrographical sensors assist in monitoring of prevalent conditions, supporting SAR and managing environmental hazards.
* Electro-Optical Systems (EOS) consist of imaging devices to provide visual situational awareness.
* Radio Direction Finder (RDF) is a sensor system that indicates the bearing of a VHF transmitting station. This is useful for identifying targets that cannot be identified by other means.
* Long Range Sensors, such as satellite-based systems are rarely used in VTS systems. However, they can provide supplementary information to locate vessels. They may also assist SAR operations.

# 1106 Data Processing

Data processing functions aim to build information that is relevant to the VTS operation by processing data gathered by sensors and/or by external systems. Some of this data is only used by the VTS center for managing day-to-day operations.

Specific data processing functions comprise target tracking and sensor data fusion, to maintain an up-to-date traffic image.

Other data processing functions collect and extract data to provide information which supports VTS operations. For example, up-to-date vessel and voyage data is maintained and can be accessed by the VTSO.

# 1107 VTS Human/Machine Interface

The Human / Machine Interface (HMI) can be broadly defined as the User Interface which is the space where interaction between humans and machines occurs. The primary aim of this interaction is to provide an intuitive, accurate and failsafe presentation of information which aids the VTSO in making operational decisions. Other user interfaces include, for example, recording and replay, system management, security monitoring and maintenance.

In addition to the HMI on screen, the VTS center user environment is of paramount importance. Ergonomic design should consider providing a comfortable environment for long periods of use and allow for adjustments to minimize fatigue.

# 1108 Decision Support

Decision Support helps to assess situations, to plan and to provide timely and necessary information for taking decisions.

For example, CPA/TCPA is a commonly used tool in a VTS, delivering TOS, and helps in maintaining traffic separation.

Note that decision support in VTS is under continuous development, resulting in tools that will support an increasing number of aspects of the Operation, Planning and Management of VTS.

# 1109 External Information Exchange

VTS systems need to be able to communicate with relevant allied services, National Points of Contact for services such as LRIT, and neighboring VTS systems.

Exchange may include information linked to:

* Traffic Management
* Hazard management
* SAR
* Logistic chain support
* Law enforcement
* Environmental protection
* Waterways infrastructure management
* Maritime safety information (MSI)

# 1110 Lifecycle aspects of VTS equipment

When setting up a VTS System or adding VTS equipment, the lifecycle management strategy that is appropriate to the organization is an important consideration. This includes administrative and technical aspects such as:

* legal and procurement aspects
* human resource skills
* financial aspects
* physical limitations
* environmental conditions

Creating synergies or collaborations with allied services and complementary organizations should be taken into account.

Technical requirements such as availability, reliability, scalability, modularity, interoperability, maintainability and security should be taken into account. Also obsolescence planning regarding possible technological disruption, such as limited lifetime of equipment and software, should be consistent with the lifecycle management strategy.

The conformance to the functional and technical requirements and performance of VTS equipment should be verified and validated prior to operation, according to an agreed acceptance test plan.

Taking into account the chosen lifecycle management strategy and based on the maintenance capabilities of the VTS organization, specific technical documentation and training should be considered. Responsibility for executing and monitoring the necessary maintenance tasks, defined in an agreed maintenance plan, should be assigned. Where applicable service level agreements should be established.

# 1111 Legal and other aspects of VTS equipment

VTS systems have to be operated within the Legal framework set by the national competent authority and consistent with national and international law. The following paragraphs introduce key issues that must be considered:

Licensing and approval certificates

When specifying and purchasing VTS equipment; consideration should be given to the requirement to seek telecommunications authority approval in the form of an appropriate license.

Equipment must conform to the appropriate regulations for the purpose intended;

Restrictions on the export of certain technologies exist and therefore the VTS Authority must ensure they can obtain this equipment.

Recording and replay, Traffic and incident analysis

Within both national legal obligations and limitations, provision should be made for the storage, security, retrieval, integrity and presentation of VTS data.

The data type, resolution and period of time for storage have to comply to incident/accident investigation procedures of the VTS Authority and other authorized parties. The data should be recorded automatically and be capable of replay without impact to on-going VTS operations.

Data sharing

When addressing data sharing and/or collaboration with other organizations, VTS authorities must consider for example data integrity, confidentiality, availability as well as legal issues, such as privacy. These issues are described in more detail in:

IALA Guideline N° 1086 – The Global Sharing of Maritime Data and Information.