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20ter, rue Schnapper, 78100
Saint Germain en Laye, France
Telephone +33 1 34 51 70 01 Telefax +33 1 34 51 82 05
E-mail - iala-aism@wanadoo.fr Internet - http://www.iala-aism.org

FOREWORD

This fourth edition of the IALA VTS Manual has been prepared by the VTS Committee. It updates the guidance and advice provided in previous editions to assist authorities considering the implementation of a new Vessel Traffic Service or the upgrading of an existing service.

The VTS Committee, formed in 1980, has evolved in recent years. Its membership now represents most of the world's leading national maritime authorities whose delegates are widely experienced mariners and VTS professionals. The VTS Committee is also supported through participation from relevant international sister organisations. This ensures that the Committee is able to speak with international authority on VTS matters and, importantly, to develop new procedures to meet the emerging needs for modern traffic management and to enhance maritime safety.

As a result, this increased pool of expertise and experience has enabled the Committee to develop a new style of VTS Manual with the aim that it should fully meet the needs of the profession and those responsible for managing its activities. It is intended that it should be a general source of reference on any topic and provide a pointer to the more detailed material that any VTS professional may seek.

IALA welcomes feedback about its publications. Readers are invited to send comments or suggestions, which will be taken into account when considering the publication of the next edition.

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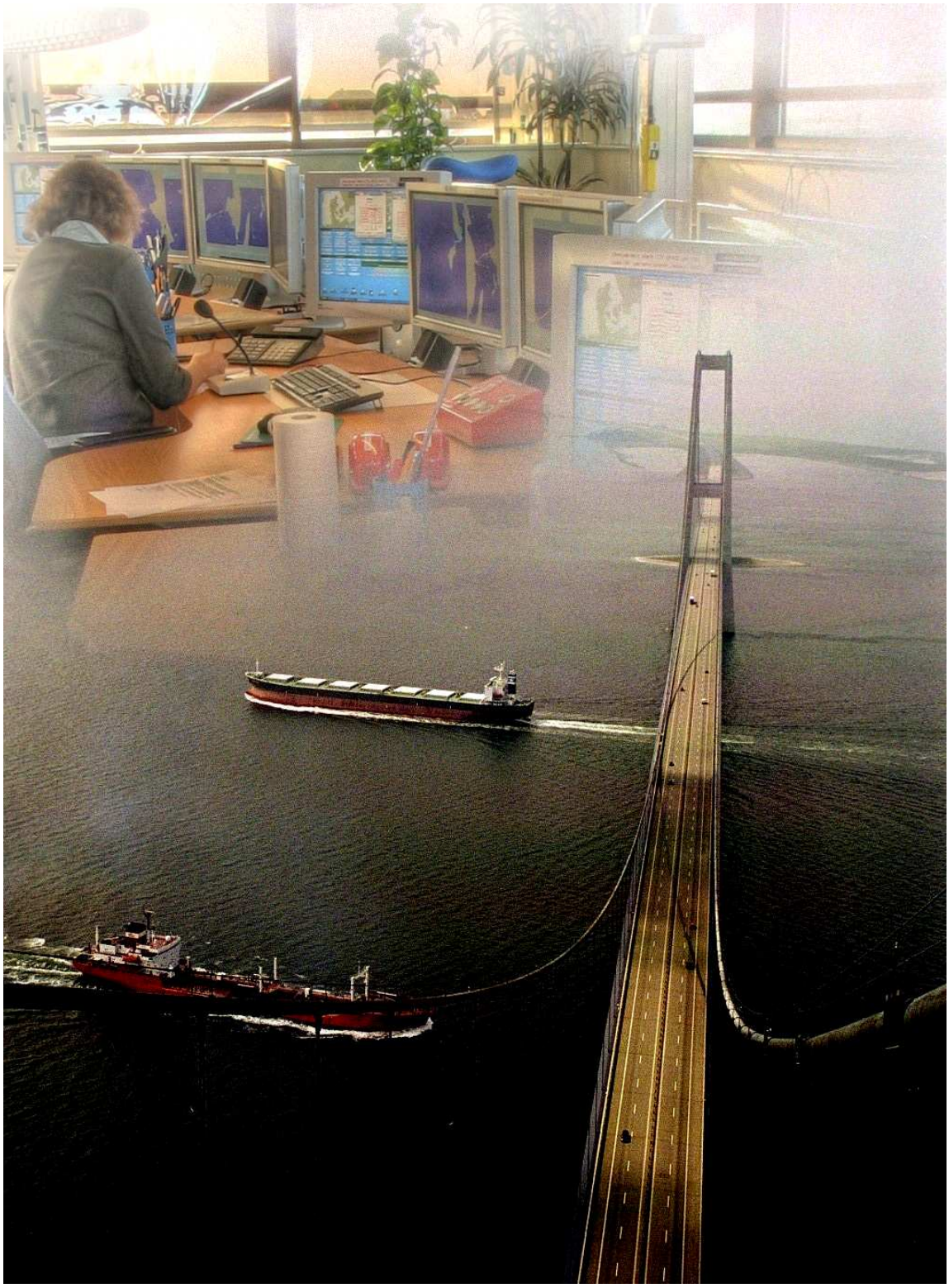

Great Belt Denmark where VTS provides protection for the bridge

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CHAPTER 1: INTRODUCTION

0101 Purpose of the Manual

This is the fourth edition of the IALA VTS Manual. Like its predecessors, it is intended to be a comprehensive guide to VTS and a point of reference for further detailed study.

The contents are aimed at a wide readership to encompass all who are in any way involved with the policy for, provision, operation and effectiveness of VTS; including those with management responsibility at national level and those who deliver services to the mariner.

0102 Development of VTS – A Brief History

The movement of goods by sea has supported world commerce for centuries, giving rise to a need for ships to navigate safely and efficiently. To this end, authorities throughout the world have provided aids to navigation in and around their coastal waters. The earliest aids to navigation were shore side beacons and lights, followed by the introduction of buoys. Over the years, these aids have been steadily improved upon with greater visibility and range and the addition of audible signals.

Fig. 1.1: VTS test site Rotterdam 1948 Source: Photo, collection D. Zwijnenburg.

Not long after World War II, it became clear that short range, audio-visual aids to navigation were not sufficient to enable the full utilisation of port facilities in all conditions

of visibility and traffic density. Weather and congestion induced delays in vessel traffic movement resulted in serious disruption to port operations with consequences for other modes of transport.

A consensus emerged among maritime experts that traffic monitoring using shore-based radar combined with communications could be applied to enhance efficiency and safety in port areas and their approaches. Thus, the first radar based Port Control station was established in Douglas, Isle of Man, in 1948. Later the same year, the port of Liverpool established a radar site and similar trials took place in Rotterdam. (Fig. 1.1). In the nineteen-fifties, a number of shore-based radar chains were established in other European ports, including the approaches to the port of Amsterdam in 1952 and the entire Rotterdam port area in 1956.

These early systems were intended to avoid traffic delays and to increase the efficiency of traffic flow in general. However, attention was also given to the number of shipping accidents and the ways in which these might be reduced. This resulted in studies into the effect that these rudimentary vessel traffic services were having on reducing the number of accidents in port areas under their surveillance. The studies concluded that, in addition to increasing the operational hours, thereby providing better utilisation of a port's capacity, the number of accidents was also being reduced.

In the nineteen-sixties and seventies major shipping disasters, including Torrey Canyon, Metula and Amoco Cadiz, made the public keenly aware of the environmental damage that a shipping accident could cause. The ensuing public outcry for protection of the marine environment brought substantial pressure on authorities to implement measures to enhance the safety of shipping. The concern that such disasters might happen in port approaches and port areas further expanded the use of radar surveillance and vessel traffic management.

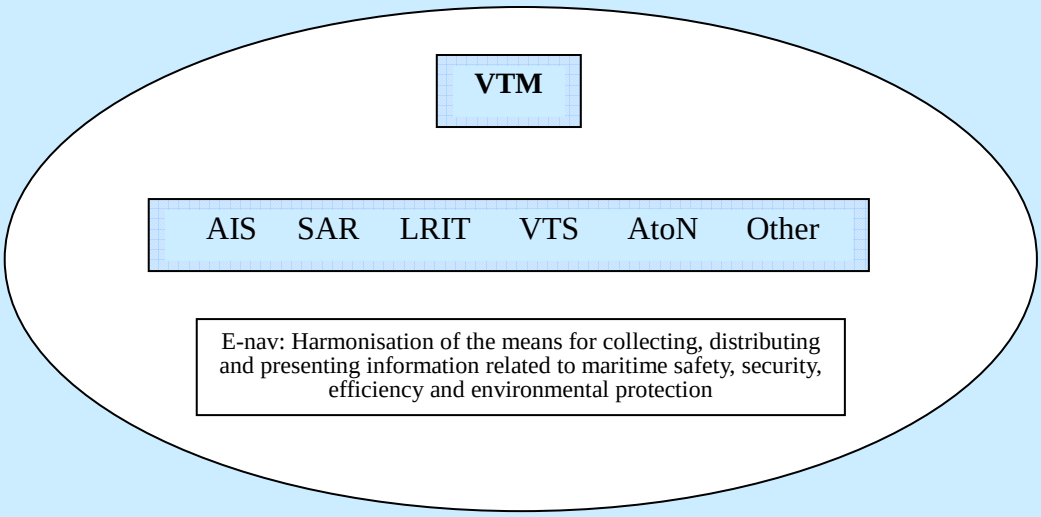
In these early days of radar-aided traffic management, the view on how to proceed further was hotly debated among the port authorities, the pilots and shipmasters. The exercise of control over shipping from ashore was a new phenomenon. It soon became apparent that some form of international harmonisation of these emerging vessel traffic services was needed. Slowly, there was movement towards a co-ordinated approach that was to become Vessel Traffic Services (VTS). VTS was defined and described, and the debate moved to the precursor of IMO, known then as the Inter-Governmental Maritime Consultative Organisation (IMCO). An Assembly Resolution, A.587(14), was adopted on the implementation of VTS that provided a framework for further harmonisation. The

requirements for VTS were considered by IALA and a follow-up study was undertaken jointly with the International Maritime Pilots Association (IMPA) and the International Association of Ports and Harbours (IAPH). In the mid-1990's the original IMO resolution on VTS was revised and updated with the adoption in 1997 of IMO Assembly Resolution A.857(20), the internationally recognised source policy document for VTS.

The development of modern technology was very important for the technical concept of VTS. The concept has developed from a simple radar and voice radio system, with the aim of enhancing navigation in poor visibility, to a modern system using multiple sensors with the objectives of enhancing safety, improving the efficiency of maritime traffic and protecting the marine environment.

At the time of going to press, further significant developments are under consideration at IALA, brought about by factors that include concerns for maritime security, the need to increase the efficiency of traffic and advances in technology and capability. Shore organizations, other than VTS authorities, at local, national and regional level need to interact with vessels. There is thus a role to be filled in the context of Vessel Traffic Management (VTM) at a level higher than the traditional roles of VTS.

Vessel Traffic Management may be described as a collection of global maritime activities supported by information services with the object of improving the safety, security and efficiency of waterways, vessels and their cargo and ensuring environmental protection. In this context, it is likely that VTM would comprise VTS as a central component and would include other activities such as AIS, LRIT, enforcement of laws and treaties, and search and rescue (SAR). A pictorial representation of the concept is:



It is envisaged that development of this concept will be considered in detail at IALA and incorporated into the work programme with a view to developing proposals that will form the basis of consultation with IMO and other interested bodies.

Fig. 1.2: Potential Future Developments that impact VTS

The realities of modern shipping, with larger and less manoeuvrable ships, traffic congestion in ports, hazardous cargoes and the potential for environmental damage,

demand that sophisticated measures be taken to reduce risks. Establishing a Vessel Traffic Service is a significant response to that demand. When established, implemented and operated within the context of international laws, conventions and maritime customs, and with the co-operation of vessel operators, a VTS can contribute substantially to the safety and efficiency of maritime traffic and protection of the environment.

As a result of the improvements in efficiency, safety and the reduction of potential environmental pollution experienced by authorities using a VTS, together with the rapid developments in computer technology, the number of Vessel Traffic Services has increased considerably and there are now about 500 of these services operational. In some countries VTS systems have been established in inland waters with the same overall objectives that apply to the maritime VTS systems.

As Vessel Traffic Services have grown in number throughout the world, the operating concepts have led to various categories of VTS, including coastal, port or harbour, and river services. A coastal VTS is a service provided to assist the safe and expeditious passage of shipping through coastal waters, particularly where there is a high density of maritime traffic or an area of environmental sensitivity or through difficult navigation conditions. Similarly, a port, estuarial or river VTS is a service provided to assist the navigation of shipping when entering or leaving ports and harbours or when sailing along rivers or through restricted waters.

0103 Bodies involved with VTS

IALA attaches great importance to its association with other maritime consultative bodies that participate in the work of the VTS Committee and have played a key role in the development of guidance and the contents of this publication. These consultative bodies include the following international organizations:

International Maritime Pilots Association (IMPA),
International Harbour Masters Association (IHMA)
International Federation of Shipmasters' Associations (IFSMA)
International Association of Ports and Harbours (IAPH) and
The Nautical Institute.

0104 IALA Publications

IALA has established a hierarchy of documents that it publishes as indicated in the table below. Detailed policy guidance and advice is published in IALA Recommendations.

It is not intended that a similar level of detail be provided in this manual when such information is available elsewhere, as referenced in the text below.

IALA Recommendations These documents represent the highest level of IALA documentation (equivalent to a 'standard' in an intergovernmental organization). Recommendations provide direction to IALA members on uniform procedures and processes that will facilitate IALA objectives. IALA recommendations contain information on how members should plan, operate and manage Aids to Navigation. Recommendations may reference relevant International Standards and IALA Guidelines.

IALA Guidelines These documents provide detailed information on an aspect of a specific subject, indicating options, best practices and suggestions for implementation. IALA Guidelines relate to planning, operating and managing Aids to Navigation

IALA Manuals These documents provide an overall view of a large subject area. Whilst aimed at introducing a subject to a widely varied readership, reference is also made to IALA Guidelines and IALA Recommendations, as well as other related international documents, as an indicator of further study.

Fig. 1.3: Hierarchy of IALA Publications

0105 Definitions and Abbreviations

A list of definitions and a glossary of abbreviations of the terms commonly used in connection with VTS are respectively at Annexes A and B to this chapter.

ANNEX A: DEFINITIONS

Accident	An unintended event resulting either in fatality, injury, ship loss or damage, property loss or damage, or environmental damage.
Accredited Training Institute	An establishment approved by a competent authority for the purposes of training VTS Operators, VTS Supervisors and/or On-the-Job Training Instructors and is in possession of a valid Certificate of Accreditation.
Accredited training programme	A course of study comprising basic or advancement training at an Accredited Training Institute and "on-the-job" training carried out at the appropriate VTS Centre.
Aid to Navigation	Any device or system, external to a vessel, which is provided to help a mariner determine position and course, to warn of dangers or of obstructions, or to give advice about the location of a best or preferred route.
Allied Services	Allied Services are services actively involved in the safe and efficient passage of the vessel through the VTS area.
Automatic Identification System (AIS)	A broadcast transponder system, operating in the VHF maritime mobile band.
Competence	The ability to perform defined tasks or duties effectively
Competent Authority	The authority made responsible, in whole or in part, by the Government for the safety, including environmental safety, and efficiency of vessel traffic and the protection of the environment in the area.
Exclusion Zone	A geographical area, within which all other vessels should remain clear unless authorised. The size and shape of the area may vary depending on the risks involved.
Hazardous Cargoes	Hazardous Cargoes include: • Goods classified in the IMDG Code • Oils, noxious and harmful substances defined in MARPOL • Radioactive materials listed in the INF Code.
Instruction(s) (as to a vessel's navigation or movements)	When a VTS is authorized to issue instructions to vessels, these instructions should be result-oriented only. The details of execution, such as course to be steered or engine manoeuvres to be executed should be left to the discretion of the master or pilot on board the vessel.

On-the-job training (OJT)	Training and familiarisation provided at the VTS Centre at which the person will be employed. It includes training on the particular services provided by the VTS, the facilities and equipment used, the local geography and appropriate port regulations and procedures.
Place of Refuge	A place where a ship in need of assistance can take action to enable it to stabilize its condition and reduce hazards to navigation, and to protect human life and the environment. (IMO Resolution A.949(23).
Refresher Training	See Updating/Refresher Training.
Revalidation Training	Training required by the Competent and/or VTS Authority in order to revalidate a VTS Operator Certificate. The period of revalidation training is determined by the Competent and/or VTS Authority.
Ship Domain	An operational zone around, above or below a vessel within which an incursion by another fixed or moving object, or another domain, may trigger reactions or processes. (see 0605)
Ship Safety Zone	A zone around a vessel within which all other vessels should remain clear unless authorised. (see 0605)
Stakeholder(s)	Any individual, group, or organization able to affect, be affected by, or believe it might be affected by a decision or activity. The decision-maker(s) is a stakeholder.
Updating/Refresher Training	Training required by the Competent and/or VTS Authority in order to ensure that the level of competence is maintained appropriate to the service type(s) provided by the particular VTS centre when, for example, there has been a break in service, new equipment installed or new operating procedures have been introduced.
Vessel Traffic Management	Vessel Traffic Management is the co-ordination and exchange of data about global maritime activities. It may incorporate VTS and include information from other maritime agencies.
Vessel Traffic Service	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 respond to traffic situations developing in the VTS area.
VTS authority	The authority with responsibility for the management, operation and co-ordination of the VTS, interaction with participating vessels, and the safe and effective provision of the service.

VTS area	The delineated, formally declared service area of the VTS. A VTS area may be subdivided in sub-areas or sectors.
VTS centre	The centre from which the VTS is operated. Each sub-area of the VTS may have its own sub-centre.
VTS Certification Log	A record of VTS related certificates and endorsements awarded to VTS personnel by the Competent and/or VTS Authority. The record may, for example, be in the form of a logbook or the certificates themselves may be kept separately.
VTS Manager	Some VTS organisations may require the appointment of a manager to administer and interface with regional or port management authorities. In such circumstances the manager should possess managerial qualifications to the satisfaction of the Competent Authority.
VTS Operator	An appropriately qualified person carrying out VTS operations on behalf of a VTS authority. (VTSO)
VTS Operator Course Certificate	A certificate awarded upon successful completion of the IALA Model Course V103/1 VTS Operator training at an accredited VTS training institute. This course certificate alone is not an authorisation to operate as a VTSO.
VTS Operator Certificate	A VTS certificate of competence awarded by the Competent Authority after the candidate VTSO has successfully completed both the V103/1 training and OJT at the specific VTS centre where the VTSO is employed, as well as meeting any specific requirements of the Competent Authority.
VTS Personnel	Persons trained in VTS operations, holding the appropriate qualifications required by a Competent Authority and acting as VTS Operator, VTS Supervisor and OJT Instructor at a VTS centre. VTS personnel may also include VTS Managers and Technical Support personnel. These latter personnel should ideally hold qualifications appropriate to the duties performed.
VTSO Position	The place in a VTS Centre from which a VTSO carries out his/her duties.
VTS Sailing Plan (VTS Route Plan)	A plan that is mutually agreed between a VTS Authority and the master of a vessel concerning the movement of the vessel in a VTS area.
VTS services	VTS should at least comprise an *information service* and may also include others, such as *navigational assistance service* or a *traffic organization service,* or both of these services, defined in Resolution A.857(20), as follows:

- An information service is a service to ensure that essential information becomes available in time for on-board navigational decision-making.
- A navigational assistance service is a service to assist on-board navigational decision-making and to monitor its effects.
- A traffic organization service is a service to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the VTS area.

VTS Supervisor	An appropriately qualified VTSO carrying out supervisory duties in a VTS Centre on behalf of a VTS authority.
VTS Supervisor Course Certificate	A certificate awarded upon successful completion of the IALA Model Course V-103/2 VTS Supervisor training at an accredited VTS training institute. The course certificate alone is not an authorisation to operate as a VTS Supervisor.
VTS traffic image	A VTS traffic image is the surface picture of vessels and their movements in a VTS area.

ANNEX B: GLOSSARY OF ABBREVIATIONS

AIS	Automatic Identification System
AISM (see IALA)	Association Internationale de Signalisation Maritime (Title of IALA in the French language)
ALRP	As low as reasonably practical
ARPA	Automatic Radar Plotting Aid
ARTA	Automatic Radar Tracking Aid
AtoN	Aid(s) to Navigation
CAS	Collision Avoidance System
CBA	Cost benefit analysis
CCTV	Closed circuit television
COLREGS	International Regulations for Preventing Collisions at Sea
COG	Course over the ground
CPA	Closest point of approach
DCPA	Distance to closest point of approach
DGNSS	Differential Global Navigation Satellite System
DGPS	Differential Global Positioning System
DP	Dynamic Positioning (A vessel control system for precise positioning)
DR	Dead Reckoning
DSC	Digital Selective Calling
EC	European Community
ECDIS	Electronic Chart Display and Information System
ECS	Electronic chart system
EDI	Electronic data interchange
EEZ	Exclusive Economic Zone (Defined in UNCLOS)
EMPA	European Maritime Pilots' Association
ENC	Electronic Navigation Chart
EPIRB	Emergency Position Indicating Radio Beacon
EPTO	European Permanent Traffic Observatory
ETA	Estimated time of arrival
ETD	Estimated time of departure
EU	European Union
FSA	Formal Safety Assessment
GLONASS	Global Navigation Satellite System
GLOSS	Global Sea Level Observing System
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
HAZMAT	Hazardous Material
HMI	Human-Machine Interface
HNS	Hazardous and Noxious Substances
HSC	High Speed Craft

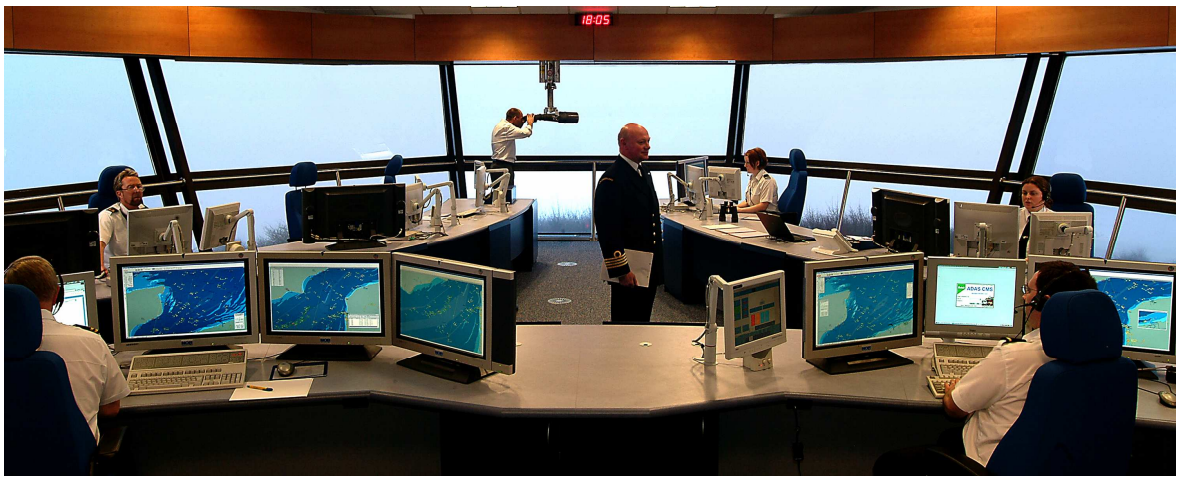
IACS	International Association of Classification Societies
IALA (see AISM)	International Association for Marine Aids to Navigation and Lighthouse Authorities
IAMSAR	International Aeronautical and Marine Search and Rescue Manual
IAPH	International Association of Ports and Harbours
ID	Identification
IELTS	International English language testing system
IFSMA	International Federation of Shipmasters' Association
IHMA	International Harbour Masters' Association
IHO	International Hydrographic Organisation
ILO	International Labour Organisation
ILS	Integrated logistics support
IMDG	International Maritime Dangerous Goods Code
IMO	International Maritime Organization
IMPA	International Maritime Pilots' Association
IMSO	International Mobile Satellite Organisation
INMARSAT	International Maritime Satellite Organisation
INF	Irradiated Nuclear Fuel on board Ships Code
INS	Integrated Navigation System
INS	Information Service
IOC	Intergovernmental Oceanographic Commission
ISM	International Safety Management Code
ISO	International Standards Organisation
ISPS	International Ship and Port Facility Security Code
ITU	International Telecommunications Union
ITU-R	International Telecommunications Union – Radiocommunications Bureau
LRIT	Long Range Identification and Tracking
MARPOL	Regulations and provisions of the International Convention for the Prevention of Pollution from Ships 1973/1978
MAS	Maritime assistance service
MEDEVAC	Medical evacuation
MEPC	Marine Environment Protection Committee (Committee of IMO)
MMSI	Maritime Mobile Service Identity (number)
MRCC	Maritime Rescue Co-ordination Centre
MSC	Maritime Safety Committee (Standing Committee of IMO)
MTBF	Mean time between failures (in hours)
MTTR	Mean time to repair (in hours)
NAS	Navigational Assistance Service
NAVGUIDE	IALA Aids to Navigation Guide
NUC	Not Under Command (see Colregs)
OJT	On-the-job training
OJTI	On-the-job training Instructor
OPRC	International Convention on Oil Pollution Preparedness, Response and

	Co-operation (OPRC),1990
PIANC	Permanent International Association of Navigation Congresses
PLA	Prior learning assessment
PLAR	Prior learning assessment and recognition
PSSA	Particularly Sensitive Sea Area
RACON	Radar response Beacon
RCC	Rescue co-ordination centre
RCDS	Raster chart display system
RDF	Radio Direction Finder
RIS	River Information Service
RNC	Raster navigation chart
ROT	Rate of turn
RSO	Recognized Security Organisation (ISPS Code)
RTI	Radar traffic image
RTT	Real time tracking
SAR	Search and Rescue
SART	Search and Rescue transponder
SMCP	Standard Marine Communication Phrases
SOG	Speed over the ground
SOLAS	Convention on the Safety of Life at Sea
SPA	Special Protection Area
SRS	Ship reporting system
STCW	Standards of Training, Certification & Watchkeeping for Seafarers
STDMA or SOTDMA	Self-organising time division multiple access
TCPA	Time to Closest Point of Approach
TOS	Traffic Organisation Service
TSS	Traffic Separation Scheme (Colregs Rule 10 and IMO Publication 927)
UKC	Under keel clearance
UNCLOS	United Nations Convention on the Law of the Sea
UTC	Universal Time Co-ordinated
VDR	Voyage Data Recorder
VDU	Visual display unit
VHF	Very High Frequency (radio in the 30-300 MHz band)
VTM	Vessel Traffic Management
VTMIS	Vessel Traffic Management and Information Service
VTS	Vessel Traffic Services
VTSO	Vessel Traffic Services Operator
WMO	World Meteorological Organization

VTS in support of tourism. RMS Queen Mary 2 on passage of Synnylvsfjorden, Norway

VTS in support of commerce. Kwai Tsing Container Terminal, Hong Kong SAR
Some 70 container vessels enter and leave Hong Kong daily, accounting for some 20 million container movements annually

VTS in Action: A Guardship used in support of the VTS that protects the bridge across the Great Belt, Denmark



VTS in Action: Watchkeeping at the Channel Navigation Information Service, Dover, England

VTS in Action: Another safe departure; a vessel makes an early morning sailing from the River Thames, London.

CHAPTER 2: LEGAL FRAMEWORK

0201 Introduction

The successful organisation and provision of Vessel Traffic Services generates a self-evident need for international agreement as to how shipping from various flag-states can successfully and harmoniously interact. At the same time, there is a concomitant need for domestic national law to reflect universally accepted objectives in relation to the ports that such shipping uses.

Thus there is the need to have a clear and unambiguous route from the global concept, characterized by IMO as *'Safer Ships, Cleaner Seas'*, seen as the strategic imperative and internationally agreed as a good thing, to the local byelaw requirements that might govern the actions of a single VTS Operator in a small local port. Generally, the mariner wishes to be part of a regime where for regulatory and procedural purposes all ports 'look-the-same' and where they feel comfortable; the only principal difference between ports being that of geography.

It is the purpose of this chapter to demonstrate the link between internationally agreed conventions and the successful provision of vessel traffic services at local level that have the potential to be part of the delivery of the safety system envisaged.

0202 The United Nations and International Law

The General Assembly of the United Nations declared the period 1990-1999 to be the United Nations Decade of International Law. The main purposes were, *inter alia*:

- To promote acceptance of, and respect for the principles of international law;
- To promote means and methods for the peaceful settlement of disputes between States, including resort to, and full respect for the International Court of Justice;
- To encourage the progressive development of international law and its codification.
- To encourage the dissemination of international law.

Several major developments in international law have occurred under the auspices of the United Nations. These range from the development in the 1970-80s of the Law of the Sea to, more recently, the negotiation and adoption of several key international treaties in such areas as international environmental law, international economic law, the legal measures to counter international terrorism, and the creation of new international organizations and entities.

0203 United Nations Convention On The Law Of The Sea

The United Nations Convention on the Law of the Sea (UNCLOS) was adopted in 1982. UNCLOS lays down a comprehensive regime of law and order in the world's oceans and seas; establishing rules governing all uses of the oceans and their resources. It embodies in one instrument traditional rules for the uses of the oceans and introduces new legal concepts and addresses new concerns. As a result, coastal States can now claim jurisdiction over internal waters, territorial seas, contiguous zones, archipelagic waters, exclusive economic zones (EEZs) and the continental shelf. However, the extent of the jurisdiction that can be claimed is different for each of the waters, seas and zones. When a VTS is being considered, care should be taken to establish the extent of jurisdiction that can be applied to the VTS area and its sub-areas or sectors, noting that participation is not mandatory outside of territorial waters.

With regard to the authority that may be given to a VTS, a State retains the right to control its internal waters and all vessels that are subject to the jurisdiction of the State. Therefore, the authority to establish and operate vessel traffic services in this region is clearly established, including the right to mandate participation in a VTS scheme and to exercise control over a vessel's movements. Within territorial waters, a coastal state may exercise its authority subject to the right of innocent passage. Beyond territorial waters, a state's authority with regard to VTS is substantially reduced.

In straits used for international navigation, a VTS Authority cannot restrict or impede the innocent passage of vessels. In these instances a state should endeavour to enter into agreements with neighbouring states, or other maritime nations, to agree standards of conduct for vessels operating in these waters. These standards may include provisions for voluntary participation in a VTS.

The full text of UNCLOS is available at www.un.org/Depts/los/convention.htm

The Division for Ocean Affairs and the Law of the Sea (DOALOS) of the Office of Legal Affairs of the United Nations serves as the secretariat of the Convention on the Law of the Sea and provides information, advice and assistance to States with a view to providing a better understanding of the Convention and the related Agreements, their wider acceptance, uniform and consistent application and effective implementation. The Division monitors all developments relating to the Convention, the law of the sea and ocean affairs, and reports annually to the General Assembly of the United Nations.

Although the International Maritime Organization (IMO) is explicitly mentioned in only one of the articles of UNCLOS (article 2 of Annex VIII), several provisions in the

Convention refer to the "competent international organization" to adopt international shipping rules and standards in matters concerning maritime safety, efficiency of navigation and the prevention of marine pollution from vessels and by dumping. In such cases, the expression "competent international organization", when used in the singular in UNCLOS, applies exclusively to IMO, bearing in mind its global mandate as a specialized agency of the United Nations.

0204 International Maritime Organization

The IMO was established as an UN agency by Convention in 1958. Several important international conventions had already been developed, including the International Convention for the Safety of Life at Sea (1948), the International Convention for the Prevention of Pollution of the Sea by Oil (1954) and treaties dealing with load lines and the prevention of collisions at sea. The IMO was made responsible for ensuring that these conventions were kept up-to-date and given the task of developing new conventions when the need arose.

The creation of IMO coincided with a period of great change in world shipping and the Organization was kept busy from the start developing new conventions and ensuring that existing instruments kept pace with changes in shipping technology. It is now responsible for more than 40 international conventions and agreements and numerous protocols.

0205 IMO - Mandate

IMO has a global mandate for, and has focused its activities on the adoption and implementation of international rules and standards for the safety of navigation, prevention of pollution of the marine environment from vessels', and maritime security. Also, it intensified its treaty-making activity aimed at ensuring that prompt and adequate compensation is paid to victims of maritime accidents. The wide acceptance and uncontested legitimacy of IMO'**s** universal mandate is evidenced by the following facts:

- More than 160 sovereign States are Members of IMO;
- All Members may participate at meetings of IMO bodies in charge of the elaboration and adoption of recommendations containing safety and anti-pollution rules and standards. These rules and standards are normally adopted by consensus; and
- All States, irrespective of whether or not they are Members of IMO or the United Nations, are invited to participate at IMO conferences for the adoption of new IMO conventions.

At present, between 125 and 150 States (depending on the treaty) have become Parties to the main IMO conventions. Since the general degree of acceptance of these shipping

conventions is mainly related to their implementation by flag States, it is of paramount importance to note that States that are Parties to these Conventions represent more than 90 per cent of the world's merchant fleet.

Adoption of new treaties, and amendments to existing ones, have been guided by adherence to the philosophy that rules and standards should be developed in order to prevent accidents at sea, and not in response to them. Accordingly, operational policies are constantly under review in order to ensure that shipping activities conform to the highest possible safety and anti-pollution preventative regulations. The IMO attaches the highest priority to the proper implementation of its numerous rules and standards that are contained in the treaties and focuses its efforts to ensure that flag and port States and ship-owners develop their capacities and fully exert their responsibilities.

0206 IMO Conventions

The majority of conventions adopted under the auspices of IMO or for which the Organization is otherwise responsible fall into three main categories. The first group is concerned with **maritime safety**; the second with the **prevention of marine pollution**; and the third with **liability and compensation**, especially in relation to damage caused by pollution. Outside these major groupings are a number of other conventions dealing with facilitation, tonnage measurement, unlawful acts against shipping and salvage.

0207 IMO Conventions relevant to VTS

The principal Conventions that have applicability to the establishment, organization and conduct of VTS operations, and the training and certification of VTS personnel are set out in Fig. 2.1 overleaf.

0208 SOLAS

Vessel Traffic Services were not specifically referred to in the International Convention for the Safety of Life at Sea (SOLAS) 1974, but in June 1997 IMO's Maritime Safety Committee adopted a new regulation to Chapter V (Safety of Navigation), which set out when VTS can be implemented. A revised chapter was adopted in December 2000, and entered into force on 1 July 2002. Regulation 12, Vessel traffic services, states:

1. Vessel traffic services (VTS) contribute to safety of life at sea, safety and efficiency of navigation and protection of the marine environment, adjacent shore areas, work sites and offshore installations from possible adverse effects of maritime traffic.
2. Contracting Governments undertake to arrange for the establishment of VTS where, in their opinion, the volume of traffic or the degree of risk justifies such services.

Instrument	Entry into Force
International Convention for the Safety of Life at Sea , 1974 (SOLAS) Protocol 1978 Protocol 1988 Chapter XI ISPS Code	 May 1980 May 1981 February 2000 June 2004
Convention on the International Regulations for Preventing Collisions at Sea, 1972.	July 1977 (Amended 1981, 1987, 1989, 1993 and by resolution A.910(22) of November 2001.
International Convention on Seafarers' Training, Certification and Watchkeeping, 1978 (STCW) Amendment 1995	 April 1984 February 1997
International Convention on Maritime Search and Rescue (SAR), 1979 Revised by MSC.70(69)	 June 1985 January 2000
Convention on the International Maritime Satellite Organization, 1975/76 (IMSO)	July 1979 (Amended 1985 & 1989)
International Convention for the Prevention of Pollution from Ships, 1973 and amended 1978 (MARPOL 73/78)	October 1983
International Convention for Control and Management of Ballast Water and Sediments	Adopted 2004; enters into force 12 months after ratification by 30 states.
International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990 HNS Protocol 2000	 May 1995 Not yet in force (2004)

Fig. 2.1: IMO Conventions that have relevance to VTS

3. Contracting Governments planning and implementing VTS shall, wherever possible, follow the guidelines developed by the Organization. The use of VTS may only be made mandatory in sea areas within the territorial seas of a coastal State.

4. Contracting Governments shall endeavour to secure the participation in, and compliance with, the provisions of vessel traffic services by ships entitled to fly their flag.

5. Nothing in this regulation or the guidelines adopted by the Organization shall prejudice the rights and duties of Governments under international law or the legal regimes of straits used for international navigation and archipelagic sea lanes.

0209 Safety of Navigation & Maritime Security

The General Assembly of the United Nations invited (Resolution 58/240, December 2003), the IMO to strengthen its functions with regard to port State control in relation to safety and pollution standards as well as maritime security regulations. A new, comprehensive

security regime for international shipping entered into force in July 2004 following the adoption by the Conference of a series of measures to strengthen maritime security and prevent and suppress acts of terrorism against shipping. The Conference adopted a number of amendments to the 1974 Safety of Life at Sea Convention (SOLAS), the most far-reaching of which establishes the new International Ship and Port Facility Security Code (ISPS Code).

0210 Places of Refuge and Maritime Assistance Services

The General Assembly of the United Nations welcomed (Resolution 58/240, December 2003), the work of the International Maritime Organization in developing guidelines on places of refuge and maritime assistance services for ships in need of assistance and encourages States to draw up plans and to establish procedures to implement those guidelines for ships in waters under their jurisdiction. In the aftermath of a number of tanker incidents which had taken place since 1999, the Maritime Safety Committee decided to consider the issue of places of refuge mainly from the navigational safety viewpoint and commissioned the drafting of guidelines:

1. Actions that a master of a ship should take when in need of a place of refuge (including actions on board and actions required in seeking assistance from other ships in the vicinity, salvage operators, flag State and coastal States).
2. The evaluation of risks, including the methodology involved, associated with the provision of places of refuge and relevant operations in both a general and a case by case basis; and
3. Actions that are expected of coastal States for the identification, designation and provision of such suitable places together with any relevant facilities.

These principles are set out in IMO Resolutions A.949(23) and A.950(23).

0211 Standards for Training Certification and Watchkeeping (STCW)

IMO has the authority to vet the training, examination and certification procedures of Contracting Parties to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978. This important change made in the 1995 amendments to the Convention entered into force on 1 February 1997. Governments will be required to provide information to IMO's Maritime Safety Committee for it to judge whether the country concerned meets the requirements of the Convention.

Noting that STCW 1995 conference called for the development, to common standards of those established for mariners, of the training and certification of maritime pilots and VTS personnel, it is to be expected that at some future date IMO authority may similarly be extended. However, it should be further noted that partly in response to STCW 1995 and

partly in response to demands from its membership, IALA developed a training regime (V-103) for VTS personnel to match the format and requirements of those established for mariners in STCW 1995. This training regime was approved by IMO at MSC Circ 952.

0212 Marine Pollution - Particularly Sensitive Sea Areas (PSSA)

A Particularly Sensitive Sea Area (PSSA) is an area that needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities. The MARPOL Convention also defines certain sea areas as "special areas" in which, for technical reasons relating to their oceanographical and ecological condition and to their sea traffic, the adoption of special mandatory methods for the prevention of sea pollution is required. Under the Convention, these special areas are provided with a higher level of protection than other areas of the sea. The criteria for the identification of PSSAs and the criteria for the designation of special areas are not mutually exclusive.

In many cases a PSSA may be identified within a Special Area and vice versa. When an area is approved as a PSSA, specific measures can be used to control the maritime activities in that area, such as routeing measures, strict application of MARPOL discharge and equipment requirements for ships, such as oil tankers; and the installation of Vessel Traffic Services (VTS).

The IMO has designated the following PSSAs:

- The Great Barrier Reef, Australia;
- The Sabana-Camagüey Archipelago in Cuba;
- Malpelo Island (Colombia);
- The Florida Keys (United States);
- The Wadden Sea, Denmark, Germany and the Netherlands;
- Paracas National Reserve, Peru;
- Western European Waters;
- Torres Strait;
- Canary Isles;
- Baltic Sea (except Russian waters), and
- Galapagos Archipelago.

The RAMSAR Convention has established further environmental protection measures that affect the use of coastal and estuarial waters. (See 0404)

0213 Regional Undertakings – European Community

The European Parliament has established (Directive 2002/59/EC dated 27 June 2002) a

vessel traffic monitoring and information system along the coasts of Member States. The purpose of the Directive is to establish within the sea areas subject to the jurisdiction of Member States of the European Community a vessel traffic monitoring and information system to enhance the safety and efficiency of maritime traffic. Additionally the Directive seeks to improve the response by authorities to incidents, accidents or potentially dangerous situations at sea, including search and rescue operations, and contributing to a better prevention and detection of pollution by ships. Member States shall monitor and take all necessary and appropriate measures to ensure that the masters, operators or agents of ships, as well as shippers or owners of dangerous or polluting cargoes carried on board such ships, comply with the requirements set out in the Directive.

The Directive imposes responsibilities on Member States for the arrangements for, and conduct of the system and, generally, on most commercial shipping, regardless of flag state, whose passage passes through the sea areas concerned. It imposes mandatory participation requirement on shipping and compliance with the VTS procedures whilst within the territorial seas of Member States.

(Note: Member States of the European Community are Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Portugal, Poland, Romania, Slovak Republic, Slovenia, Spain, Sweden and United Kingdom. The Directive applies also to Norway and Iceland)

0214 Enforcement

The enforcement of IMO conventions depends upon the Governments of Member States. Contracting Governments enforce the provisions of IMO conventions as far as their own ships are concerned and also set the penalties for infringements, where these are applicable. They may also have certain limited powers in respect of the ships of other Governments.

In some conventions, certificates are required to be carried on board ship to show that they have been inspected and have met the required standards. These certificates are normally accepted as proof by authorities from other States that the vessel concerned has reached the required standard.

Should an offence occur within the jurisdiction of another State, however, that State can either cause proceedings to be taken in accordance with its own law or give details of the offence to the flag State so that the latter can take appropriate action. Under the terms of the 1969 Convention Relating to Intervention on the High Seas, Contracting States are empowered to act against ships of other countries that have been involved in an accident or

have been damaged on the high seas if there is a grave risk of oil pollution occurring as a result. The way in which these powers may be used are very carefully defined, and in most conventions the flag State is primarily responsible for enforcing conventions as far as its own ships and their personnel are concerned. The IMO has no powers to enforce conventions save for its powers in connection with STCW (see 0211)

0215 National Legislation

Contracting States to international conventions are sovereign states that undertake, as part of the accession and ratification process to each convention or protocol, to enact appropriate national legislation to give effect to the provisions that have been agreed. Such enactments will, where appropriate, include provisions for enforcement and sanctions for infringements.

Whilst it is for governments to determine how best to enact international agreements within the framework of national legislation, it is evident that some broad similarities emerge in the way that states undertake this responsibility. Most governments find it necessary in the maritime context to rely on two broad bodies of primary legislation; one concerned with its flag shipping, the other with its geographical jurisdictions. These can be summarized as:

- Marine, or Shipping, or Merchant Shipping Laws or Acts; and
- Harbour, or Port, or Docks Laws or Acts

With regard to the second category, which is normally of a national character with uniform applicability to all port undertakings, it may be accompanied by local legislation that has applicability only to the port to which it refers.

Some typical examples of national legislation in connection with VTS are given at Annex A to this chapter. The table provides a synopsis of some of the various methods used by states to implement international obligations.

0216 Port State Control

Under the provisions of the IMO Conventions (Fig.2.1) the government of a flag state is responsible for promulgating laws and regulations to give the applicable conventions full and complete effect that a ship is fit for service and the seafarers qualified for their duties. In some cases it is difficult for the Flag State to exercise the necessary degree of continuous control over their flag ships, because they may not frequently visit the flag state. This can be partly overcome by the derogation of these tasks to the Port State that the ships visit. Port State Control procedures have been established by IMO and promulgated in Resolution A.787(19), as amended by Resolution A882(21).

ANNEX A: SOME NATIONAL LEGISLATIVE MEASURES

1 Australia

The Australian Government shares responsibility for regulating shipping and providing marine aids to navigation with Australia's six State Governments and the Northern Territory Government. The Australian Government is responsible for safety regulation of trading vessels on interstate or international voyages; the State/Northern Territory Governments are responsible for regulating trading ships on intrastate voyages, fishing vessels, pleasure craft and inland waterways vessels. The Australian Government is responsible for aids to navigation for large ships engaged in ocean navigation and the State/Northern Territory Governments are responsible for aids to navigation required specifically for fishing vessels and recreational craft and covering entry to ports, rivers and approach channels. The State/Northern Territory Governments also are responsible for regulation of ports and several State Governments operate VTS systems to manage vessel traffic around their major trading ports. The Navigation Act 1912 regulates ship safety and implements the major international maritime conventions on ship safety, while the Lighthouses Act 1911 regulates the establishment and maintenance of the national marine aids to navigation network, for which the Australian Government is responsible.

The Australian Government and the Queensland State Government share a particular interest in ship safety and pollution prevention in the World Heritage listed Great Barrier Reef, off the Queensland coast, and Torres Strait, the international shipping strait separating the northern tip of Australia (Queensland) and Papua New Guinea. In 1996, the IMO approved the establishment of a mandatory ship reporting system, REEFREP, covering the inner shipping route through the Great Barrier Reef and the Torres Strait, to improve navigational safety in the region. The Great Barrier Reef and the Torres Strait are designated as Particularly Sensitive Sea Areas (PSSA). (See 0404). REEFREP, a mandatory ship reporting system, derives its authority from the Navigation Act 1912 (Marine Orders Part 56, REEFREP) in relation to general safety of navigation powers and relevant regulations under the International Convention for Safety of Life at Sea (SOLAS). REEFREP is operated under a joint Australian Government and Queensland State Government arrangement whereby the Australian Maritime Safety Authority (AMSA), which is the Australian Government's ship safety statutory authority, and Maritime Safety Queensland, the Queensland State Government's ship safety statutory authority, jointly manage the REEFREP facility, REEFCENTRE, located at the port of Hay Point, Queensland. In 2004 the IMO endorsed its designation as a Coastal VTS.

2 Canada (Canada Shipping Act, 1989) The Canada Shipping Act (CSA) is Canada's major legislation on maritime affairs. Originally formatted along the lines of the British Merchant Shipping Act, it has, since its conception, undergone a number of amendments. Before 1989, the CSA had no specific provision for the establishment or operation of VTS, nor did it contain any requirements to be met by ships in these respects. When VTS systems were introduced for Canadian waters during the 1960s and 1970s, the establishing authority was indirectly based on an amendment to the CSA dealing with aspects of pollution. It was subsequently decided however that such authority was insufficient for the intended legal mandate for Canadian VTS.

A specific provision was therefore included in the CSA, 1989. Specifically, sections 562.15 - 562.2 of Part IX of the CSA, 1989 provides the authority for VTS in Canada including the establishment of VTS zones and the development of regulations to be followed by ships when within and approaching such zones. There is also provision for the Coastguard to direct the movement of ships under specified conditions, as well as empowering the Commissioner of the Coastguard to establish the qualifications and training of VTS operators (called Marine Traffic Regulators).

3 France

Maritime Ports Code

Art L323-1 Inside a maritime port, fairways and access channels, a shipmaster ..... who has not complied with orders given, whatever the means used, by the Harbour Master or his Assistant with regard to the movement of his vessel, is liable to a fine of the amount.....

Art R311.3 The Harbour Masters jurisdiction extends to access channels and fairways when safety matters are concerned.

Art R311-6 Harbour Masters and their Assistants are responsible for the control and supervision of navigation lights, signals and beacons, in port waters and access channels by day and by night.

Art R311-7 Harbour Masters regulate vessel entry to and departure from ports and harbours and direct all maritime traffic movements.

Port Entry

Masters of ships wishing to enter a port should provide the Harbour Masters office, 24 hours in advance or at the latest when leaving the previous port when the journey is shorter than 24 hours, their ETA at the roadstead or at the mooring buoy. The Harbour Master may deny port access to vessels which may constitute a danger to the port. No vessel may enter

a port or move within the port unless authorised by the Harbour Master. Authorised port entry may be subject to previous survey by an authorised surveyor.

4 Hong Kong

Shipping and Port Control Ordinance, Chapter 313 of the Laws of Hong Kong is the principal legislative instrument for marine and port control affairs in the Special Administrative Region.

The requirement for vessels to participate in VTS is stipulated in subsidiary legislation; the Shipping and Port Control Regulations. These regulations include the requirement for vessels:

- To provide Pre-Arrival Notification not less than 24 hours before the intended entry into Hong Kong waters;
- To carry radio equipment that is capable of operating on the HK VTS working VHF channels;
- To report their arrival, departure and movements in Hong Kong waters to the Vessel Traffic Centre;
- To report any anomalies to the Vessel traffic Centre.

The Regulations empower the authorized officer in the Vessel Traffic Centre to issue directions to shipping under specified conditions.

5 Italy

A national law (Law March 7, 2001, n. 51, article 5) appoints the Ministry of Infrastructure and Transportation responsible for the managing of the VTS Centres and in accordance with the Ministry of the Environment and the Protection of Territory gave the right to finalized the acts to establish a VTS system .

A Decree (Decreto Interministeriale 28 January 2004) directs the Italian Coast Guard to be the national VTS Authority, with responsibility for the operational management of VTS in Italy. More general key provisions of the maritime traffic regulations are:

- Art.83 of the National Navigation Code provides for the Ministry of Infrastructure and Transport to limit or to forbid the traffic in given areas of territorial waters for reasons of public order or navigation safety and, in agreement with the Ministry of Environment and Protection of Territory, for reasons of the protection of the marine environment;
- Art.256 of the decree of the President of the Italian Republic, November 8, 1991, n. 435, delegates powers to the Ministry of the Infrastructure and

Transportation to establish and manage traffic separation schemes;

- Art.59 of the National Navigation Code provides for the Chief of each maritime Coast Guard District to set ordinances on any safety aspect related to navigation in his area of responsibility.

6 Japan

The Japan Coast Guard (JCG) was established in 1948 as an organization responsible for peace and security at sea, ensuring maritime traffic safety, rescuing ships and persons in distress at sea, the prevention and assistance in maritime disasters and protecting the marine environment. Among these activities, 'ensuring maritime traffic safety' is a highly significant role and the JCG have established and operate VTS organizations to meet this requirement.

In Japan, maritime traffic is regulated by three laws. The Law for Preventing Collisions at Sea is based on the requirement of the International COLREGS; The Maritime Traffic Safety Law specifies special rules for certain sea areas where traffic is most congested; and Port Regulations provide special rules for traffic safety in harbours.

7 Netherlands

The primary legislation stems from the *Scheepvaartverkeerswet*, the national Shipping Traffic Act of 1988 and its subsequent amendments. This is complemented and enhanced by various Statute Orders and Ministerial Decrees. At local level competent authorities are empowered to, and required to establish Harbour Byelaws for each port or local area; provisions for the regulation of VTS are included in this legislation.

8 United Kingdom

Vessel Traffic Monitoring and Reporting Regulations 2004 The national competent authority for VTS, the Maritime and Coastguard Agency (MCA), regulates VTS by statutory notice. These instructions, which are the United Kingdom implementation of the European Parliament and Council Directive 2002/59/EC, are published also by the UK Hydrographic Office and included in the VTS World Guide.

Harbours Act 1964 The Harbours Act 1964, Section 20, provides for harbour authorities to establish "control of movement" orders for securing, so far as is practicable, the safe and uninterrupted movement of ships in their respective harbours and the approaches thereto. A "control of movement" order may contain provision for a number of matters including the body or bodies by whom the scheme established by the order is to be administered (eg, the relevant harbour's VTS service) and the person specified (usually the harbour master)

to give directions to ships within the harbour and within its approaches to which the scheme relates, for securing that they move only at specified times and to or from specified places, through specified areas, along specified routes or through specified channels, and so on.

In addition to the Harbours Act, most UK ports have supplemental legislation specific to the individual port authority. For example, the Port of London Act, 1968, provides for the making of "general directions" for navigation of vessels in the Thames and also for the harbour master to give "special directions" to any specific vessels. Ports such as London, therefore, have published General Directions for Navigation that require the mandatory reporting of vessels to the ports VTS and for vessels to be regulated in accordance with directions given from the VTS. The "marine traffic controller" in the Port of London Authority Thames Navigation Service has the full delegated responsibility of the "harbour master".

9 United States of America

Ports and Waterways Safety Act of 1972 (PWSA) This Act promotes the safety and protection of the environmental quality of ports, waterfront areas and navigable waters of the United States. This legislation expands Coast Guard jurisdiction over all vessels using the ports of the United States and authorises the Coast Guard to "..establish, operate and maintain vessel traffic services and systems for ports, harbours and other waters subject to congested vessel traffic".

Port Safety and Tank Vessel Safety Act of 1978 This Act amends the PWSA and provides the Coast Guard with a broader, more extensive and explicitly stated authority. The Act addresses improvements in the supervision and control over all types of vessels, foreign and domestic, operating in the United States navigable waters; and in the safety of all tank vessels, foreign and domestic, which transport and transfer oil or other hazardous cargoes in US ports as well as improvements in the control and monitoring of vessels operating in offshore waters near the United States coastline; and vessel manning and pilotage standards. The Act includes regulatory authority over areas not previously covered, such as participation with neighbouring nations in co-ordinated vessel traffic systems in boundary waters, lightering operations in offshore areas and discouraging activities such as tank washing and dumpings at sea in preparation for loading cargoes.

Oil Pollution Act of 1990 (OPA90) This Act amends the PWSA and imposes new requirements on the operations of oil tankers in the United States, addresses shortcomings in navigation safety in Prince William Sound, Alaska, and enhances the authority of the Coast Guard to regulate effectively the conduct of all vessels in the United States.

Particularly, Section 4107 of the Act, widens the Coast Guard's authority so that they "... may construct, operate, maintain, improve or expand vessel traffic services..." Furthermore, the Act requires that participation in VTS is mandatory for certain classes of vessels for whom it had previously been voluntary.

Vessel Traffic Services Regulations (33 CFR Part 161, Subpart B) These regulations are administered to facilitate the safe and efficient transit of vessel traffic within the navigable waters of the VTS area or Co-operative Vessel Traffic Management Systems (CVTMS) area so as to reduce the potential for collisions, groundings and rammings and the loss of lives, property and environmental harm associated with these incidents. They include communication, vessel operation and navigation restriction requirements.

TABLE 1 - EXAMPLES OF NATIONAL LEGISLATION, STATUTORY INSTRUMENTS AND REGULATORY GUIDANCE FOR VTS

Country	Primary Legislation	Secondary Legislation/ Statutory Instruments	Guidance at National Level	Byelaws
Australia	At National Level: (Applies to REEFREP only) Navigation Act 1912 *Australian Maritime Safety Authority Act 1991* At State Level : Queensland: Transport Operations Marine Safety Act 1994 (TOMSA 1994).	Marine Orders Part 56 (Applies to REEFREP only). Marine Orders are subordinate legislation, made under the Navigation Act Regulations under the TOMSA Act 1994	REEFGUIDE – A Shipmaster's Guide to the Torres Strait and the Great Barrier Reef.	N/A at national level Regional Harbour Masters in the State of Queensland can direct shipping within port limits
Hong Kong SAR, China	The Shipping and Port Control Ordinance, Chapter 313 of the Laws of Hong Kong SAR.	Sub-legislation: The Shipping and Port Control Regulations (Chapter 313A of the Laws of Kong Kong SAR)	NA	NA
Italy	Law (7 March 2001, Number 51, art 5) Maritime Transport. Pollution Prevention and Maritime Traffic Monitoring.	Inter-Ministry Decree (28 January 2004) Establishment of VTS system	Coast Guard Directive 001, National Regulations for VTS	Local Coast Guard VTS Procedures – User manuals Local Coast Guard Ordinances
Japan	Law for Preventing Collisions at Sea (1977) Maritime Traffic Safety Law (1972) Port Regulation Law (1948)	Various Cabinet Orders and Regulations	Various notices	
Netherlands	Scheepvaartkeerswet (Shipping Traffic Act 1988	Various Statute Orders and ministerial Decrees	None	Port or local area byelaws established by the local competent authority.
United Kingdom	General: Harbours, Docks and Piers Act 1847 Harbours Act 1964 European Communities Act 1972 (Sect 2 (2)) Merchant Shipping Act 1995 (Sect 85 & 86) Local: An Act setting out the governance of each port by name. (e.g. The Milford Haven Conservancy Act 1983)	Statutory Instruments: Merchant Shipping Notices (MSN) Harbour Revision Orders Harbour Empowerment Orders The Merchant Shipping (Vessel Traffic Monitoring and Reporting Requirements) Regulations 2004	**Port Marine Safety Code** and accompanying **Guide to Good Practice** Marine Guidance Note (MGN) MGN Nos 180,238,239 and 240. Designation by the Maritime and Coastguard Agency as National Competent Authority to comply with the EC Vessel Traffic Monitoring Directive.	Harbour Byelaws applicable to each port and its locality. Established by the local competent authority, subject to the granting of relevant powers in local legislation.
United States of America	Port and Waterway Safety Act of 1972, as amended.	Code of Federal Regulations 33CFR, part 161.	US Coast Guard Marine Safety Manual.	Established by each local VTS Authority in the form of 'User's Manuals'

CHAPTER 3: REGULATION OF VESSEL TRAFFIC SERVICES

0301 Introduction

The previous chapter set out the international and regional legislative framework that has been agreed by the majority, and in many cases all, of the maritime states. In their turn, these states have given effect to their international undertakings by introducing the relevant powers, obligations and duties into domestic national legal systems.

This chapter sets out the mechanisms that have been developed, in the light of the legal framework discussed above, to provide regulatory guidance and advice for establishing and operating vessel traffic services.

0302 International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)

IALA comprises a membership of approximately 75 national members and 30 affiliated organizations. The headquarters is in St. Germain-en-Laye, on the outskirts of Paris.

National membership is open to application by a National Authority of any country legally responsible for the provision of aids to navigation. Associate membership is open to application by any other service, organisation or agency that is concerned with aids to navigation. Manufacturers and distributors of marine aids to navigation equipment or services may apply for industrial membership.

IALA is a non-governmental association bringing together services and organizations concerned with the provision or maintenance of marine aids to navigation systems and allied activities at sea and on some inland waterways, that are navigable by ocean-going vessels. In this context, VTS is considered to be an aid to navigation.

The aim of IALA is to foster the safe, economic and expeditious movement of vessels, through the improvement and harmonization of aids to navigation worldwide and other appropriate means for the benefit of the maritime community and the protection of the environment. It does this by developing international co-operation by promoting close working relationships and encouraging IALA members, in particular, and maritime professionals generally, to take account of published recommendations, standards and guidelines, many of which are developed and kept up-to-date by the Association.

0303 IALA – Committee Structure

IALA Committees are the backbone of the work done through the Association. The IALA Council establishes a committee when a subject relevant to the aims of IALA is considered

to need on-going study or discussion in a particular field of study or technology. A committee may also be asked to provide continuous monitoring of elements of subjects that could influence decisions concerning the provision of Aids to Navigation, including VTS.

Committees meet regularly, normally twice each year, at the IALA Headquarters and are important to the work of IALA, keeping abreast of all developments relating to their area of expertise. The Committees prepare, review and revise relevant IALA publications in accordance with their Work Programme. The programmes for the Committees generally cover a 4-year study period, from one IALA Conference to the next. The present committee structure is shown below:

ANM	Aids to Navigation Management – The committee deals with management issues experienced by members.
EEP	Engineering, Environmental and Preservation - concentrating on the preservation of traditional aids to navigation and the engineering aspects of all aids to navigation.
E-NAV	Electronic Navigation - concentrating on both terrestrial and satellite systems such as GNSS, and radar and radio based aids to navigation.
VTS	Vessel Traffic Services – deals with all issues connected with VTS.

Fig 3.1: IALA Committee Structure

0304 VTS Committee

The VTS Committee comprises representatives of national members, affiliated organizations (see 0103) and industrial members. It meets every six months, usually at IALA headquarters and is attended by about 50 delegates. The representation is well spread globally and, more recently, regionally; resulting in a diverse mix of experience drawn from many parts of the world. Equally diverse is the individual experience of members, many are in possession of current master mariners, pilots or VTS qualifications and many are engaged daily in the management or operation of VTS or act as a national co-ordinator. This diversity is an important asset to ensure that IALA remains in the van of VTS developments and speaks with the authority and experience of its membership.

A primary objective of the VTS Committee is the provision of sound and timely advice to IALA members on VTS matters. Given the complexity of modern, multi-discipline

systems and management, it rarely does this in isolation, consulting frequently with other committees, notably the AIS and Radionavigation Committees, now renamed the e-Nav Committee, and with allied organizations and the IMO.

The formal posts on the VTS Committee include a Chairman and Vice Chairman and a Secretary, drawn from the headquarters staff, whose purpose is to ensure continuity. The Committee's work programme is decided on a 4-yearly basis, to match the policy guidelines set by Council, but new items are constantly being added to meet changes in the maritime environment and the demands of members. A key product of the Committee's work is the publication of the IALA VTS Manual, usually every four years.

Work items are normally allocated, where this is appropriate, to one, or more, of three Working Groups (WG) that have the following broad remits:

- Operations;
- Information Management; and
- Personnel and Training

The outputs of all the WGs is considered in plenary session of the entire VTS Committee before any recommendations are submitted to the Secretariat for approval by Council.

0305 VTS Policy Development

IALA maintains very strong links with IMO; it is represented on numerous standing bodies and is in close touch with developments and trends that affect the maritime environment. A consequence of these links, together with the wide range of experience of its membership and the quality of its published material, is that IALA is recognized as an authority in its field. It is thus able to offer advice and guidance to the maritime community and to influence developments associated with aids to navigation and VTS where the interests of the mariner can best be served.

The principle policy and regulatory document for vessel traffic services is IMO Resolution A.857(20), *Guidelines for Vessel Traffic Services,* adopted on 27 November 1997. This resolution, like its predecessor published in 1985, was drafted by the VTS Committee at IALA and is kept under frequent review to ensure that it continues fully to meet the needs of the profession. On the last occasion in 2003, it was decided that the resolution remained up-to date but that amplifying guidance on a number of related topics needed to be made available.

Such information will be published by IALA as the need arises and, where appropriate, in this Manual.

0306 IALA Publications

Authoritative and reliable documents and publications are the cornerstone of IALA's work to make available to the VTS and maritime professions world-wide the most up-to-date advice and guidance. A current list of those dealing with VTS related topics is at Annex A to this chapter. More information can be obtained directly from IALA, see below.

0307 Contact with IALA

The IALA website is www.iala-aism.org and has links to an up-to-date list of publications and the means for obtaining them by post. The e-mail address is iala-aism@wanadoo.fr, which can be used for obtaining further information or for making contact with the VTS Committee.

THE FUTURE – IALA STRATEGIC PLAN

0308 Trends in VTS

Drawing on the work currently being undertaken the following trends have emerged in a recent study on maritime operations and management relevant to VTS:

Standards

- Environmental standards will continue to acquire ever-higher stringency and priority;
- Professional competence of marine personnel will continue to vary, notwithstanding the adoption of international standards;
- The pursuit of common standards will continue, particularly on a regional basis; and
- Comprehensive and effective risk assessment will increasingly become the basis for the safe management of navigation.

User Requirements

- Commercial pressures will demand ever more rapid and reliable transport and cargo handling schedules, while reducing costs and improving quality of service;
- The need for more comprehensive wide-area traffic information will lead to an increase in the volume of information being exchanged between ships and shore organisations;
- Coastal waters and inland waterways will be increasingly used for recreational and other purposes. In addition, inland and short sea shipping will increase their environmental attractiveness as methods of transport of goods and passengers; and
- Co-ordination of port services will become increasingly important in the interests of safety, security, protection of the environment and improvement of economic

performance, particularly where such services may be obtained from external sources.

Technology

- Ship design and technology will continue to evolve, particularly in the areas of information processing and communication; and
- Advances in technology will necessitate an expanding requirement for capital expenditure and trained personnel. This will offer opportunities for increased efficiencies and the potential for the delivery of additional services.

Security and Allied Services

- Heightened international security concerns will have an impact on maritime trade and transport processes. These same concerns are already leading to a requirement to track commercial shipping at long range; and
- The use of formal and more effective systems to manage safety and security at sea and in port will increase.

0309 Consequential impact on VTS

These overall maritime trends are likely to lead to the following consequences for VTS:

- VTS will play a central role in gathering and disseminating information for safety, security, environmental protection and economic performance purposes;
- Automated systems for the effective management and validation of transferred data between ships, VTS centres and VTS networks will be increasingly required;
- Exchange of information between VTS systems will lead to the formation of VTS networks.;
- VTS information will increasingly be used by various allied services in the global tracking of vessels;
- The need for quality assurance to international standards for VTS systems, including equipment, personnel, and operating procedures, will increase;
- The need to assure and certify the competency of VTS operators and supervisors in order to reduce any exposure to increased liability will add to the scope and priority of such training;
- The need to manage recreational and other small craft traffic by VTS and by other means in order to ensure the safety of navigation in areas where

commercial and high-density recreational traffic co-exist, will increase;

- As the quality and accuracy of vessel tracking improves, the possibility to control traffic by means of instructions, rather than information and advice, will be used more widely as a mechanism for reducing risk; and
- The control of traffic by VTS centres will bring a greater exposure to liability.

0310 Conclusions

The study on maritime operations and management relevant to VTS concluded with the statement:

> "IALA recognises that the trends in maritime operations towards enhanced safety, security, efficiency, accountability and environmental responsibility, together with anticipated technical advances, will result in significant future change. As a consequence, and where appropriate, IALA will lead developments, influence debate, and produce relevant recommendations and guidelines that may impact on the use or management of aids to navigation, including VTS."

ANNEX A: IALA PUBLICATIONS ABOUT VTS RELATED TOPICS

Publication	Date
IALA Recommendations	
V-102 Application of "User pays" principle to Vessel Traffic Services	March 1998
V-103 Standards for Training and Certification of VTS personnel	May 1998
V-119 Implementation of Vessel Traffic Services	September 2000
V-120 Vessel Traffic Services in Inland Waters	June 2001
V-125 Integration and Display of AIS and other information at a VTS Centre	December 2004
V-127 Operational Procedures for Vessel traffic services	June 2004
V-128 Operational and Technical Performance Requirements for VTS equipment	June 2007
A-123 The Provision of Shore Based AIS	June 2007
A-124 AIS Shore Station and networking aspects relating to AIS service	June 2003
A-126 Use of AIS in Marine Aids to Navigation	June 2007
Note: Prefixes: 'V' indicates a recommendation produced by the VTS Committee, 'A' by the AIS Committee.	
IALA Guidelines	
1014 Accreditation of VTS Training Institutes	May 2001
1017 Assessment of training requirements for existing VTS Personnel, candidate Operators and the revalidation of VTS Operator Certificates	June 2001
1018 Risk management	June 2000
1026 AIS as a VTS Tool	December 2001
1027 Designing and implementing simulation in VTS training	June 2002
1032 Aspects of Training of VTS Personnel relevant to the introduction of AIS	June 2003
1045 Staffing Levels at VTS Centres	December 2005
1046 Response plan for marking new wrecks	June 2005
1055 Preparing for a voluntary IMO Audit on VTS Delivery	December 2006
1056 Establishment of VTS Radar Services	June 2007
IALA Manuals	
VTS Manual (Previous editions 1993, 1998, & 2002)	2008
Aids to Navigation Guide (Navguide5) (Previous editions 1990, 1993 & 1998)	2001
IALA Model Courses of Training	
V-103/1 VTS Operator – Basic training	March 1999
V-103/2 VTS Supervisor – Advancement Training	March 2000
V-103/3 VTS Operator & VTS Supervisor – On-the-Job Training	March 1999
V-103/4 VTS OJT Instructor	December 2001

Fig. 3.2: IALA Publications for VTS

CHAPTER 4: FUNCTIONS OF VTS

0401 Introduction

At its simplest the function of VTS is to provide three principal services; to aid the mariner in his safe use of the sea, to afford him unhindered access to pursue commercial and leisure activities and to contribute to keeping the seas and the adjacent environment free from pollution.

> "Vessel Traffic Services (VTS) contribute to the safety of life at sea, safety and efficiency of navigation, the protection of the marine environment, the adjacent shore area, worksites, and offshore installations from possible adverse effects of maritime traffic" SOLAS Chapter V, Regulation 12

Experience shows that, in general, these ideals are subject to potentially greater and more intense risks in the coastal littoral, particularly at shipping choke points and at the interface with ports and estuaries. Equally, it is here that the benefits derived from VTS can be of considerable value and, when properly implemented, outweigh the costs of provision.

The IMO recognises the importance and value of VTS as a contributory tool in the conduct of a number of potentially high risk shipping operations and in the protection of the environment.

> 2.1.2 A clear distinction may need to be made between a Port or Harbour VTS and a Coastal VTS. A Port VTS is mainly concerned with vessel traffic to and from a port or harbour or harbours, while a Coastal VTS is mainly concerned with vessel traffic passing through the area. A VTS could also be a combination of both types. The type and level of service or services rendered could differ between both types of VTS; in a Port or Harbour VTS a navigational assistance service and/or a traffic organization service is usually provided for, while in a Coastal VTS usually only an information service is rendered.
>
> IMO Resolution A 857(20)

Contracting Governments to SOLAS are expected to undertake the establishment of VTS where, in their opinion, the volume of traffic and the degree of risk justifies this. When planning and implementing VTS the Contracting Governments shall, whenever practical, follow the IMO Guidelines on VTS (IMO Resolution A.857(20)) and endeavour to secure participation in, and compliance with the provisions of, VTS by ships under their flags.

0402 Key Functions of a VTS

To fulfill these overall purposes VTS may carry out one or more of several functions. The most important functions are related to contributing to and thereby enhancing:

- Safety of life at sea;

- Safety of navigation;
- Efficiency of vessel traffic movement;
- Protection of the marine environment; and
- Protection of the adjacent communities and infrastructure.

In addition VTS can contribute to:

- Efficiency of related activities; and
- Supporting Maritime Security.

The benefits of implementing a VTS are that it allows identification and monitoring of vessels, strategic planning of vessel movements and provision of navigational information and assistance. It can also assist in prevention of pollution and co-ordination of pollution/emergency response. The efficiency of a VTS will depend on the reliability and continuity of communications and on the ability to provide accurate and unambiguous information. The quality of accident-prevention measures will depend on the system's capability of detecting a developing dangerous situation and on the ability to give timely warning of such dangers.

The precise functions of any VTS will depend upon the particular circumstances in the VTS area and the volume and character of maritime traffic. A port VTS will often have different main functions than a coastal VTS. (This is addressed in more detail in Chapter 5) When a VTS is established the existence of, and the functions carried out by, the VTS will need to be promulgated to concerned parties and relevant stakeholders.

0403 Safety of Life at Sea and Safety of Vessel Traffic

Incidents involving vessels can lead not only to material damage and injuries, but also to loss of life. As a VTS contributes to the prevention of such incidents resulting from vessel traffic, the VTS not only contributes to the improvement of safety of vessel traffic, but at the same time to the improvement of safety of life at sea. In addition the VTS might be able to assist in mitigating the consequences from traffic-related and non traffic-related incidents, which in itself contributes to the improvement of safety of life at sea. By being proactive VTS can contribute to:

- Preventing incidents from developing;
- Preventing incidents from developing into accidents;
- Preventing accidents from developing into disasters;
- Mitigating the consequences of incidents, accidents and disasters; and

- Unlike other aids to navigation VTS has the capability to interact and influence the decision making process on board the vessel. VTS might detect the development of close quarter situations between vessels or vessels standing into danger and can thus alert such vessels accordingly and, in some cases, instructing them to take certain avoiding action, providing that any instructions or advice issued by the VTS is result orientated only. As approximately 80% of maritime accidents can be attributed to the human factor, the improvement that can be gained through the involvement of and interaction with the VTS as an additional safeguard can easily be seen.

Although safety of life should be the primary reason for implementing VTS, the needs of other VTS-functions (see 0402) often provide more persuasive arguments for its installation. However, the beneficial effects of VTS on the expected (or even actual) number or size of vessel traffic accidents and casualties will often be difficult to determine. The preferred way, but unfortunately not an easy way, to be able to assess the effect of VTS on vessel traffic safety is by determining the risk reduction, which is or can be achieved by VTS. IALA has developed such a risk management tool for this and other aids to navigation management purposes. (See Chapters 6 and 7)

Consideration, implementation and even operation of VTS is in essence a risk management activity, trying to reach an acceptable risk level at acceptable costs and efforts. In actual VTS-operations, e.g. determining whether a vessel passage through the VTS-area is safe enough, the above-mentioned risk management methods can also be useful, but this still remains a mostly skill- and experience-based activity. Therefore, it is vitally important to develop clear operational procedures, which are properly based on a risk-analysis approach and which are consistently applied.

If an incident has occurred or is likely to occur, VTS can be used to support incident mitigation operations. In the context of vessel traffic safety VTS might support for example Maritime Assistance Services, Places of Refuge, Search and Rescue (SAR), fire fighting, pollution response and salvage operations. In some VTSs such operations are carried out under the supervision of the VTS-authority.

0404 Efficiency of Vessel Traffic

VTS can improve the efficiency of vessel traffic in two ways, i.e. through:

- Reducing accidents; and
- Increasing the utilization of the infrastructure (waterways, locks, ports etc).

Prevention of an accident directly leads to an improvement, i.e. preventing a deterioration, of the efficiency of vessel traffic. An accident causes delays for the vessels involved and for vessels in the vicinity. With serious accidents there can be delays, including stopping or re-routeing of traffic for a lengthy time.

Infrastructure has a certain capacity, both in the size of and the number of the vessels that can be accommodated. A VTS can safely increase the maximum capacity by enabling:

- Larger vessels to use the infrastructure (e.g. larger draft, width, length, height);
- Longer use of the infrastructure (e.g. tidal windows, continued operation under adverse conditions); and
- More use of the infrastructure (e.g. higher traffic density, higher speed).

The resulting improvement for the vessels concerned in carrying capacity and reduction in delays increases the efficiency of these vessels. At the same time this increases the utilization of the infrastructure, which may either eliminate delays or reduce the need for costly investments in the expansion of this infrastructure. These economic benefits are more directly noticeable to the stakeholders concerned and are easier to determine than the benefits of VTS for safety of navigation. Methods to determine these economic benefits are described in Chapter 7 of this Manual.

0405 Protection of the Environment

In many societies, communities and areas, the protection of the environment is increasingly considered the highest priority. Pollution can also cause substantial economic damage to activities, in particular those activities dependant on a clean environment, such as tourism, recreation and fisheries. Generally pollution, in particular oil spills by tankers are the biggest concerns, but accidental bunker spills by other vessels and spills of chemical cargoes into the water, and accidental emissions of polluting gasses into the air can also cause environmental pollution.

The Ramsar Convention on Wetlands is an intergovernmental treaty adopted in 1971. It is the first global intergovernmental treaty on the conservation and sustainable use of natural resources. The Convention entered into force in 1975 and now (2004) has 138 Contracting Parties, or member States. Though the central Ramsar message is the need for the sustainable use of all wetlands, the "flagship" of the Convention is the **List of Wetlands of International Importance** (the "Ramsar List"). This lists more than 1,370 wetlands for special protection as "Ramsar Sites", covering 120 million hectares (1.2 million square kilometres), larger than the surface area of France, Germany, and Switzerland combined. Many of these sites are in coastal zones and estuaries adjacent to shipping and port activities.

Protection of the environment is often a substantial driving force for determining the need for VTS. It has resulted in VTS being implemented in areas with relatively low traffic volumes (where the need for safety of vessel traffic did not sufficiently justify VTS), in particular in areas where relatively high quantities of polluting cargoes are transported, especially if these areas are considered to be environmentally sensitive. In addition to the explicit formal recognition of the contribution of VTS in SOLAS there is an implicit recognition of the contribution VTS can deliver to the protection of the environment in UNCLOS. VTS is one of the four possible 'associated protective measures' specifically mentioned in the Guidelines for the establishment of 'particularly sensitive sea areas' (PSSA).

At regional level, there is a growing formal recognition of the contribution VTS can offer to the protection of the environment. In the EU, the Directive of the establishment of a community vessel traffic monitoring and information system (Directive 2002/59/EC) specifically mentions VTS as one of the components of this EU-wide system to protect the environment.

Special Areas and Particularly Sensitive Sea Areas

MARPOL 73/78 defines certain sea areas as "**special areas**" in which, for technical reasons relating to their oceanographical and ecological condition and to their sea traffic, the adoption of special mandatory methods for the prevention of sea pollution is required. Under the Convention, these special areas are provided with a higher level of protection than other areas of the sea.

A **Particularly Sensitive Sea Area (PSSA)** is an area that needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities. The criteria for the identification of particularly sensitive sea areas and the criteria for the designation of special areas are not mutually exclusive. In many cases a Particularly Sensitive Sea Area may be identified within a Special Area and vice versa.

Apart from preventative actions to avoid incidents and mitigation actions, when incidents have occurred, VTS can also support and contribute to the identification of sources of illegal spills. With the information available in the VTS on vessel movements in the VTS area, sources of pollution in or nearby the VTS area can be more easily identified and proven. It should also be noted that when a vessel knows that it is being monitored by VTS this helps to deter her from intentionally discharging any pollutants.

As environmentally sensitive areas are often outside port areas at sea, it might sometimes be desirable to have the VTS-coverage extend into international waters or straits for the protection of these sea areas. It should be realised that VTS-participation by vessels can

only be made mandatory in international waters or straits that have been adopted by IMO, otherwise VTS participation in these waters is voluntary.

As with the safety of vessel traffic, measuring the effect of VTS on protection of the environment is not easy. The impact of VTS on the size and number of accidents is difficult to determine, as is the impact of VTS on the reduction of the pollution, which could possibly result from such accidents. This requires a thorough risk analysis, which needs availability and access to data on traffic, circumstances and environmental sensitivity. As mentioned in 0403 above, IALA has developed a risk management tool to assist in and simplify this task.

0406 Protection of the adjacent communities and infrastructure

In certain ports, narrow straits and inland waterways, vessels sail in close proximity to populated areas and associated infrastructure. In ports there are also industrial activities with its associated infrastructures. Generally, accidents involving spills or emissions of hazardous chemicals in fluid or gaseous form are the biggest concern, but deaths, injuries and damage can be caused by vessels sailing into shopping centres, restaurants, housing blocks etc. on the waterfront, as has happened in the past. Also the additional impact of a chain reaction in oil or chemical plants on the waterfront initiated by an accident with a vessel needs to be considered.

Again, a VTS might either prevent such accidents occurring or developing into disasters. VTS are also being used by the emergency services in the event of marine emergencies, which necessitate the co-ordination of all activities within the area concerned.

0407 Risk Assessment

As with the safety of vessel traffic and protection of the environment, it is not easy to assess the effect of VTS on protection of the adjacent communities and infrastructure. Not only the impact of VTS on the size and number of accidents is difficult to determine, but also the impact of VTS on the reduction of the risks for the adjacent communities and infrastructure which could possibly result from such accidents. This requires a thorough risk analysis, which needs availability and access to data on traffic, circumstances and sensitivity of the adjacent communities and infrastructure. As previously mentioned, IALA has developed the a risk management tool to assist in and simplify this task.

0408 Efficiency of related activities

In ports there are many activities related to shipping, known as ‘allied services’, such as:

pilotage	towage
bunkering	line handling
repairs	chandlery
immigration	inspections
cargo/passenger transfer	customs
cargo (onward) transport	cargo treatment/processing
security	agents

Fig. 4.1: Typical Allied Services

All of these 'allied services' may benefit from correct and timely information about actual and expected vessel positions, movements, destinations and times of arrival. This enables those allied services to enhance their own efficiency, whilst at the same time to better plan and utilise their resources, which may reduce the cost base.

Every port therefore seeks improvement in information gathering and dissemination as a means to offer a better port service to the shipping community and so to obtain a competitive advantage over other ports. This promotion and enabling of information exchange with allied services forms part of the development of so-called 'Vessel Traffic Management and Information Services' (VTMIS), together with promotion and enabling information exchange with e.g. other VTS centres.

VTS has a significant amount of such relevant information. In this respect the contribution that can be offered by supplying this information to businesses involved in cargo transfer and onward transport (by road, rail, inland waters and sea) is gaining importance. It improves the optimisation of the overall logistical chain of intermodal transport from producer to consumer. The transfer of information concerning cargo position, movement, destination and ETA is part of the interconnectivity within this chain, which is essential to improve intermodal transport. When the cargo is still on board the information concerning the whereabouts and intentions of involved vessel is, in part, an acceptable substitute for the desired cargo information.

Making information accessible to VTS Users and allied services offers direct benefits to the port and transport community. This, of itself, can be a significant driving force for implementing VTS, in particular for port authorities trying to improve the competitive position of their port. However, special attention needs to be given as to which information it is appropriate to make available. There are legal restrictions and societal sensitivities with regard to the protection of privacy and commercially sensitive information. Modern times have made us more aware of misuse of this information by terrorists, criminals and vandals.

Finally, it has to be realised that VTS may not be the only source of information, e.g. for

ETA, there might be other sources, which might produce conflicting information. Such conflicts must be resolved before the information is distributed.

0409 Supporting Maritime Security

As a result of terrorist attacks and the increased perception of the threat of terrorist activity, security is a high priority for the maritime community. Together with the aviation industry, maritime transport is one of the forerunners in improving the security of transport. IMO has addressed maritime security by the adoption of the International Ship and Port Facility Security (ISPS) code, the development of which continues.

International Ship and Port Facility Security (ISPS) Code requires each Contracting Government to conduct port facility security assessments. Security assessments will have three essential components. First, they must identify and evaluate important assets and infrastructures that are critical to the port facility as well as those areas or structures that, if damaged, could cause significant loss of life or damage to the port facility's economy or environment. Then, the assessment must identify the actual threats to those critical assets and infrastructure in order to prioritise security measures. Finally, the assessment must address vulnerability of the port facility by identifying its weaknesses in physical security, structural integrity, protection systems, procedural policies, communications systems, transportation infrastructure, utilities, and other areas within a port facility that may be a likely target. Once this assessment has been completed, Contracting Government can accurately evaluate risk.

0410 Security in the VTS Environment

There are three distinct aspects associated with security of the VTS environment.

Firstly, there is the need to ensure that the operation of a VTS is not exposed to, or susceptible to the risks of terrorist attack. This situation should apply to all VTS operations, not least because of the general duty of care that a VTS authority should exercise in relation to client shipping. Under ISPS there are a number of minimum functional security requirements for ships and port facilities. For port facilities, the requirements include:

- Port facility security plans;
- Port facility security officers;
- Certain security equipment;
- Monitoring and controlling access;
- Monitoring the activities of people and cargo; and
- Ensuring security communications are readily available.

Secondly, there is the potential for VTS to obtain information that may aid or assist security agencies in counter-terrorist activities. However, this second situation will normally only apply when a VTS authority enters into specific agreement with national authorities on a case-by-case basis.

Thirdly, although VTS is not by definition a security-related system, the integrity of VTS data and systems must be protected and security assessments should be considered. It is necessary to prevent unwanted and unauthorized access to the VTS system, i.e. connection to external systems, like the internet, should not be made directly. Conversely, whilst it may often be desirable to make some VTS information public, this may unwittingly introduce an opportunity for unauthorised access to be gained into the system or to the data it holds.

Protection against terrorist action in the maritime domain requires, among many things, a complete image of vessel traffic in areas of concern with information on the intentions and cargoes of those vessels as well as vigilant monitoring of this vessel traffic. This information could also be of use to support actions against smuggling of goods and illegal immigrants.

VTS monitors a traffic image of almost all vessel traffic in the VTS area and possibly in adjacent waters. VTS has trained operators monitoring this traffic real-time. Whilst it is recognized that security issues are a national matter, VTS Centres can, at present, only contribute to certain security issues. Mainly because VTS Centres are not able to see all traffic, particularly small craft, and VTS-operators are not specifically trained to recognise potential security threats nor are they qualified and equipped to deal with them.

Why VTS? Assistance to mariner and pilot. Above, the busy port of Hong Kong, ferries and regional trade in the foreground and one of the world's largest container terminals at Tsing Yi in the distance. Below, a narrow waterway and mixed traffic in Sweden

Why VTS? Traffic Management in very narrow waterways, above, the bridge at Tjorn, Sweden. Below, traffic passing a congested point on the Inland Sea, Japan.

CHAPTER 5: TYPES AND FUNCTIONS OF VESSEL TRAFFIC SERVICES

0501 Introduction

In many waterways vessels can operate independently under any conditions of traffic and weather. In these circumstances there is no requirement for a VTS and vessels operate unaided. However, there are many waterways where vessels rely on interaction with shore authorities to conduct their movements safely and efficiently and where a VTS is required. The purpose of this chapter is to identify the contribution of vessel traffic services and to set out the options available to a Competent Authority for their provision.

0502 Vessel Traffic Services

The diagram below gives a pictorial overview of vessel traffic service types and functions.

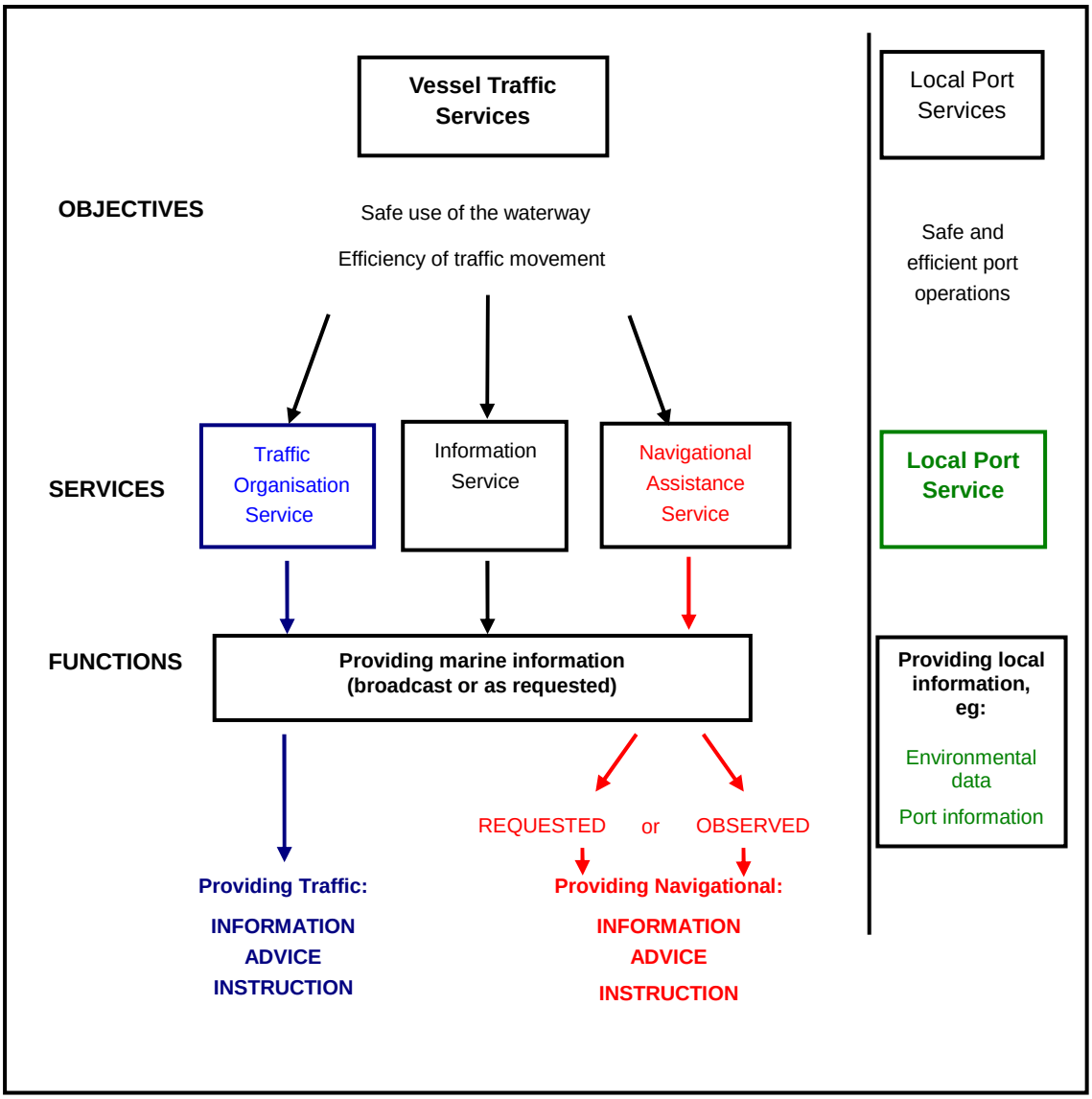


Fig. 5.1: Types and Functions of Traffic and Port Services

0503 Prerequisites

The prerequisites for Vessel Traffic Services (VTS) and Local Port Services (LPS) are:

Vessel Traffic Services

- Authorised by the Competent Authority;
- Staffed by V-103 certificated personnel;
- Equipped as appropriate to provide INS/NAS/TOS;
- Interacts with traffic;
- Responds to traffic situations.

Local Port Services

- Does not require to be authorised by the Competent Authority;
- Staffed and trained appropriate to task;
- Equipped appropriate to task.

> The Competent Authority is the Authority made responsible, in whole or in part, by the Government for the safety, including environmental safety, and efficiency of vessel traffic and the protection of the environment. IMO Resolution A.857(20)

0504 Local Port Services

Local Port Services (LPS) is an organisation ashore that only provides information to the bridge team and does not interact with traffic. LPS is designed to improve port safety and co-ordination of port services by dissemination of port information with vessels and berth or terminal operators. It is mainly concerned with the management of the port, by the supply of information on berth and port conditions. LPS can also provide liaison between vessels and allied services.

Examples of LPS may include:

- Shipping schedules;
- Meteorological and Hydrological data;
- Berthing information;
- Availability of port services.

LPS is not an authorized VTS. It is not required to have the ability and/or the resources to respond to developing traffic situations, nor is there a specific requirement for a traffic image. In addition, the training requirement for personnel is less comprehensive and the

operators are not normally certificated to the V-103 standard but should be trained to meet local requirements. It should be noted that LPS are outside of the scope of this manual as they do not meet international standards, although they will invariably meet the standards of a lower level of capability sufficient to meet local needs. In consequence LPS is not considered further in this manual.

0505 Vessel Traffic Services

An authorized VTS will be capable of offering one or more of the following service types:

- **Information Service (INS).** An Information Service provides essential and timely information to assist the on-board decision-making process. An Information Service does not participate in on-board decision-making;
- **Traffic Organisation Service (TOS)**. A Traffic Organisation Service is a service to provide for the safe and efficient movement of traffic and to identify and manage potentially dangerous traffic situations. A Traffic Organisation Service provides essential and timely information to assist the on-board decision-making process and may advise, instruct or exercise the authority to direct movements;
- **Navigational Assistance Service (NAS).** A Navigational Assistance Service may be provided in addition to an Information Service and/or Traffic Organisation Service. It is a service to assist in the on-board navigational decision-making process and is provided at the request of a vessel, or when deemed necessary by the VTS. A Navigational Assistance Service provides essential and timely navigational information to assist the on-board decision-making process and may inform, advise and/or instruct vessels accordingly.

FUNCTIONS

The functions of each service type are outlined below and identify the major activities that may be expected from each service type, together with an indication of the role that they can be expected to undertake.

0506 Information Service (INS)

This service type involves maintaining a traffic image and allows interaction with traffic and response to developing traffic situations. An INS provides essential and timely marine information to assist the on-board decision-making process, which may include:

- The position, identity, intention and destination of vessels;
- Amendments and changes in promulgated information concerning the VTS

area such as boundaries, procedures, radio frequencies, reporting points;

- The mandatory reporting of movements; and
- Meteorological and hydrological conditions, notices to mariners, status of aids to navigation; limited manoeuvrability that may impose restrictions on the navigation of other vessels, or any other potential hindrances.

0507 Traffic Organisation Service (TOS)

A Traffic Organisation Service provides essential and timely information to assist the on-board decision-making process. It may involve the provision of information, advice and instructions. Traffic Organisation concerns the forward planning of movements to maintain vessel safety and to achieve efficiency. This service may involve:

- The position, identity, intention and destination of vessels;
- Amendments and changes in promulgated information concerning the VTS area such as boundaries, procedures, radio frequencies, reporting points;
- The mandatory reporting of movements;
- Information such as meteorological and hydrological conditions, notices to mariners, status of aids to navigation;
- Specific information such as traffic congestion and special vessels with limited manoeuvrability which may impose restrictions on the navigation of other vessels or any other potential hindrances;
- The allocation of waterspace;
- Establishing and operating a system of traffic clearances - all or certain classes of vessels may be required to participate in this service and shall not proceed without clearance;
- Establishing routes to be followed and speed limits to be observed and such other measures as may be considered necessary and appropriate by the VTS;
- Specific information, such as traffic congestion and advice about vessels with VTS sailing/route plans. These are an instrument of traffic organisation and the ability of a VTS to contribute to vessel safety. It is a major source of information to the VTS. The category of vessels for which a VTS sailing plan is compulsory and the details required should be clearly identified. A VTS sailing plan normally includes the intended route, the estimated time of arrival in the VTS area or the departure from a berth or an anchorage in the

VTS area. It may also take into account the general flow of traffic, efficiency and co-ordination with allied services.

0508 Navigational Assistance Service (NAS)

A Navigational Assistance Service may be provided in addition to an Information Service or Traffic Organisation Service. It is a service that provides essential and timely navigational information to assist in the on-board navigational decision-making process. It may also involve navigational advice and/or instruction.

Navigational Assistance may be provided at the request of a vessel or when a navigational situation is observed and intervention by VTS is deemed necessary. Such assistance requires positive identification and continuous communication throughout the process. It is important that the provision of Navigational Assistance is agreed between the vessel and the VTS providing the service. Acceptance by the vessel of the Navigational Assistance Service should be established, and the beginning and the end of navigational assistance should be clearly stated.

Clear operational procedures should be in place for the provision of Navigational Assistance when requested by a vessel, or when observed and intervention is deemed necessary by the VTS. The authorisation of VTS personnel to provide this service should also be identified. VTS Authorities should give careful consideration to staffing levels, their qualifications and equipment capability when implementing this type of service. Navigational Assistance may involve the provision of information, such as:

- Course and speed made good by a vessel;
- Position relative to fairway axis, navigational features and/or way-points;
- Proximity to navigational hazards; and
- Positions, identities, intentions and any restrictions of surrounding traffic.

Navigational Assistance may also involve the additional provision of advice and/or instruction, and may include or require:

- An assessment of the suitability of the vessel to respond to the advice provided including an assessment of linguistic ability;
- A review of vessel characteristics including manoeuvrability relative to the area in which the service is provided and any defects or deficiencies;
- An assessment of the environmental conditions;
- An assessment of the implications of the cargo carried;

- A review of the proposed sailing plan;
- Recommendations on measures to maintain the sailing plan noting that any advice on courses and speeds should be result orientated;
- The use of message markers;
- The use of a dedicated frequency; and
- Restriction of other traffic movement.

When the VTS is authorised to issue instructions to vessels, these instructions should be result-oriented only, leaving the details of the execution to the master or pilot ….

0509 Promulgation of Information and Categorisation of Services

The services offered to the mariner by a VTS should be promulgated to vessels in internationally recognised marine publications. This should include details of the VTS, its capabilities, rules, regulations, requirements and procedures. The information promulgated should be verified, or up-dated, at least at annual intervals. Further information can be found in Chapter 13.

0510 Certification and Audit of VTS

The responsibility for determining the VTS service type required to mitigate identified hazards lies with the Competent /VTS Authority who are accountable for the standards they set. This includes the resources, staffing levels, training and qualifications.

Appropriate and adequate operational and administrative procedures should be in place. The Competent Authority should ensure that the operational and administration procedures used by a VTS Authority are appropriate for the advertised services through certification. Certification can be achieved by an appropriate auditing and accreditation process. IALA Guideline 1055 provides advice on preparing for audit of the delivery of VTS services.

It is a national responsibility to determine whether the Competent Authority has taken action to ensure that the VTS Authority/Centre has appropriate procedures and practices in place to meet the declared standards.

CHAPTER 6: PRINCIPLES OF TRAFFIC MANAGEMENT

0601 Introduction

This chapter discusses principles of traffic management that an authority may wish to implement in order to enhance safety in a port or waterway. These principles may be enacted in conjunction with the various types of VTS discussed in the previous chapter. However, before implementing any measure, the authority should evaluate the local waterway conditions. The evaluation should include a review of the geography, meteorology, hydrology and environmental issues of the port or regional area; an assessment of the types and numbers of vessels operating within it; consideration of commercial factors and other activities; a review of the waterspace management techniques, and conclude with an evaluation of the types of VTS service and how they can contribute to safety and efficiency of marine traffic operating within the area. The primary issues are outlined below and may need to be taken into account in determining whether a VTS is required to enhance safety, a process that is described more fully in Chapter 7.

0602 Geography, Meteorology, Hydrology and Environmental Issues

The geography, meteorology and hydrology of the local or regional area will determine the way in which traffic operates within the area and how it may be managed.

Geography This involves an assessment of the water available for navigation, identification of the fairways or channels and how they might be marked. Consideration should also be given to the proximity of isolated dangers and the quality/availability of primary and alternative methods of positioning and navigation. Guidance on assessing the criteria for safe shipping movements has been published the by the International Association of Navigation (PIANC) and includes a discussion of the risks associated with, and the relationship between factors such as vessel draught, underkeel clearance (UKC) and channel width. UKC is a key risk management and safety feature. Its calculation includes an allowance for factors such as: vessel construction, water density, squat, wave and swell allowance and bottom type.

Meteorology Factors such as the speed and direction of the prevailing wind, direction and height of the waves, visibility and the formation of ice may impact on the assessment of the safe operating patterns in a particular area, fairway or channel and the types of vessels that may be permitted to operate within the area.

Hydrology The establishment of safe operating areas, fairways and channels should take into account the hydrology of the area. This will include factors such as the

stability of the seabed, the accuracy of surveys, tidal ranges, tidal streams, prevailing currents and swell.

Environmental Issues There are areas where the risk of, or consequences of an incident would be such that extra safety provisions, over that normally applied, may be appropriate. These areas must be identified so that the VTS can accommodate them.

The object of approach channel design is safety and navigability for the shipping traffic which will use the port. A final stage will be to carry out a marine traffic analysis and risk analysis. Marine risk embraces the risk to life, damage to the marine environment and the potential commercial loss to a port in the event of an accident.

0603 Vessel Types and Traffic Density

The geography, meteorology and hydrological considerations above should be closely linked with an assessment of the types of vessels, their size and manoeuvrability, traffic density, traffic patterns and the trade being conducted in the area. The inter-relationship between the environmental factors and the vessel size is self-evident but special consideration may need to be given to the type of vessels and the cargoes being carried, particularly where these incur additional risk. International guidance provides options for some high-risk ships, and national legislation may dictate the need for additional restrictions in the management of certain cargoes.

The Society of International Gas Tanker and Terminal Operators (SIGTTO) document "LNG Operations in Port Areas" gives guidance about the factors that need consideration when establishing the size of domain that should be used with liquefied gas shipping when in a narrow channel. Such guidance relies on the output obtained from a relevant risk-assessment.

0604 Commercial Factors and Other Activities

Ports must operate in an efficient manner to meet the needs of the users but this must be done without impinging on the safety of operations. Recreational activities, issues associated with oil and gas production and Naval operations may take place within the area to be covered by a Vessel Traffic Service. A good working relationship needs to be established and maintained with other users of the area and Allied Services. The authority must make due allowance for any potential conflict between safety, commercial operations and other activities, and pre-empt such conflicts before they arise.

0605 Waterspace Management Techniques

Having established the available waterspace and the type of vessels that will be operating within the area, a number of techniques are available to manage traffic. These include:

- **Channel and Fairway Dimensions** Safety of navigation may be enhanced by establishing a deep-water channel within a buoyed fairway that would permit shallower draught vessels to navigate safely outside of the deep draught channel, whilst remaining within the buoyed fairway.
- **Traffic Separation Schemes** Traffic Separation Schemes (TSS) may be established to organize traffic where traffic patterns and traffic flows indicate that this may be desirable. TSS may be established by national authorities within their territorial sea but those in international waters must be adopted by IMO. Guidance for establishing a TSS is in IMO Publication - *Routeing Instructions.*
- **Two-Way Traffic** Within a channel, normal two-way traffic flows may be permitted. This may involve granting approval for overtaking and for encounters involving vessels carrying hazardous cargoes. Further consideration should be given to additional restrictions involving overtaking and encounters at pinch points such as bends in the channel.
- **One-Way Traffic** Risk assessment may indicate the desirability of limiting the flow of traffic to one-way only for all vessels or for vessels of a particular size, type or cargo.
- **Point of No Return** Ports with significant tidal ranges may need to identify "points of no return" or "abort" points to ensure that a vessel can return to safe water, a lay-by berth or an anchorage in the event that the planned berth is unable to accept the vessels.
- **Anchorages** In establishing anchorage areas, consideration should be given to factors such as shelter, depth, holding ground and proximity to channels and fairways. Specific anchorages may be reserved for use by large vessels or those carrying dangerous goods that are unable to proceed to their planned berth.
- **Slot Management** Two-Way and One-Way Management techniques may be combined with the requirement for slot management. This is the process whereby a vessel is allocated a time window or turn to make or begin its transit through all or part of a designated channel.
- **Ship Domain** An operational zone around, above or below a vessel within which an incursion by another fixed or moving object, or another domain, may trigger reactions or processes. The size of a domain may vary for the same vessel dependent on a number of circumstances such as: the dimensions of the

waterway; traffic density; ship size; ship characteristics; ship speed; and aspect of encounter. A Ship Domain is widely used in traffic simulation models, encounter criteria, traffic lane design criteria, VTS planning, risk assessment, collision avoidance, and for other applications such as establishing operational procedures and the dimensions of a Ship Safety Zone.

- **Ship Safety Zone** A zone around a vessel within which all other vessels should remain clear unless authorised. The size of the Ship Safety Zone may vary depending upon such factors as: the dimensions of the waterway; ship size; ship characteristics, cargo, and the degree of risk. The dimensions selected should be determined taking into account these details and a relevant risk assessment.
- **Exclusion Zone** A geographical area, within which all other vessels should remain clear unless authorised. The size and shape of the area may vary depending on the risks involved.
- **Authorisation of Ship Movements** Traffic movements may be managed within a port through the authorisation of ship movements. This requires vessels to seek clearance before entering or navigating within a VTS area and may include the provision for advanced notice to enable the managing authority to assess the situation and veto the movement should this be necessary.
- **Control of Arrivals and Departures** The control of arrival and departure times to and from the berth or pilot station or port approach point is an effective way of managing traffic movements and establishing priorities for individual vessels. This is frequently achieved through negotiation with allied services.

0606 Service Type

Assessment of the issues above are fundamental considerations in determining the need for a VTS (see Chapter 7) and in selecting the service type (see Chapter 5) appropriate to that VTS if deemed appropriate. Waterspace Management Techniques such as the establishment and marking of channels and fairways and the establishment of Traffic Separation Schemes are passive measures that may be used in conjunction with a VTS, but may also be used in isolation. Techniques involving the closer management of vessel traffic, however, will invariably involve the establishment of a VTS.

Where it is decided to establish a VTS, Waterspace Management Techniques will be a key consideration in determining the type of service that will be required. For example, the control of departures and arrivals may be achieved through allied services, and other

passive measures, such as channels/fairways and TSS, may be used to complement a local traffic service. Other measures described above are active measures that would normally dictate the requirement for a Traffic Organisation Service. The complexity of the navigational environment will determine, through risk assessment the service type required. In all cases, the training and qualifications of VTS Operators providing the service and their authorisations (see Chapter 12) should be clearly identified and clear operating procedures established (see Chapter 17).

Clear and timely information is key to the provision

of good vessel traffic services.

CHAPTER 7: DETERMINING THE NEED FOR VTS

0701 Introduction

This chapter provides guidelines to aid the decision making process in judging the need for establishing a VTS, or for reviewing an existing VTS, by providing a framework to assist competent authorities to:

- Assess the risks associated with a waterway;
- Assess the contribution that VTS can provide in mitigating risk and improve the safety and efficiency of navigation, safety of life and the protection of the environment;
- Determine the level of sophistication of the vessel traffic management system required where it is decided that a VTS is the appropriate tool.

In deciding whether or not to implement a VTS there are essentially two fundamental questions to be addressed by a competent authority. These are:

1. What are the environmental, safety and economic consequences of having or not having a VTS, given the currently implemented safety systems?

2. What is the level of investment that can be justified by the improvement in the system safety?

0702 Mechanisms to Improve Maritime Safety and Efficiency of Navigation

Each harbour, port or coastal waterway is inherently different and the requirement to manage navigation varies considerably. It should be recognized that a VTS may be essential in some waterways; however, different mechanisms may be more appropriate in others. Determining whether a VTS is an appropriate mechanism to address concerns about the levels of safety is often difficult to assess. In most, if not all cases, the need for a VTS only becomes readily apparent when all mitigating factors are considered. This will normally require a formal assessment of navigational risk to identify what management of navigation is required and to what degree monitoring and traffic organisation needs to play a role in mitigating risk.

From the risk assessment some authorities may identify the need to provide a VTS as specified in IMO Resolution A.857(20) *Guidelines for Vessel Traffic Services* and in IALA publications, such as the IALA Recommendation V-119 *Implementation of Vessel Traffic Services*. Other mechanisms, such as Local Port Services (see Chapter 5), will often provide a suitable level of service to mitigate risk where it has been assessed that a

VTS, as described above, either exceeds the requirement or is inappropriate. Identifying the threshold between Local Traffic Services and VTS is often difficult to determine. It is likely to be port specific and will only become clear in the risk assessment process, when all of the mitigating factors are considered. Local Traffic Services are applicable where interaction is unnecessary to fulfil the statutory requirements of the harbour authority's duties with regards to navigational safety.

> The Inception and the Feasibility and Design Phases should provide details of the VTS requirements to enable cost and performance estimations to be carried out under the Cost/Benefit Study Phase. The Cost Benefit Study should consider direct risk reduction (which may be vague), the less evident benefits that a future VTS might offer and the further value added services for shipping in the future. A realistic cost estimate for running a VTS is important. An estimate of possible future cost reduction to be achieved by slimming down the other waterway infrastructure costs should also be provided. In the case where the Feasibility Study gives a positive result, the Competent Authority may proceed with the final design and planning work and launch a bid for tenders.
>
> Sometimes the Inception, Feasibility and Design, Risk Assessment and Cost/Benefit Phases of the project are altogether classified as the Feasibility Study. This approach could be followed in the case where the Competent and/or VTS Authority has carried out a separate initial investigation to identify all the options available to address the risk and has subsequently determined that the preferred solution is to proceed with a Feasibility Study. Furthermore, the Feasibility and Design Phases may be incorporated within one phase, as opposed to comprising two separate phases. In this Recommendation, the Feasibility and Design has been treated as a single Phase. IALA Recommendation V-119

0703 Benefits of VTS

The purpose of VTS is to improve the maritime safety and efficiency of navigation, safety of life at sea and the protection of the marine environment and/or the adjacent shore area, work sites and offshore installations from possible adverse effects of marine traffic in a given area. VTS may also have a role to play in security.

The benefits of implementing a VTS are that it allows identification and monitoring of vessels, strategic planning of vessel movements and provision of navigational information and navigational assistance. It can assist in reducing the risk of pollution and, should it occur, coordinating the pollution response. Many authorities express difficulty in establishing justifiable criteria for identifying whether VTS is the most appropriate tool to improve the safety and efficiency of navigation, safety of life and the protection of the environment. A VTS is generally appropriate in areas that may include any, or a combination, of the following:

- High traffic density;

- Traffic carrying hazardous cargoes;
- Conflicting and complex navigation patterns;
- Difficult hydrographical, hydrological and meteorological elements;
- Shifting shoals and other local hazards and environmental considerations;
- Interference by vessel traffic with other waterborne activities;
- Number of casualties in an area during a specified period;
- Existing or planned vessel traffic services on adjacent waterways and the need for cooperation between neighbouring states, if appropriate;
- Narrow channels, port configuration, bridges, locks, bends and similar areas where the progress of vessels may be restricted;
- Existing or foreseeable changes in the traffic pattern in the area.

0704 Needs Analysis

Installation of a VTS invariably requires considerable investment. It is strongly recommended that before considering the establishment of a new VTS, or the enhancement of an existing VTS, a Competent Authority should undertake a formal study to define clearly the need, the functional requirements and to identify the costs of implementation. IALA Recommendation V-119 *Implementation of Vessel Traffic Services* provides guidance of the items to be addressed. It sets out four key steps (Fig. 7.1) for a needs analysis to determine whether a VTS is an appropriate mechanism to maintain or improve maritime safety and, if so, whether the Competent Authority has the requisite capability and resources to implement one.

1. Preliminary Assessment (Inception)	The inception phase is intended to answer the question of whether active traffic management is the appropriate means to address the local traffic problems. This phase includes a preliminary risk assessment and in some cases may be enough to identify whether to proceed further.
2. Feasibility and Design	The Feasibility and Design Phase is intended to identify the functional requirements required to attain the desired level of safety and efficiency of the maritime traffic.
3. Formal Risk Assessment	The Risk Assessment Phase is intended to confirm that the measures being designed and introduced will reduce the risk of collisions and groundings in the area to a level considered by the Competent Authority to be satisfactory.
4. Cost / Benefit Analysis	The cost / benefit phase is intended to identify whether the expected reduction in risk would be justified in terms of the level of investment required.

Fig. 7.1: Steps for undertaking needs analysis

Figure 7.2 shows the position of the steps within the VTS implementation process.

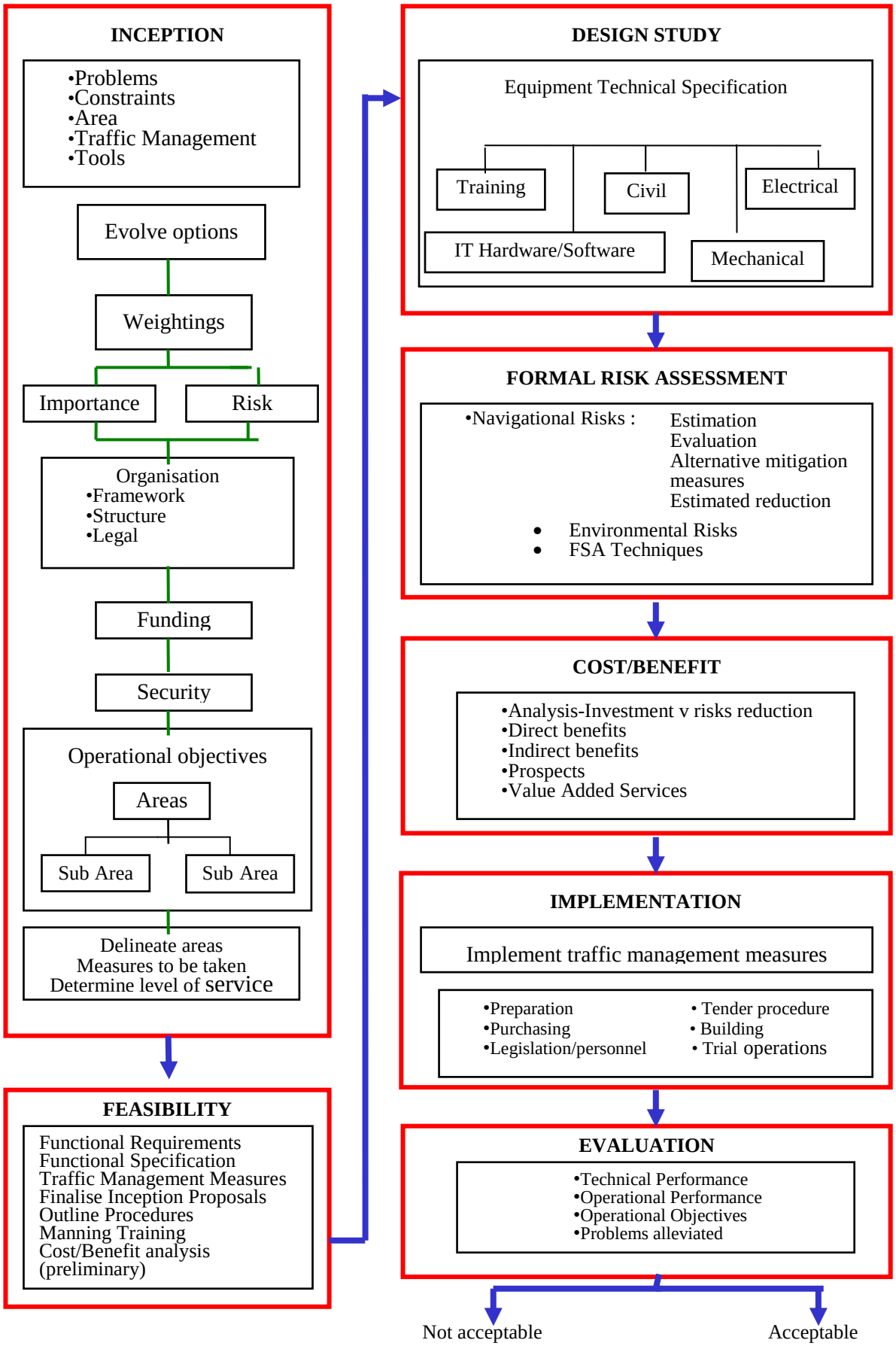


Fig 7.2: Main phases in the development and procurement of a VTS

0705 Preliminary Assessment (Inception)

The purpose of the preliminary assessment phase is to decide the suitability of VTS as an appropriate traffic management option. Where this is confirmed, the information collected will provide the basis for undertaking the feasibility study. The preliminary assessment should identify as a minimum, the potential hazards, as well as the existing organisational infrastructure, operations and procedures.

The preliminary assessment should identify whether active traffic management is an appropriate means to address the local traffic problems. Active traffic management should only be used in those areas where other means are inadequate to provide the desired level of safety and protection of the environment.

The preliminary assessment phase should be an iterative process that involves the following key steps:

- A review of the organisational structure, including its culture, policies, procedures and priorities;
- A review of the legal framework;
- A definition of the area under consideration including its oceanographic characteristics;
- A definition of and/or quantification of:
  - The inherent navigational and environmental attributes of the waterway;
  - The stakeholders;
  - The economic and environmental value of the waterway;
  - The public interest;
  - The maritime traffic using the waterway;
  - Available incident data, such as such as collisions and groundings;
  - Available data on traffic problems, including delays, and
  - Security considerations.
- An identification of the existing safety management structure, including it’s strengths and weaknesses;
- An identification of the key risks to navigation not being addressed by existing safety management structure;
- An identification of the options to address the key risks;
- A definition of the operational objectives to alleviate the risks, and
- An identification of the most appropriate traffic management tools, in terms

of effectiveness and costs, to mitigate the defined problems. These traffic management tools may range from simple routeing measures through to the implementation of an advanced VTS system.

It should be recognized that one of the main difficulties faced in undertaking any form of risk assessment is that, in many cases, the full consequences of recorded casualties are not available. In such circumstances they should be estimated by expert judgement. Account should also be taken that future events are not simply an extension of history, so more refined methods need to be applied to assess the estimated casualty costs and other consequences for, say, the next ten years, or so, by taking into account all foreseeable trends. Risk estimation and evaluation form vital inputs to any risk assessment.

Future developments of the port infrastructure and the resulting changes in traffic volumes and composition, including dangerous cargoes, together with and any other relevant development in the area concerned should be considered in this phase. In the specific case of a Coastal VTS, future trends in traffic volume and other activities in the coastal area, such as fishing, recreation and offshore activities need to be taken into account. Equally relevant, is the need to consider developments in VTS technology and SOLAS requirements, for navigational and communication equipment on board vessels.

Where it is decided to establish a VTS, the following aspects need to be addressed;

- Organisational framework of the national and local maritime authorities in relation to implementing new traffic management solutions, VTS in particular; and
- The adequacy of the existing regulatory or legislative framework, including local by-laws, rules and recommendations. Special attention has to be devoted to ascertain any requirement for adjusting the framework to ensure the effective implementation of a VTS.

In deciding upon the establishment of a VTS, VTS Authorities or Competent Authorities should also consider the responsibilities and the availability of the requisite technology and expertise.

0706 Feasibility and Design

The Feasibility and Design Phase is intended to identify the functional requirements needed to achieve the desired level of safety and efficiency of the maritime traffic. The foundation for proceeding with the Feasibility and Design Study Phase is the information

compiled in the preliminary assessment (Inception) Phase and the expected functions and benefits of a future VTS. This input may also give an indication of the desired type of service to be provided by the VTS.

To establish the functional requirements for the VTS the VTS/Competent Authority needs to assess the types of vessels using a particular area, the requirements to aid their safe and expeditious passage, the operational benefit of a VTS and the broad implications of providing the service. These considerations should take into account the existing aids to navigation and traffic routeing schemes in the area concerned.

It is very important in this Feasibility and Design phase that the functional requirements to be developed do not lead to unnecessary expense in the future operation of the VTS. Any consultants appointed by the VTS/Competent Authority should be independent from any VTS equipment manufacturers, thus ensuring independent and impartial advice. Furthermore, consideration should be given to the availability of the requisite technology and expertise. This is of particular importance for the required regular maintenance and to remedy defects and other trouble-shooting.

The feasibility and design study phase is also intended to provide a VTS Authority with a framework for proceeding with development against carefully established guidelines of requirement, cost, risk and time. It should comprise some or all of the following:

- Description of the constraints and context in which the VTS will operate;
- Evaluation of the technology available and determination of the standards to be used;
- Evaluation of the human resources needed for operation of the system and consideration of manning levels, training and skills required;
- Evaluation of the health and safety facilities needed to safeguard staff and other persons associated with the VTS system;
- Preparation of a management plan for the entire development;
- Assessment of the method, or methods, to be used for Quality Assurance;
- Assessment of the probability that the VTS system will be developed, installed, tested and ready for operational use within both the required time scale and the available financial resources;
- Development and evaluation of system design options, which may include the location of the VTS buildings themselves. Advances in technology have

enabled a number of VTS Centres to be sited remotely from the actual harbour/waterway. In addition, security implications may drive the site selection decision;

- Determination of the Integrated Logistic Support (ILS) requirements, including the identification of the through-life elements of the system and the means for achieving enhancement and upgrades;
- Automatic data exchange, data validation, and
- Evaluation of a Cost-Benefit analysis and the identification of any trade-offs.

The feasibility sub-phase should identify the range of activity that will need to be examined during the technical specification sub-phase, show the feasibility of any actions suggested and eliminate high-risk elements. On satisfactory completion of the feasibility sub-phase the VTS Authority will be in possession of a highly detailed basis for proceeding to technical specification phase with confidence that its outcome will provide a viable solution for developing the system. Attention is also drawn to IALA Recommendation V-119 *Implementation of Vessel Traffic Services*, which provides a comprehensive list of the functional requirements to be addressed within the feasibility sub-phase.

In order better to facilitate the Cost Benefit Analysis it is important that a basic functional design is provided. Further, a system model, containing in broad outline the key system attributes (sensors and other components), will be required.

The Technical requirements specification should produce the definitive statement of how the system, including buildings, is to be constructed, and how sub-systems and components should interact with each other to produce a viable VTS. IALA Recommendation V-128 *Operational and Technical Performance Requirement for VTS Equipment* provides further guidance.

0707 Formal Risk Assessment

The Risk Assessment Phase is intended to confirm that the measures being designed and introduced will reduce the risk of collisions and groundings in the area to a level considered by the Competent Authority to be satisfactory. The risk level should be calculated by taking into account:

- The type, size, speed, manoeuvrability, routes and spatial distribution of ships using the area, including local craft;
- The types of aids to navigation provided in the area and their locations; and,

- The traffic routeing schemes in use in the area.

A total risk equation comprises the probability, or frequency, of an incident occurring, the consequences of an incident and the Governmental or public acceptability of such an incident. The risk assessment should identify and quantify each of these aspects.

IALA Guideline 1018 *Risk Management* provides a general risk assessment and risk management methodology for Marine Aids to Navigation including Vessel Traffic Services (VTS) so that all types of risks can be effectively managed. The Guidelines may be used when assessing the optimum mix of aids to navigation, including VTS, for mitigating risk.

0708 Reference Documentation

Documentation that should be consulted includes, but is not limited to:

- The IALA Guidelines 1018 *Risk Management* These Guidelines break down the Risk Management process into five clearly identifiable steps, namely, Risk Identification, Risk Assessment, Risk Control Options, Decision Making and Take Action - contain further details on risk assessment.
- IALA Risk Assessment Models

0709 Cost Benefit Analysis (CBA)

After completion of the Design and Risk Assessment Phases, an extensive analysis of the costs and benefits is needed to justify large public and/or private investments, such as a VTS. Even if not all costs and benefits can be translated into monetary terms, the CBA can assist in a more complete and rational decision-making process. It can also contribute to the proper allocation of the cost recovery by the various benefiting parties, as well as the determination of the system requirements. As such, CBA forms an integral and essential part of the process for implementation of a new VTS or modification of an existing VTS, which should be considered in conjunction with the implementation of other traffic management instruments to achieve the same objectives. The CBA forms a building block in the process of risk management. The methodology is described at Annex A to this chapter.

Both the additional direct and indirect benefits and prospects that a VTS might offer, including additional value added services for the traffic in the future as well as the benefits to shore based port operations, should be taken into consideration. A direct benefit that could be taken into consideration, amongst others, is the probable reduction in

other waterway infrastructure costs that may arise from implementation of the changes, such as replacing labour intensive processes using traditional equipment with more modern equipment and automated processes.

Indirect benefits should include an estimation of costs that would otherwise have been incurred in the event of an incident/accident, based on the projected difference between the frequency of occurrence of such incidents/accidents before and after implementation of any changes.

ANNEX A: COST BENEFIT ANALYSIS (CBA) OF VTS

1. Introduction

This annex offers outline guidance on how to carry out a CBA. This is a complex task as quantification of safety benefits and the translation of these benefits in monetary terms is difficult and often comes down to expert opinion. However, there are a number of ways to eliminate, or at least reduce, the subjective element.

2. Determination of Costs

The cost components of a new VTS consist of two distinctive elements, namely the initial investment costs and the lifetime operating costs. All cost components should be identified and quantified in terms of amount and the budget timeline. When considering a modification of an existing VTS, as opposed to a new VTS, only the additional costs should be assessed.

The investment costs are the total costs initially incurred for investments such as:

- Preparation (e.g. feasibility studies, tendering, procurement, legislation);
- Building works (e.g. VTS Centres, radar locations, VHF masts, power/water/telephone connections);
- Equipment purchase and installation (e.g. radar, VHF and other communication, computers, software, VTS work consoles, vessels/vehicles);
- Project management and administration (including intermediate measures);
- Organization set-up (e.g. recruitment and training of staff, developing procedures)

Often the costs for preparation, the set-up of the organization and the project management/administration are overlooked.

These investment costs are sometimes depreciated as capital costs during the lifetime of the VTS, depending on the accounting system used. At the end of the lifetime of the VTS the investments might still have a residual value which needs to be deducted from the initial investment costs at present value.

The operation costs are the annual costs incurred over the lifetime of the VTS for expenditures such as:

- Maintenance and repairs of the building works (including spare parts);

- Maintenance and repairs of the equipment (including spare parts);
- Personnel (including replacement and additional/refresher training);
- Consumables (e.g. power, water, telephone, data exchange); and
- Insurance cover (if appropriate).

Electronic equipment quickly becomes outdated and unviable to maintain. Therefore regular replacement by more up-to-date equipment during the lifetime of the VTS needs to be considered in the operational costs assessment.

3. Determination of Benefits

The determination of the potential benefits of VTS is even harder than the determination of the costs. However, some guidance is detailed below. The benefits to be gained may include:

- Reduced (risk of) damage to life, infrastructure and environment; and
- Improved economic performance.

The benefits can be for both in terms of a specific vessel as well as for the area as a whole. The area as a whole will include benefits to not only other vessels in the vicinity but also other activities in the vicinity

Under “other activities” there is a tendency to only think of the economic activities in ports. However, in or near ports there is often also an extensive population engaged in other activities, which need to be protected. With coastal and offshore VTS the benefits to fishing, offshore activities and tourism should be considered. In-depth knowledge of not only shipping, but all other activities in the area, together with their economic and environmental sensitivities is needed. Account should be given to future developments. In-depth analysis of past incidents, their causes and consequences, together with an insight into the effects a VTS might have on these is required.

The benefits to **reduced (risk for) damage to life, infrastructure and environment** are the hardest to determine. The different types of incidents that could have been prevented by a VTS (e.g. groundings and collisions) and of the different types of incidents where a VTS could have limited the consequences (e.g. by acting as co-ordination centre for other emergencies, such as fire on board) should be listed. An assessment can then be made of the number of incidents that could have been prevented by a VTS and the number of incidents where the negative consequences could have been reduced by a VTS.

The benefits to the **improved economic performance** of the vessel and the area can be quantified by measuring the reduction by the VTS in "down time" of both the vessel and the related shore based activities, resulting from fog and other circumstances. Also the economic effects by reduction in operational limitations of other activities based on the introduction of a VTS should be taken into account. More difficult is the determination of the benefits of information provided from the VTS on vessel movements to allied services, which can improve the (economic) performance of these services (e.g. ETA notification to port services).

By multiplying these with the averaged day rates of the average or individual vessels and other activities/facilities on an annual basis, an estimate of these annual benefits can be obtained.

In general terms the benefits to be gained from a VTS include improved safety of traffic by prevention of situations leading to an unacceptable risk; contributing to safe passage. The benefits to safety of traffic achievable by a VTS may depend upon the type of service provided and functions performed.

4. Calculation of Benefits

A calculation of the benefits can be carried out by the following steps:

- Inventory of incidents which happened in the area under consideration when there was no VTS (types of accidents, e.g. standings, collisions, circumstances during the incidents, e.g. visibility, tide, storms, behaviour of affected ships, probable reasons which led to the incidents);
- Inventory of traffic related delays by waiting and speed reductions in the area under consideration when there was no VTS;
- Inventory of amount, composition, dangerous or noxious cargoes and behaviour of traffic and specific conditions which may impair the traffic in the area under consideration;
- Calculation of probability of incidents in the case of no VTS, resulting from the registered traffic, taking into account fairway layout and width, numbers of encounters and the sizes of concerned ships, distribution of traffic and circumstances; and
- Calculation of costs caused by the above incidents, taking into account ship and cargo, other affected ships, infrastructure, human life, remedial action, potential consequences for traffic flow and other activities in the area and

potential environmental consequences, as well as the costs caused by delays.

5. Assessment of Avoidable Costs

Taking into account the above factors, an assessment of the costs that can be either avoided or reduced by the use of a VTS can then be made. This provides an indication of the benefits achieved by the VTS in financial terms. There is some research, which indicates that a full VTS can reduce accidents in areas of high traffic density by 50%. However, the number of incidents and associated costs that can be prevented or limited by a particular VTS cannot be calculated exactly. This assessment can be made on the basis of:

- **Statistical evaluation of the existing situations and experiences (also elsewhere)**
  This gives hard facts and figures, but might be misleading if circumstances are significantly different or have changed during the long measuring period needed to obtain reliable statistics;
- **Consultation of experienced mariners, VTS-staff and consultants**
  This is often an inexpensive method achieving quick results, but subjective (especially when only a few experts are available) and may not be valid for new situations;
- **Mathematical models**
  These models, where for instance the effect of VTS on the penetration of the vessels domain is calculated, produces objective results, but could be unreliable as a model is a simplification of reality; and
- **Simulation methods**
  These methods, where certain situations are recreated on a simulator or PC and tested by multiple runs, if possible in faster time, offers statistical reliable results in a short time, incorporating the human factor. However, a simulator is also only a model and can be expensive.

As all methods have certain advantages and disadvantages and none is perfect, a combination should be applied. This should result in quantitative values on reduction of the number of incidents or their consequences by VTS, which will need to be translated into monetary terms.

Some damage is difficult to translate into monetary terms. Damage or loss leads to repair and replacement costs, which can be determined relatively easily, but also leads to loss of earnings, which needs to be taken into the calculations too. The same applies to loss of earning of other affected activities (think of the loss of earnings in fishing and tourism after an oil spill) and the damage to the environment in general. There can be loss of

reputation as well (think of the damage to the reputation and therefore business of an oil company after an oil spill), which is almost impossible to translate into monetary terms. If certain effects cannot be translated into monetary terms they should at least be noted and mentioned in the outcome of the CBA.

Estimating the monetary worth of a human life is a sensitive issue, considering that occasionally, people are injured or die as a result of an accident. For the purpose of CBA, the value of a human life is inherently an estimate, one that is pondered upon regularly. Public sector management often draws upon elaborate socio-economic modelling, when decisions are required on the building of roads, railways, etc. Among the several factors taken into account in such models are a person's life expectancy, the net present value of their future earning potential, and other demographic factors.

On the basis of experience a categorisation of incident sizes for each incident category can be made. A distinction could and should be made between small incidents, which occur frequently but have little consequences, and disasters, which occur seldom, but have large consequences.

With small incidents an actual reduction in the number of incidents by VTS can be determined and used in the further calculations. As an example; if in an area there are 10 small collision incidents per year with less then 4 million USD damage (average 0,2 million USD) and the VTS could reduce this by 40% a benefit of (0,40 x 10) x 0,2 = 0,8 million USD per year could be allocated to the VTS.

With disasters only a reduction in the risk of a disaster occurring by the VTS can be determined. As an example: if in an area 1 collision disaster is expected every 20 years with more then 4 million USD damage (average 40 million USD) and the VTS could reduce this by 15% a benefit of (0.15 x 40) / 20 = 0.3 million USD per year could be allocated to the VTS.

By thus multiplying the (risk) reduction of incident type/size combinations and their consequences with the (average) damage of an incident type/size combination on an annual basis as well as multiplying the reduction in delays with the day rates of the affected activities an estimate of these annual benefits can be made.

6. Comparison of Costs and Benefits

There are well-known and widely used methods for comparing costs and benefits to assist in the decision making process. These are available in many books on business

economics. In these methods the costs and benefits are discounted to a fixed point in time, often the starting point of the project t_0. The discounted value of all costs during the lifetime of the VTS can be calculated as follows:

$$C_0 = [C_y / (1 + i)^y] + [C_n ((1 + i)^n - 1) / i (1 + i)^n]$$

with:

C_0 = discounted total costs at year t_0
C_y = incidental cost at year t_y
C_n = recurrent annual costs over the period between t_0 and t_n
i = interest rate

With VTS the incidental costs C_y are usually all initial investment costs, spread-out differently over the building years of the VTS, as well as planned midlife modernisation investments. The recurrent annual costs C_n are usually the operational costs, which vary little over the operational years of the VTS.
The discounted value of all benefits during the lifetime of the VTS can be calculated in a similar manner:

$$B_0 = [B_y / (1 + i)^y] + [B_n ((1 + i)^n - 1) / i (1 + i)^n]$$

with:

B_0 = discounted total benefits at year t_0
B_y = incidental benefits at year t_y
B_n = recurrent annual benefits over the period between t_0 and t_n
i = interest rate

With VTS the incidental benefits By are usually all cost savings, generated by the prevention of a major incident by the VTS at one or more years, selected and determined by experts. The recurrent annual benefits Bn are usually the annual cost savings and additional revenues, generated by the improved economic performance of the vessels and the "area", as well as the annual cost savings, generated by the prevention of one or more small incidents per year by the VTS.

The selection of the interest rate to be used in these calculations depends on the required "rate of return". If the VTS is financed with public (national) funds the current interest rate of state bonds is often used in these calculations as this reflects the costs for obtaining funds by the (national) administration in case of a general budget deficit. Generally this varies between 2 and 10%. If, on the other hand, the VTS is financed with private funds,

for instance by a private port, the set desired general rate of return on investments by this organisation is often used to be able to compare the cost/benefit results of the investment in a VTS with other desired investments by this organisation. Generally this varies between 5 and 20%.

The other determining factor is the expected lifetime of the VTS. In general a lifetime for the VTS as a whole of 20 years is used, but in particular electronic equipment outdates quicker and will most likely need to be replaced every 10 years. By deducting the discounted total costs at year t_0 (C_0) from the discounted total benefits at year t_0 (B_0) the "net present value" (NPV) can be determined. If this is a positive amount the investment is worthwhile. The size of the positive amount indicates how worthwhile the investment is predicted to be.

7. Sensitivity Analysis

The outcome of these calculations depends very much on assessments and/or modelling, in particular on the influence a VTS has on the (risk) reduction of incidents. Therefore it is advisable to also carry out a sensitivity analysis. This can be done by making the same calculations based on altered input values, such as assessments, modelling and/or interest rates, to obtain insight into the need and necessity of a VTS should future predictions about conditions differ from those expected.

8. Cost Allocation

As part of these calculations not only all or most expected costs and benefits of a VTS are determined in monetary terms, but also who will bear the costs and profit from the benefits is determined. This can form a basis for the cost allocation of the VTS. For instance, if the calculations show that the costs are mostly borne by the VTS Authority but the benefits are mostly for the vessel, in particular by improved economic performance of the vessel, there is an objective case for user charging and an indication as to how much this should be.

CHAPTER 8: PLANNING AND ORGANISATION OF VTS

0801 Introduction

Chapter 7 identified the methodology for determining the need for VTS. This Chapter addresses the issues involved in planning the subsequent organisation of a VTS.

0802 Geography

The following need to be taken into consideration when establishing the limits of the VTS Area and its division into VTS sectors:

- **Local geography** The local geography will be the determining influence on the size of the area to be covered by a VTS. In the case of ports these vary enormously in their geography. Some ports are extremely simple and are little more than an indentation in the coast protected by breakwaters. Entry and exit is through a passage between the breakwater heads, which give direct access to the open sea. Vessels are only restricted in their freedom to manoeuvre as they pass through the breakwater and into the port itself. At the other extreme are estuarial ports, often far from the open sea with long approaches encumbered by shallow, shifting sandbanks. Vessels using these ports will be restricted navigationally and possibly be unable to anchor or reverse course over long stretches of their passage.
- **Traffic Separation Schemes** The existence or addition of traffic separation schemes within or adjacent to the VTS area may be to be taken into account.
- **Anchorages** Consideration should be given to the designation of anchorages or anchorages areas.
- **Hazards to navigation** For example, offshore structures, particularly the increasing pressure to site Offshore Renewable Energy Installations (OREI) close to navigable channels, may need to be considered not only in the management of vessel traffic but in the planning of the VTS Area/Sector. The impact of such structures on both shore based and marine radars should be carefully considered.

0803 Meteorology and Hydrography

The prevailing weather, in particular visibility and wind together with the tidal range and stream, may impose difficulties on the ability to navigate safely. Together with the local geography, they determine the degree of navigational difficulty likely to be encountered by a vessel. An appreciation of these physical factors, plus any interface with local or regional services, is needed.

0804 Other Considerations

- **Numbers of vessels and types** The numbers of vessels, including local traffic, and their type is significant. A simple count of vessels, although of value, is not sufficient. The vessels need to be considered with regard to their size, type, equipment, manoeuvrability, spatial distribution and cargo so that the optimum service meeting the needs of all users and without placing unnecessary constraints on the movement of any of the vessels can be identified.

- **Commercial factors** Any VTS must take into consideration any potential conflict between safety and commercial operation and pre-empt such conflicts before they arise. Ports must operate in an efficient and timely manner and meet the needs of their users, but this must be done without impinging on the safe operation of the port. The distribution of ship arrivals and departures may be an important factor influencing the port management resources. Unannounced arrivals and departures can have a considerable and adverse effect on the viability of a port. Some ports, such as ferry ports and container terminals, operate to a schedule, which has to be maintained in virtually all weathers.

- **Other Activities** Naval operations, oil and gas production and recreational activities may take place within the area to be covered by a Vessel Traffic Service. These activities will also influence the operation of the Service and must be taken into account. A good working relationship needs to be established and maintained with other users of the area.

- **The size of the VTS area and the proximity of hazards and dangers** These will be key considerations in assessing the positional and navigational accuracy requirements in a VTS system.

- **Positional and Navigational Accuracy requirements** Modern digital charting offers the opportunity of providing greater accuracy and the choice on the level of detail that is provided on the background to the traffic image. However, care must be taken with respect to the date of the source data, when using such products, as this source data may not have been gathered to modern positional accuracy standards. Advice and recommendations on navigational accuracy requirements are documented in IMO Resolutions A.915(22) and A.953(23).

- **Datum** Care needs to be taken to ensure that all data inputs such as AIS and ECS are aligned to a common datum.

- **Display Symbology** Refer to IALA Recommendation V-125, *The use and presentation of symbology at a VTS Centre.*

SERVICES

0805 Service Provision: Mandatory/Voluntary

Within the Territorial Waters of a State, participation in VTS can be made mandatory. Outside of Territorial Waters, the jurisdiction of a VTS is limited by the provisions of the United Nations Conference on the Law of the Sea (UNCLOS). However, it often occurs that a VTS is sited in close proximity to an IMO approved traffic separation scheme, and transgressions of the scheme may be reported to the offending vessel as information, and to the flag state of the vessel concerned for action, under the Regulations for the Prevention of Collision at Sea (COLREGS). In addition, it may be the case that IMO has agreed Mandatory Reporting by all or certain classes of vessel for specific areas, such as an IMO adopted Traffic Separation Scheme.

0806 Service Types for VTS

Having taken into account the geographical area, traffic density and traffic pattern, the VTS Authority will need to consider the service types to be provided, as described in Chapter 5. Account must be taken of the differing On-the-Job Training (OJT) requirements for VTS personnel.

0807 Allied Services

Co-operation with allied services is a supporting activity of the VTS, which is intended to increase the safety and efficiency of the traffic, the protection of the environment and the effectiveness of the VTS, without adding to the reporting burden of the vessel. This co-operation is both safety and efficiency related. It should be a continuous process and is of particular importance in cases where a VTS sailing plan is to be established and action between services needs to be agreed. Procedures for the co-operation between parties should be established.

Incidental co-operation with emergency services, such as Search and Rescue and Pollution Control should be conducted in accordance with pre-established contingency plans in which the procedures for the co-operations are laid down and responsibilities established.

0808 Adjacent VTS

Co-operation between adjacent VTS centres and/or authorities can be of particular interest

where two such services share a common border because they may need to coordinate jointly with the master of a ship when the VTS sailing plan is being agreed. In other cases it should be recognised that the exchange of data between adjacent VTS could give advance notice of arrivals thus relieving the reporting burden of vessels. It could also provide an Administration/Competent Authority/VTS Authority with valuable information on future traffic and cargo flows in its intermediate sea area.

0809 Operational Management

The provision of the following capabilities may need to be considered in the planning and organization of a VTS:

- **Marine Communications** The number of sectors will determine the requirement for frequency allocation in a limited VHF marine communications band. Application to regulating authorities will be required and consideration should be given to frequency allocations in adjacent areas to minimise interference.
- **Prohibited or Dangerous areas** Vessel traffic may need to be kept clear of areas of ecological significance or other hazards. This may influence the routing of traffic and the key points for surveillance and traffic monitoring.
- **Places of Refuge** It may be prudent to identify potential "Places of Refuge" to cater for marine emergencies at local and national level.
- **Separation Criteria** Safety of navigation can be enhanced in particularly sensitive areas or confined/restricted waters through separation techniques. This may be achieved by:
    - Time separation. Time separation is achieved by a vessel having exclusive use of a certain area or a restricted passage for a given time span. The time slots may be allocated as part of a VTS sailing plan.
    - Distance separation. Distance separation is a method whereby vessels are given a minimum distance between each other in order to transit the whole or certain areas and restricted passages. The separation distances to be maintained are allocated and monitored by the VTS centre and may differ depending upon the categories of vessels or the cargo which is carried. Overtaking restrictions and/or minimum passing distances may be part of this method of traffic organisation.
- **Emergency and Incident Management** Configuration of a VTS Centre should take into account the need to manage incidents and emergencies.

Issues that should be addressed include:

- Workstation(s). Provision should be made for additional staff to manage the specific incident whilst the VTS continues with the primary traffic management function. This may be in the form of dormant workstations or a plan to reconfigure existing positions to make best use of the facilities available.
- Planning. Contingency plans and action sheets should be prepared.
- Liaison. Consideration should be given to the links that may be necessary with emergency services including the coastguard.
- Training. Contingency plans should be exercised.

- **Pollution Control** Pollution is a specific concern resulting from an incident or emergency that may have far reaching consequences for a port or coastal VTS. In addition to the measures mentioned in Emergency and Incident Management above, consideration my need to be given to the control of pollution. Prevention measures may include special regulations and controls for vessels carrying Hazardous cargos, which should be addressed in the planning of the VTS.

- **Surveillance requirements for the VTS area** There is a need to take into account the extent of the VTS area with regard to the surveillance equipment necessary. In principle the equipment should be able to cover an area well in excess of the designated VTS area, so as to allow for any decrease in performance in poor weather conditions. The surveillance equipment in most common use continues to be radar although other systems, such as the Automatic Identification System (AIS) and CCTV, are used to good effect. Therefore, depending on the services that a VTS is to carry out the radar coverage can be:
  - Nil (automatic identification systems, voice communication and reporting only);
  - Partly (covered areas chosen intentionally with some blind sectors);
  - Totally by one radar sensor (without any blind sectors); or
  - Totally by two or more radar sensors (for large VTS areas and to cover for shadow effects of other vessels).

0810 Security

VTS is primarily concerned with the provision of services to compliant commercial traffic in order to facilitate navigational safety and environmental protection. In order to discharge these responsibilities, VTS facilities are equipped with sensors and communications, capable of generating the required information. As mentioned above,

information is often of value to allied services, which typically include, but are not limited to, customs and immigration authorities, ship agents and port service providers.

In the current heightened security environment, and following the additional security measures adopted by the IMO at its Diplomatic Conference in December 2002, it is entirely sensible that national security organisations should take full advantage of the information generated by VTS centres (See 0408). This is best achieved by recognising that security organisations should, where appropriate, become the recipients of VTS generated information as allied services, provided the safety of navigation is not affected.

With the increasing acceptance by national competent authorities of the IALA V-103 training and certification process, it needs to be recognised that such training does not address specific security duties. Accordingly, and in countries where national arrangements require VTS personnel to perform such functions, the staffing and training to fulfil a security role should remain a national responsibility.

VTS centres, systems and personnel are potential targets for hostile activity. To counter such circumstances, VTS Authorities should consider the need to protect against perceived vulnerabilities. This should be done in conjunction with the relevant national security organisation.

0811 Internal Organization

Having identified the VTS Area, the number of Sectors and the Types of Service to be provided, the manning of the VTS can then be addressed. The number of Sectors and the shift patterns will dictate the number of VTS Operators required and the complexity of the VTS will determine the need for a VTS Supervisor.

Other functions, such as the management of Allied Services, may be carried out from the VTS Centre and additional personnel may be required to undertake these additional tasks in order to prevent VTS Operators from being diverted from their primary responsibility for the Safety of Navigation.

The VTS Authority's/Centre's organisation must be firmly backed by documented administrative processes and operational procedures. These aspects are covered more fully in later chapters.

0812 Legal Basis

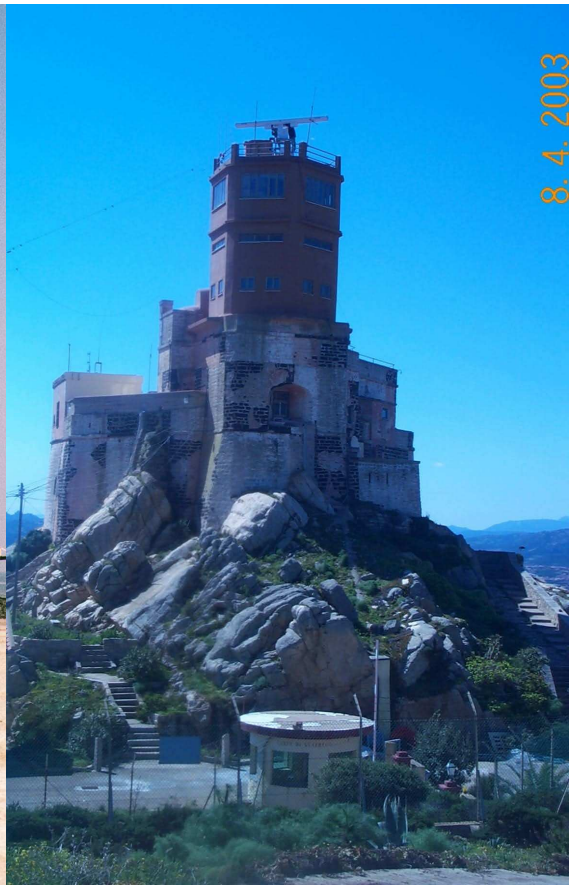
The legal framework for VTS is explained in Chapter 2. From these international and national regulations including matters such as Traffic Separation Schemes, the legal basis

for the VTS at a local level will need to be determined.

In planning a VTS, the powers and authority delegated to individual VTS Operators will need to be established by the VTS Authority. All VTS personnel should be aware of the legal basis under which they are operating and from which they derive the authority to interact with traffic. The following will need to be addressed:

- The type of service that may be offered by individual operators. This is particularly relevant in respect of Navigational Assistance Services, which may require specific authorisation;
- To whom the power to issue compulsory directions has been delegated, if any;
- How to process and to whom to report infringements of regulations;
- Powers of enforcement; and
- VTS and Operator liability

Radar is a key requirement for most VTS. Siting the antenna in the right location and obtaining adequate height requires much consideration. Some solutions: above, an automatic facility at Oostdyckbank, ten miles off the Belgian coast (Flemish Waterways); below left, at Saeftinghe, and below right, the old tower a La Maddalena, Italy. (Italian Coastguard)



Above left, a modern installation at Raskat, Russia Above right, a lighthouse in Bermuda is given additional capability for VTS functions. Below, a multi-purpose tower at Bisan, Japan.

CHAPTER 9: PROCUREMENT CONSIDERATIONS

0901 Procurement Process

Depending on the administrative set-up, a VTS Centre or Authority may or may not have delegated procurement authority. In a number of cases procurement will be centrally controlled and strict procurement procedures and financial controls, which may be unique to the individual country or region, as in the case of the EU Member States, may apply. This Chapter focuses on those aspects of procurement that will be generally applicable and should be given consideration to when sourcing the VTS. A typical procurement cycle is shown below:

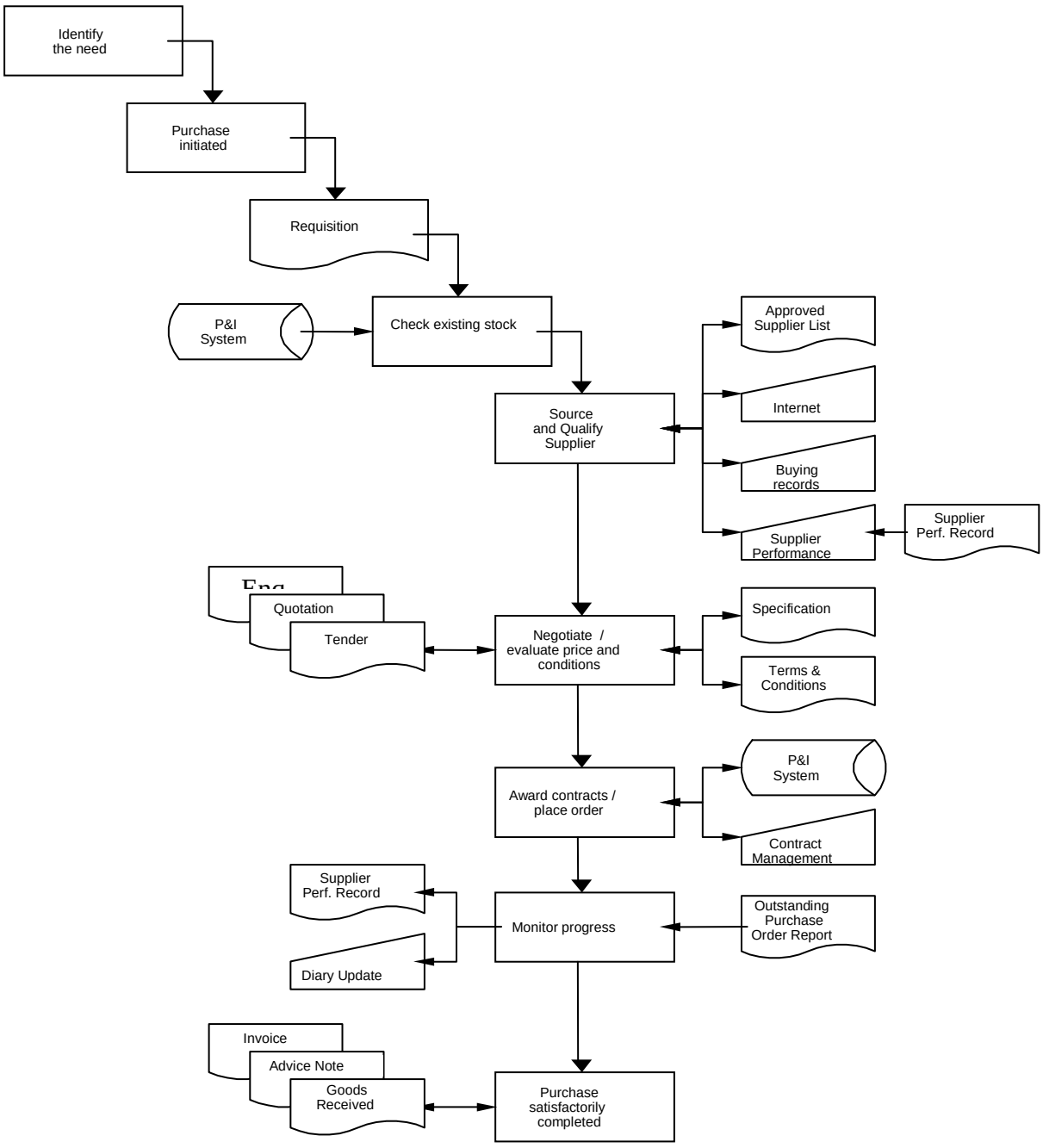


Fig. 9.1: A Typical Procurement Cycle

Figure 9.1 above assumes that those responsible for the procurement process have access to a Purchase and Inventory (P&I) System. In a number of cases purchasing may be carried out electronically.

Factors to be considered in the procurement process could include:

- Obtaining value for money through competition among suppliers, avoiding dependence on monopoly suppliers;

- Ensuring concise specifications of the goods, services or works to meet operational requirements adequately. The specification must clearly stipulate what the purchaser wishes to buy and the supplier is expected to provide. It must be a true and accurate statement of requirements and ensure that the principle of open and effective competition is observed;

- Submitting requisitions in good time to enable effective Supplier competition;

- Buying the best combination of quality and price, which meets the need within the resources available, reviewing whole life costs and not necessarily just the lowest initial Tender;

- Supporting the standardisation of equipment, goods, services and working practices;

- Securing on time delivery. In some countries this may be achieved through the use of time penalties;

- Verifying the capability of the supplier to provide reliable, quality products and services;

- Testing all products and deliverables at appropriate stages;

- Developing mutually satisfactory relationships;

- Protecting against corporate and financial risk through fraud, unethical behaviour or contractual liability;

- Economies of scale, efficiency gains and general cost-savings through consolidated orders wherever possible;

- Ensuring the individual and collective performance of all persons involved in the process;

- Publishing operational performance indicators;

- Ensuring appropriate skills are available in Specification Writing, Negotiation, Supplier Appraisal, and Contract Drafting/Management;

- Developing key Procurement and Inventory personnel; and

- Effective monitoring of the progress of the procurement throughout the cycle.

0902 Audit Controls

It may be a requirement that separate Audit Controls need to be effected by External and Internal Financial and Quality Auditors, to ensure compliance with policies, procedures and any instructions. These financial audits are usually separate from any carried out under a VTS Authority's Safety Management System and under the IMO Voluntary Audit Scheme, although both may impact on the Procurement Process.

Sound procurement practice helps to ensure that equipment is fit-for-purpose.

(Picture shows the approaches to Tokyo)

CHAPTER 10: VTS EQUIPMENT

1001 Introduction

Traffic density, navigation hazards, local climate, topography and extent of a VTS area sets the requirements for VTS equipment and these factors will have substantial impact on life-cycle costs of a VTS and the acquisition of VTS equipment. This may include:

- Communications;
- VTS Radar System;
- Automatic Identification System (AIS);
- Closed Circuit TV Cameras (CCTV);
- Hydrometeo Equipment; and/or
- VTS Data System.

The required features and, in particular, the need for coverage by sensors, e.g. radar, should be determined by an assessment of the service to be provided, the safety level to be achieved and the user requirements of the VTS system. Subsequently, suitable positions for the equipment should to be determined by site survey, analysis, simulations and/or site-tests to ensure that the required functions and coverage will be provided. Detailed guidance is given by IALA Recommendation V-119 on the *Implementation of Vessel Traffic Services* and IALA Recommendation V-128, *Operational and Technical Performance Requirements for VTS Equipment*. V-128 is divided into three different levels of capabilities:

- **Basic** - applicable to VTS information service and, where applicable, navigational assistance service;
- **Standard** - applicable to all types of VTS as identified by IMO – information service, navigational assistance service and traffic organizational service – for areas with medium traffic density and/or without major navigational hazards;
- **Advanced** - applicable to VTS areas with high traffic density and/or specific major navigational hazards.

The VTS authority should decide on appropriate levels. Different levels may be used as applicable within a single VTS, for example, part of a VTS area may call for a Basic capability and another part may call for a Standard capability.

1002 Communications

Communications in a VTS area are presently heavily biased towards voice systems, mostly using VHF radio. This requires a complex combination of procedural and language skills, which must be thoroughly understood by all VTS Personnel. A VTS Operator will need to communicate with shipping for which he has responsibility and may also need to

communicate with other operators or allied services. The ideal situation would be for the control of all communication equipment to be integrated into each VTS Operators console.

1003 Communication with Shipping in the VTS Area

Normally the communication coverage of the VTS area will be achieved by VHF using telephony or data transmissions and will involve the following.

Communication between shore and participating vessels, using appropriate international VHF channels can take place on simplex, as well as duplex channels. In the case of duplex channels, re-transmission from the shore may need to be carried out if the information received is of interest to other vessels to enable them better to comprehend the traffic situation.

Private channels may also be available for use between VTS Centres and local service craft. However, in this case local service craft should always be able to communicate with shipping on the appropriate international VHF channel.

It is of the utmost importance that the VHF communication network of a VTS is set up properly, with high quality and reliable equipment and interconnection. The number of VHF channels required for specific VTS usage should be assessed during the Project Definition phase and arranged with their National Telecommunication Authorities well in advance of the Commissioning and Acceptance phase. Often a VTS has, apart from the sub-area or sector frequencies, one or more general reporting or emergency frequencies. The number of channels required is dependent upon the number of the various sub-areas and sectors that will be used and the overall traffic density. The VTS Authority should also seek permission from their National Telecommunication Authority to use VHF Channel 16 for emergencies and for calling ships that are not participating in the VTS.

Shipborne VHF equipment is normally capable of transmitting and receiving on the international channels 1-29 and 60-89 at full power (25W) and reduced power (1W). Where practicable it is advisable to request low power transmission from ships. Communications with vessels should be recorded, for accident investigation, disputes, etc.

1004 Very High Frequency (VHF) Radio Communication

It is common for the VTS to have its own independent VHF network, for the use within specifically designated VHF Channels. This network may be comprised of one or more VHF Channels in different sectors of the VTS Area. The VTS Authority may require specific VHF Channels to be designated by the National Telecommunications Authority for

specific types of operations. The VHF equipment must comply with national and international regulations issued by the International Telecommunications Union (ITU).

1005 Long Range Communication

In the case where a VTS Authority requires pre-arrival information, the normal maritime communication systems should be used and therefore an independent network is not required.

1006 Communication with Allied Services

VTS Centres should be equipped with the ability to communicate with allied services by the use of reliable and secure communication networks. It is usual for a VTS Centre to be equipped with a point-to-point line with Maritime Rescue Coordination Centres (MRCCs) for this purpose. However, point-to-point lines have been found to be inadequate and unnecessarily expensive to establish and maintain. Therefore it is recommended that VTS Centres should be equipped with a digital switched network, with caller identification.

1007 Other Communications

The internal communication within a VTS is of the utmost importance. If there is more than one VTS Centre it may be necessary for the operators in one VTS Centre to communicate easily with operators in other VTS Centres so that specific traffic information can be passed from one operator to another with the minimum of delay.

The following general types of communication may be required by a VTS:

- Between VTSOs in the same VTS centre;
- Where appropriate, between VTSOs in different VTS centres belonging to the same VTS;
- Between VTSOs of any adjacent VTS;
- With vessels about to enter a VTS area; and
- With Pilotage, tugboats, SAR, Port Authorities and other Authorities.

These types of communication can be achieved by using the following equipment:

- Public telephone lines;
- Private telephone lines;
- Telex;
- Facsimile;

- Radio telephony and microwave links; and
- Automated data transfer systems.

Where there is a need for communication between a VTS and a shore authority to have a high degree of operational importance, consideration should be given to providing direct telephone lines to increase the reliability and decrease the time of the connection.

1008 VTS Radar System

Depending on the services that a VTS is to carry out, the radar coverage can be:

- Nil (automatic identification systems, voice communication and reporting only);
- Partly (covered areas chosen intentionally with some blind sectors);
- Totally by one radar sensor (without any blind sectors); or
- Totally by two or more radar sensors (for large VTS areas and to cover for shadow effects of other vessels). Stereographic processing of images from 2 or more radars may also be utilised for elimination of false (ghost) echoes.

In principle VTS radars typically function like ships radars, but they will in most cases need to operate simultaneously on short and long range, preferably without the need for operator adjustments. Weather-related phenomena such as sea clutter and ducting will further influence shore-based radars more than ships' radars.

In addition, new challenges have developed over recent years, including:

- Introduction of new technologies, notably AIS, which require the presentation of radar information to be sufficiently accurate to avoid ambiguity;
- Antenna side lobes and ghost targets (multiple reflections) may lead to false and dangerous results when radar returns and AIS plots are associated. High precision, low side lobe antennas and careful location of VTS radars is therefore required to allow for unambiguous correlation of position obtained from the two information sources;
- Offshore Renewable Energy developments, such as wind farms. VTS radars will normally not be dependent on Doppler shift and they are therefore not affected by the rotation of wind turbines, but the large towers may reflect radar signals resulting in false echoes. From a VTS Operator's perspective however, these false echoes are normally easy to distinguish. Shadowing may also present difficulties but the extent of this potential problem is currently not

understood. Competent/VTS Authorities are therefore encouraged to enter into early discussions with Offshore Renewable Energy Developers in order to minimise any potential effects on VTS operations;

- Increasing demands to see small targets in rough weather, if objectives include detection of targets for security purposes; and
- Requirement to reduce spurious / out-of-band emissions.

These challenges require new solutions to meet requirements that often are more demanding than those needed for ship-board equipment.

1009 Radar Functions

When radar is required, it should be able to detect and track, for subsequent display, all specified moving or stationary targets which satisfy the detection criteria within the specified coverage areas and during all specified operating circumstances. Each radar should be equipped to reduce the adverse effects of rain and sea clutter and enhance the probability of target detection. The radar should also be designed and installed so as to eliminate, to the maximum extent possible, false echoes caused by side lobes or reflections from nearby structures.

The VTS Radar System should assist in the development of the traffic image, by performing the functions shown in Table 10.1 below.

Parameters / Capability	Basic	Standard	Advanced
Path, time and track prediction,			X
CPA,	X	X	X
TCPA,	X	X	X
Anchor watch,			X
Vessels vector,	X	X	X
Course, speed and label/identity,	X	X	X
Collision alerts.	X	X	X

Table 10.1: Radar Functions

Radar frequencies selected for VTS lie typically within the S-band and X-band frequencies, although higher frequencies, such as Ku band, are utilised. The majority of VTS services use X-band radars as a best compromise, especially since technologies for rain clutter suppression have matured. Also, as a result of production volume, they are the least expensive. The second most used frequency is S-band, due to better weather penetration in heavy rainfall. Radar operating in the S-band is typically needed if precipitation rates frequently are greater than 25mm/h and required detection distance

exceeds a few nautical miles.

The International Telecommunications Union (ITU) grants frequency band allocation, whereas permissions to transmit on given frequencies are granted on a national basis.

1010 Characteristics of Radar Targets.

The characteristics of VTS radar targets are defined by its height above sea level, its radar cross-section (RCS) and its fluctuations in RCS. Formally, the RCS is defined as the ratio between the power [in W] scattered by the target back towards the radar receiver and the power density [in W/m^2] hitting the target. Thus RCS is measured in m^2 and has the dimension of an area. There is, however, no simple relation between the physical area of the target and the RCS, as the reflected power depends on the angle of incidence as well as target properties such as material and physical shape. Targets may fluctuate severely in RCS and the returned energy is highly dependant on propagation conditions. Table 2 below provides recommended data to be used when defining requirements for a VTS.

TARGET		Type of Capability			Design Requirements		
					Radar cross section		
		Basic	Standard	Advanced	S-band	X-band	Height of Target
1	Aids to Navigation etc. –without radar reflector. Small open boats, fibreglass, wood or rubber with outboard motor and at least 4 meters long, small speedboats, small fishing vessels, small sailing boats and the like.			X		1 m^2	1 m ASL
2	Inshore fishing vessels, sailing boats, speedboats and the like.			X		3 m^2	2 m ASL
3	Aids to Navigation with radar reflector.		X	X	4 m^2	10 m^2	3 m ASL
4	Small metal ships, fishing vessels, patrol vessels and the like.	X	X	X	40 m^2	100 m^2	5 m ASL
5	Coasters and the like.	X	X	X	400 m^2	1,000 m^2	8 m ASL
6	Large coasters, bulk carriers, cargo ships and the like.	X	X	X	4,000 m^2	10,000 m^2	12 m ASL
7	Container carriers, tankers etc.	X	X	X	40,000 m^2	100,000 m^2	18 m ASL

Table 10.2: Radar target characteristics

1011 Detection Performance

Table 10.3 and Table 10.4 below provide examples of calculated range performance typical for radar equipment suitable for the three levels of capability recommended.

Antenna elevation	Target type	Modelled as fluctuating point target		Detection and tracking ranges for standard atmosphere and rain/sea state as indicated					
				Basic recommendation		Standard recommendation		Advanced recommendation	
		RCS	Height	Clear	2 mm/h rain	Clear	4 mm/h rain	Clear	10 mm/h rain
20 m ASL	1	1 m^2	1 m ASL	N/A		N/A		5 NM Up to sea state 4	NIL
	2	3 m^2	2 m ASL	N/A		7 NM Up to sea state 3	4NM	7 NM Up to sea state 5	6 NM
	3	10 m^2	3 m ASL	7 NM Up to sea state 3	4 NM	8 NM Up to sea state 4	5NM	9 NM Up to sea state 6	7 NM
	4	100 m^2	5 m ASL	9 NM Up to sea state 4	8 NM	11 NM Up to sea state 5	9NM	12 NM Up to sea state 7	10 NM
	5	1000 m^2	8 m ASL	12 NM Up to sea state 5	10 NM	13 NM Up to sea state 6	11 NM	14 NM Up to sea state 8	13 NM
50 m ASL	1	1 m^2	1 m ASL	N/A		N/A		10 NM Up to sea state 4	NIL
	2	3 m^2	2 m ASL	N/A		10 NM Up to sea state 3	7 NM	12 NM Up to sea state 5	9 NM
	3	10 m^2	3 m ASL	10 NM Up to sea state 3	6 NM	12 NM Up to sea state 4	8 NM	14 NM Up to sea state 7	12 NM
	4	100 m^2	5 m ASL	13 NM Up to sea state 4	12 NM	15 NM Up to sea state 5	13 NM	17 NM Up to sea state 7	15 NM
	5	1000 m^2	8 m ASL	16 NM Up to sea state 5	15 NM	18 NM Up to sea state 6	17 NM	20 NM Up to sea state 8	18 NM
100 m ASL	1	1 m^2	1 m ASL	N/A					
	2	3 m^2	2 m ASL						
	3	10 m^2	3 m ASL						
	4	100 m^2	5 m ASL						
	5	1000 m^2	8 m ASL						
						N/A		12 NM Up to sea state 4	NIL
						13 NM Up to sea state 3	5 NM	16 NM Up to sea state 5	10 NM
						17 NM Up to sea state 4	10 NM	18 NM Up to sea state 7	16 NM
						20 NM Up to sea state 5	19 NM	22 NM Up to sea state 7	20 NM
						23 NM Up to sea state 6	22 NM	25 NM Up to sea state 8	23 NM

Table 10.3: Typical range performance, X-band

Antenna elevation	Target type	Modelled as fluctuating point target		Detection and tracking ranges for standard atmosphere and rain/sea state as indicated	
				Standard recommendation	
		RCS	Height	Clear	16 mm/h rain
20 m ASL	3	4 m^2	3 m ASL	4 NM	3 NM
				Up to sea state 4	
	4	40 m^2	5 m ASL	7 NM	5 NM
				Up to sea state 5	
	5	400 m^2	8 m ASL	10 NM	8 NM
				Up to sea state 6	
50 m ASL	3	4 m^2	3 m ASL	7 NM	4 NM
				Up to sea state 4	
	4	40 m^2	5 m ASL	11 NM	8 NM
				Up to sea state 5	
	5	400 m^2	8 m ASL	14 NM	13 NM
				Up to sea state 6	
100 m ASL	3	4 m^2	3 m ASL	10 NM	NIL
				Up to sea state 4	
	4	40 m^2	5 m ASL	14 NM	12 NM
				Up to sea state 5	
	5	400 m^2	8 m ASL	18 NM	19 NM
				Up to sea state 6	

Table 10.4: Typical range performance, S-band

For detailed analysis, the recommended method for determination of radar coverage and range performance is a combination of site inspections and radar system performance calculations, made by experts with a sound operational and technical knowledge about the subject.

Calculation of performance should be focused on the smallest targets of interest in poor weather conditions. All applicable losses should be included in the calculations. The probability of detection and false alarm rates used should comply with that required to meet the performance required for the individual VTS.

1012 Radar Propagation Conditions

Performance should, in all cases, be evaluated assuming standard atmospheric conditions. In addition, for each individual VTS the influence from adverse propagation effects should be analysed in detail for areas of the world having tropical climate and dry and hot climate. Ducting may occur almost anywhere and all systems should be designed to eliminate

adverse effects from this. For most parts of the world evaporation ducting tends to persist most of the time, giving extended range, especially for low mounted antennas. The effect will give average improvement in detection performance and may therefore be very useful in respect to security applications, if required. The effect is usually not stable enough to be calculated as a benefit in safety applications.

1013 Radar Accuracy and Target Discrimination

Accuracy as well as range and bearing resolution/precision is necessary in order to have a clear and distinct appreciation of the movement of vessels, including those that are at anchor. Consult IALA Recommendation V-128 for further guidance.

1014 Radar Tracking

Provision of target tracking, where computers automatically follow radar plots and provide information in synthetic form, is done by a plot extraction process followed by an automatic tracking process. Plot extraction should be automatic in the entire VTS area covered by radar. Track initiation should be automatic, except in selected areas or manual depending on the concept of operations.

In automatic track initiation modes, all plots in a scan should be considered potential targets. Some of the plots will be associated with previously established tracks, while the remaining plots should be considered as candidates for new tracks, tentative tracks. Tentative tracks will become confirmed tracks if plots from consecutive scans “fit into the picture” within reasonable physical manoeuvrability limits, otherwise the tentative tracks are discarded.

The tracking system should be able to handle at least a certain number of tentative tracks and to initiate tracks and eventually to confirm tracks under certain conditions of P_d (probability of detection) and P_{fa} (probability of false alarm). It should also be possible to initiate a track manually. In manual track initiation, the operator using a graphical tool selects a plot on the radar display. When selected, this plot should form the starting point for a tentative track, which eventually should be confirmed or discarded, as in the case of automatic initiation.

If automatically or manually created tentative tracks persist over a certain length of time the tracks should be promoted to confirmed tracks. Confirmed tracks should be shown on the display. The tracking system should be able to handle at least a certain number of confirmed tracks as recommended in IALA Recommendation V-128.

If a confirmed track either moves outside a user defined maximum range, into a user defined non-tracking area and the quality of the track falls below a predefined minimum, or if the track cannot be updated with new plots over a certain length of time, then the track should be terminated. In certain cases the operator should receive a warning as defined by the VTS Authority.

False tracks may appear as a result of noise, clutter (including wakes) and ghost echoes. The maximum number of false tracks allowed is dependant on role of the VTS, however, false tracks should be avoided in safety critical areas.

There is a trade-off between the time for confirmation of tentative track and the number of false tracks. A longer confirmation time implies less false tracks and it should be possible to balance this trade-off in the setup of the VTS.

Track loss may occur as a result of $P_d < 1$ in combination with targets manoeuvring, especially in the vicinity of obstructions such as bridges. A level generally accepted is that each operator should correct up to one track loss per hour.

Swapping of track identity may occur as a result of targets moving close together or even merging for a period of time, especially if targets are overtaking with small difference in speed and course. A simple method of manual correction should be employed. In the case of AIS information being available for the radar track(s) in question, automatic correction should be performed. The problem may also be addressed by implementing operational procedures to separate targets or to prevent overtaking in critical areas.

The VTS authority should analyze critical areas, such as those in the vicinity of bridges, and provided a detailed explanation of their requirements with regard to tracking to VTS equipment suppliers to allow them to offer appropriate solutions.

1015 Automatic Identification System (AIS)

The system is intended to enhance safety of life at sea, the safety and efficiency of navigation, and the protection of the marine environment. In addition, it may contribute to maritime security. SOLAS Regulation V/19 requires that AIS should exchange data from ship-to-ship and with shore-based facilities. Therefore, the purpose of AIS is to help identify vessels; assist in target tracking; simplify information exchange (i.e. reduce ship reporting using radiotelephony); and provide additional information to assist situational awareness. In general, AIS will improve the quality of the information available to the

VTSO or OOW. AIS is a useful source of supplementary information to that derived from other navigational systems and sensors, including radar.

AIS has brought many benefits to VTS Centres. Principal amongst these is the automatic and immediate provision of vessel identity (MMSI or call sign) which, where necessary, helps to facilitate rapid radio communication, thereby overcoming the safety weaknesses and time consuming procedures inherent in the previous arrangements.

1016 Objectives of AIS

AIS shall:

- Provide information automatically to appropriately equipped shore stations, other ships and aircraft, including the ship's identity, type, position, course, speed, navigational status and other safety-related information;
- Receive automatically such information from similarly fitted ships;
- Monitor and track ships;
- Exchange data with shore based facilities; and
- Assist in ensuring the highest possible level of safety and efficiency for vessel traffic in the designated area.

AIS should improve the safety of navigation by assisting in the efficient navigation of ships, protection of the environment, and operation of VTS, by satisfying the following functional requirements:

- In a ship-to-ship mode for collision avoidance;
- As a means for littoral States to obtain information about a ship and its cargo; and
- As a VTS tool, i.e. ship-to-shore (traffic management).

AIS should provide ships and competent authorities with information from the ship, automatically and with the required accuracy and frequency, to facilitate accurate tracking. Mandating AIS carriage and establishing a service to receive, process and distribute the AIS signals received from vessels enhances safety and security and improves the ability to manage traffic.

Some shore facilities may need to act on the information received, others may need to monitor AIS and maintain an information database. For these reasons, a nationwide or regional network may be set up.

The service should also be capable of information exchange and distribution among several users ashore and afloat. Government agencies, allied services and commercial maritime interests may have justifiable needs for AIS data.

1017 Use of AIS in VTS Operations

Automatic Identification System (AIS) is a system that makes it possible to monitor and track ships from suitably equipped ships, and shore stations. AIS transmissions consist of bursts of digital data 'packets' from individual stations, according to a pre-determined time sequence. AIS data consists of shipboard information, such as: position, time, course over ground (COG), speed over ground (SOG) and heading. AIS use a broadcast and interrogation technology that operates ship-to-ship and ship-to-shore and includes limited communication capabilities. Shore stations receive the same information from AIS equipped ships within VHF range.

The International Maritime Organization (IMO) has established carriage requirements for merchant ships. The International Telecommunication Union (ITU) has defined the technical characteristics and ratified the global frequencies. In addition, the International Electrotechnical Commission (IEC) has developed methods for testing AIS for global interoperability.

AIS makes navigation safer by enhancing situational awareness and increases the possibility of detecting other ships, even if they are behind a bend in a channel or river or behind an island in an archipelago. AIS also solves the problem inherent with radars, by detecting smaller craft, fitted with AIS, in sea and rain clutter.

1018 AIS Service

For VTS purposes, an AIS service provides AIS information from one or several base stations to users. In addition to vessel data, an AIS service provides status on AIS equipment and management functions for the control of the AIS network. Where applicable, AIS should support regional Vessel Traffic Services between adjoining VTS Centres.

1019 Operational aspects

The AIS service should provide timely, relevant and accurate information to assist the decision-making processes of a VTS. The AIS service may also support port operations by providing information to appropriate shore facilities. It provides automatic vessel position reports and movement information as it is received at remote sites throughout the service area. In support of incident response, the AIS service, operates in conjunction with the port

authority, can provide information about traffic and the corresponding situational information. The AIS service also provides information to allied services to support their tasks.

AIS may provide:

- Timely, relevant, and accurate information about vessels within the area that might affect safety, security, or the decision making of the VTSO;
- Timely information about emergency and environmental conditions that might affect safety or the decision making of the VTSO;
- Where required, the transmission of relevant information to the mariner in a manner that does not distract from the task at hand, particularly in narrow, confined channels where there is heavy traffic; and
- Up-to-date knowledge regarding the route to be transited.

AIS, as well as existing aids to navigation and tools, pilotage systems, navigation management systems, and regulations provide information to the mariner but these systems require integrity monitoring to ensure the information they impart is accurate.

AIS information may support the VTS Service with incident response in alerting vessels in or planning to enter the area of concern; VTS incident analysis may be supported by review of AIS information.

1020 AIS Data and Data Rates

There are different message types, including the ship's data, required by the IMO performance standards (as well as data necessary for communication management). AIS messages transmitted by AIS Class A mobile devices can be categorised as Static, Dynamic or Voyage Related data.

In general, the following information is available to be transmitted by AIS:

- Static (manual input)
  - Maritime Mobile Service Identity (MMSI);
  - Call sign and name;
  - IMO number;
  - Length and beam;
  - Type of ship; and
  - Location of position-fixing antenna on the ship (aft of bow and port or starboard of centreline).

- Dynamic (automatic input)
    - Ship's position with accuracy indication and integrity status;
    - Position time stamp (UTC seconds only);
    - Course over ground (COG);
    - Speed over ground (SOG);
    - Heading;
    - Navigational status (e.g., not under command (NUC), at anchor, etc. - manual input);
    - Rate of turn;
- Voyage Related Information (manual input at master's discretion or as required by competent authority)
    - Ship's draught;
    - Hazardous cargo (type);
    - Destination and estimated time of arrival (ETA)

The data is autonomously sent at different update rates as follows :

- Dynamic information dependent on speed and course alteration (see Table 10.5); and
- Static and voyage related data every 6 minutes or on request (responds automatically without user action).

Ship's manoeuvering condition	Reporting interval
Ship at anchor or moored and not moving faster than 3 knots	3 min
Ship at anchor or moored and moving faster than 3 knots	10 sec
Ship 0-14 knots	10 sec
Ship 0-14 knots and changing course	31/3 sec
Ship 14-23 knots	6 sec
Ship 14-23 knots and changing course	2 sec
Ship >23 knots	2 sec
Ship >23 knots and changing course	2 sec
Note: These rates apply to Class A ship borne AIS devices. Class B devices update every 30 seconds (or less frequently.	

Table 10.5: Report Rate of Dynamic Information

1021 Coverage considerations

In general, AIS coverage ranges should approximate VHF voice communication ranges. However, actual vessel traffic density or geographic considerations (i.e., mountains or other VHF occlusions) may determine the need for additional base stations.

AIS interoperability with adjacent VTS Authorities needs to be given careful consideration to ensure adequate coverage is achieved.

1022 Short Safety-related Messages

Short Safety-related Messages are free format text messages. They can be addressed either to a specified destination (MMSI) or broadcast to all ships in the area. When used by the VTS, their content should be relevant to the safety of navigation (e.g. an iceberg sighted or a buoy not on station). Such messages can contain a maximum of 158-162 characters. Although unregulated, these messages should be kept as short as possible.

Short Safety-related Messages are an additional means to broadcast maritime safety information; their usage does not remove any of the requirements of the GMDSS, such as NAVTEX. The VTSO should not assume that all Short Safety-related Messages have been read onboard.

1023 Binary Messages

Binary Messages are additional predefined messages that may either be addressed or broadcast. Binary Messages may be transmitted and received by mobile AIS devices and AIS Base Stations that are equipped to process these messages. Shore Base Stations may receive ship's Binary Messages and redistribute them to other ships and/or users.

The display capability of AIS Binary Messages is not part of the mandatory functions of the Minimum Keyboard and Display (MKD). Ships equipped only with MKD may not be able to receive this information unless they have additional hardware, and dedicated software.

These messages are dedicated to specific applications, examples are:

- Meteorological and hydrological data;
- Dangerous cargo indication;
- Fairway closed;
- Tidal window;
- Extended ship static and voyage related data;
- Number of persons on board; and
- Pseudo-AIS targets.

Binary Messages may reduce verbal communications and enhance reliable info exchange

and reduce VTSO workload. Binary Messages are not intended to replace standard services such as GMDSS and SAR.

For further details, see IMO SN/Circ.236, dated 28 May 2004, *Guidance on the Application of AIS Binary Messages.*

1024 Assigned Mode

In order for VTS to take full advantage of AIS, access to the capabilities of an AIS Base Station is required. This access should preferably be through an AIS service. With this access, the VTS may change the reporting rate or AIS channel, send short safety-related messages, or perform other functions as necessary.

If authorized by the competent authority, a VTS may use the AIS capability to change the reporting mode (from autonomous to assigned mode, for example) of selected shipboard AIS units. This will enable the ship station to operate according to a specific transmission schedule. For example, the AIS reporting rate for a vessel transiting at a slow speed could be increased.

1025 Display of AIS data

In the VTS Centre, AIS data may be viewed on an electronic chart, either separately or combined, with the other data sources including radar. The VTSO should have the ability to filter the displayed information. To gain the best benefit the AIS information should be presented to the VTSO on an integrated display. For example, a target that is tracked by radar and AIS may be displayed with one symbol based on correlated information received from the two sensor types. The user may have the option to display the input from each sensor with two different symbols. It should also be possible to identify which sensor(s) are used to derive the target position.

IALA Guidelines on AIS include a description of the recommended AIS target symbols; these are intended for the onboard ECDIS/ECS systems. It is acknowledged that for VTS operational requirements a wider range of information may be appropriate; for example, the use of symbols that depict different types and sizes of vessels. Further, it may be necessary to show which vessels have pilots embarked, or other information.

The choice of AIS symbols to be used in VTS Centres is matter for the VTS Authority to decide. It must be noted that the IMO and IALA guidance offered for on-board AIS symbology may not be adequate for a VTS, because of the requirement for more information by the VTS Centres. IALA Recommendation V-128 *Operational and*

Technical Performance Requirements for VTS Equipment (Edition 2.0 June 2005) provides more information on this subject.

1026 AIS Data Validity

Operators should be aware that the validity of AIS data received from ships is dependent on the proper installation of AIS, correctly interfaced and functioning ship's equipment, and correct manual input of static and voyage-related data.

Caution has to be taken when using AIS data for processing. Wherever possible AIS data should be validated and correlated against other sensors and information sources.

1027 AIS References

- IALA Recommendation A-123 *The Provision of Shore Based Automatic Identification System* December 2002
- IALA Guideline 1028 *The Automatic Identification System (AIS),* Volume 1, Part 1, Operational Issues, Edition 1.3, December 2004
- IALA Guideline 1050 *The Management and Monitoring of AIS Information,* December 2005
- IALA Guideline 1032 *Aspects of Training of VTS Personnel Relevant to AIS*, June 2003
- IALA Recommendation V-128 *Operational and Technical Performance Requirements for VTS Equipment,* Annex 3, Edition 2.0, December 2005 (Under Revision)
- IMO Recommendation on Performance Standards for an Universal Shipborne Automatic Identification System (AIS) (MSC 74(69) Annex 3)

1028 Radio Direction Finder (RDF)

A number of VTS Authorities require RDF receivers to receive information on the position and assist in the identification of vessels, using their radio emission. In order to ensure accurate localization, the use of two or more separate RDF stations is required. All bearings should be automatically displayed on the chosen screen when the signal has been received after a delay of no more than 3 seconds. The bearings should remain visible on the chosen screen as long as the vessel is transmitting a signal. Consideration should be given to the requirements for availability of the bearings after the vessel has ceased transmitting, such as through recording or instant replay capability.

RDF may be regarded as being complementary to AIS. However, it may aid in the localisation of vessels not equipped with AIS. RDF is not suitable of being used for continuous tracking.

1029 Hydrological/Metrological Equipment

It is essential that a VTS Centre has access to hydrological /meteorological (hydro/meteo) systems, which will provide local Hydro/meteo information relevant to the VTS Area(s) and can, if required by the VTS Authority, disseminate this to their users and allied services. Where a VTS Authority determines a need to establish their own monitoring stations, the individual VTS Authorities should determine the accuracy and availability requirements for each VTS Centre. IALA Recommendation V-128 provides an indication of typical minimum accuracy and availability requirements.

Typical meteo variables are those provided by weather stations and include air temperature and humidity, wind velocity and direction, and visibility. In certain locations, hydro variables such as tidal level, tidal stream/current direction and velocity may be required. This data may be obtained through sensors or available in tables/databases from national authorities. Sensors providing this data, usually located at remote sites, communicate the variables to a VTS Centre via a telecommunications link. At the VTS Centre, graphical and/or numeric information is presented for use by the VTS Operators.

Hydrological and meteorological information may be integrated into VTS applications to provide the VTS Operator a real-time assessment of the environmental situation in the VTS area of responsibility. Information collected from this equipment can be provided to ships to assist in assessing the waterway conditions.

A number of countries operate tide gauges and current meters to assist the prediction of tidal heights and streams or for the broadcast of real-time information to shipping. The Intergovernmental Oceanographic Commission (IOC) is responsible for coordinating the Global Sea Level Observing System (GLOSS) program to establish global and regional networks of sea level stations for providing essential information for international oceanographic research programmes.

1030 Closed circuit TV (CCTV) Cameras

The performance requirements placed on the CCTV service varies depending on traffic density, levels of VTS, special regional features and the coverage of the VTS area. CCTV information may be integrated into VTS applications to provide the operator a real-time assessment of the situation in the VTS area of responsibility. Information collected from

this equipment can be provided to ships to assist in assessing the waterway conditions. IALA Recommendation V-128 provides an indication of minimum performance requirements.

1031 Information Management

It is the task of the information management system within a VTS, to collect, process and correlate information from different sources in order to present an integrated image of the traffic, its environment and maintain situational awareness. This information may include:

- Communications, internal and external;
- Sensor data, i.e. data used to generate the traffic image such as radar, CCTV, AIS;
- Shipping information data, i.e. vessel and cargo data, including vessel movement information;
- Meteorological and hydrological data; and
- Data from other sources if relevant.

In parallel to presentation of information to the operators, the information or part hereof, may be recorded and stored for later use.

1032 Operator Interface

The Operator Interface should include the display of the traffic image, including the traffic situation and corresponding traffic information.

1033 Traffic Situation Display

A VTS display mapping graphics, analytical graphics and overlay information should be provided to enable a VTS Operator to have a concise picture of the geographical features, waterways and navigational lanes. When this information is being displayed, in many cases the radar video echoes of the coastline should be suppressed beyond the coastline, making this area of the display available for other synthetic information. Definitions of the requirements and accuracy of all the graphic possibilities need to be developed during the Project Definition phase.

If VHF direction finders are included in the system, the bearing lines should be shown on the VTS display, with an option for the operator to switch them off.

IALA has developed a Recommendation on the use and presentation of symbology at a

VTS Centre (including AIS). VTS Authorities should refer to Recommendation V-125 for information on this matter.

1034 Traffic Information Display

In addition to the traffic situation display a VTS should include display of textual information in the form of tables etc. A list of participating vessels should include static information and dynamic information concerning the vessel, for example Vessels Name, Call Sign, IMO Number, MMSI, ETA, ETD, Course, Speed and Position, if required.

1035 Work Environment - VTS Operator Positions

A console should be provided at every VTSO position with the equipment integrated in the most ergonomic arrangement. The illumination of the operator position should be such that all relevant equipment such as the VTS monitor, communication equipment, target analyzer etc. can be monitored effectively and administrative tasks can be carried out at the same time. Daylight displays for radar equipment have the advantage that they can be operated efficiently in normal room light levels.

Care should be taken when choosing the site for the consoles that VTSO positions do not interfere with each other especially regarding sound. In addition to the sensors and the communication equipment, access to data base information is necessary at a VTSO's position for reference purposes and for providing information to shipping.

1036 Operational conditions, Redundancy and emergency precautions

The operational conditions for VTS equipment will vary from one place to another. In some countries the availability and reliability requirements need to take into account extremes of temperature or precipitation, in others special attention may need to be paid to wind force (including gusts) or earthquake resistance. The maintenance and availability of remote sensors should be given special consideration and adequate redundancy provided.

To ensure adequate availability and reliability, vital parts of the VTS, e.g. all operational VTS communication services, should have back-up systems with a power source independent from the normal power supply. The need for redundant sensors and even an alternative site for the VTS Centre should be considered. (IALA Recommendation V-119). Where provision is made for an alternative site for the VTS Centre, operations should be capable of being easily transferred to the secondary location in the event of an emergency or maintenance situation that causes the temporary closure of the primary VTS Centre.

When determining the position and range of radar equipment, the possibility of radar

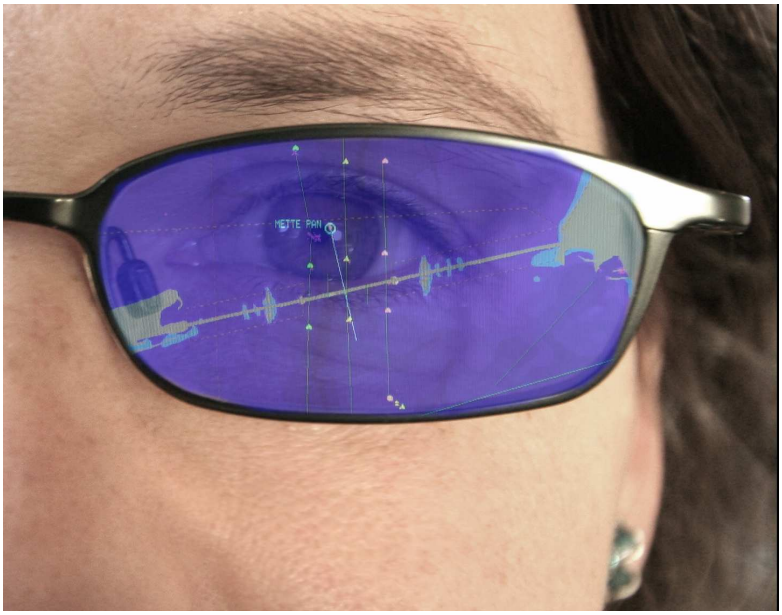
malfunction should be taken into account, and where practicable the arrangements should enable another radar, or AIS where appropriate, to provide cover for the sub-area or sector affected. One or more spare VTSO consoles should also be considered to:

- Substitute for any console that is unserviceable;
- Be used for On-the-Job training;
- Where a need exists, be used by a VTS Supervisor;
- Where appropriate, be used in the co-ordination of emergencies.

Furthermore the VTS should not be entirely dependent on synthetic images of the traffic. Instead a combination of radar video and extracted information is recommended. This will provide the VTSO with a means to verify track positions and the experienced VTSO will often be able to classify the individual target on the basis of the radar video. A VTS System should also be flexible and easily updateable alongside of the routine operations of the VTS Centre, without the need for interrupting these VTS operations.

1037 Availability and reliability of equipment

The equipment performance parameters are strongly dependant upon the services to be provided which influences the Mean Time Between Failures (MTBF) and the availability of the service. Information on availability and reliability methods is given in the IALA Guide to the Availability and Reliability of Aids to Navigation.



The shape of things to come? Head-up displays for VTS?

Whilst perhaps technically possible in the future, the picture is a reflection of a radar display at the Storebelt, Denmark.

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PERSONNEL

The Greatest Single Factor. Professional, well-trained and highly motivated staff

Worldwide, wherever VTS operations take place, mariners expect common standards of service and performance.

CHAPTER 11: VTS PERSONNEL

1101 Introduction

VTS Operators, masters, bridge watchkeeping personnel and pilots share a responsibility for good communications, effective co-ordination and understanding of each other's role for the safe conduct of vessels in VTS areas.

Depending on the size and complexity of the VTS area, service type provided as well as traffic volumes and densities, a VTS centre may comprise VTS Operators, VTS Supervisors and a VTS Manager. It is for the Competent/VTS Authority to determine the appropriate levels in order to meet its obligations and to ensure that appropriately trained and qualified personnel are available.

VTS Authorities should develop detailed job descriptions for personnel at each VTS centre, based on the service type or types to be provided, the equipment available and the co-ordination needed with other internal departments and allied services.

Examples of job descriptions are shown in "Roles and Responsibilities" below and in the IALA Recommendation V-103. These job descriptions can be expanded as necessary to encompass more fully the responsibilities specific to each VTS centre.

ROLES AND RESPONSIBILITIES

1102 VTS Operator

The key person in any VTS operation is the VTS Operator, who is responsible for establishing and maintaining a traffic image, which will facilitate interaction with the vessel traffic thus ensuring the safety of navigation within the VTS area of responsibility. The VTS Operator is also required to decide on actions to be taken in response to developing traffic situations, after careful analysis of the data being collected.

The job description for the VTS Operator should include the aims and objectives of the operational work carried out by the Operator, the tasks and responsibilities involved together with the skills and knowledge required to carry out the work efficiently and effectively. The job description should also clearly state what service type the VTSO is authorized to provide.

The following list provides examples of the activities carried out by a VTSO:

- Maintain situational awareness and monitor the traffic image with all available sensors within the area of responsibility;

- Maintain communication with ships as appropriate to the service type provided by the VTS using all available communication facilities;
- Operate equipment for communications, data collection, data analysis and establishment of a traffic image;
- In an Information Service (INS), provide relevant information at appropriate times;
- In a Navigational Assistance Service (NAS), assist and provide such information as may be needed to aid a ship in difficult navigational or meteorological circumstances or in case of defects or deficiencies. NAS may be given on request by a vessel or when deemed necessary by the VTS;
- In a Traffic Organisation Service (TOS), organise and plan the vessel traffic movements within a waterway to prevent congestion and dangerous situations;
- Communicate with allied services and other agencies as appropriate;
- Ensure that all adopted standard operating procedures and relevant waterway regulations are adhered to;
- Take appropriate actions in emergency situations and other special circumstances defined for the VTS area. Where appropriate, co-ordinate communications for such situations and/or circumstances; and
- Maintain a log of all incidents/accidents occurring within the area of responsibility.

1103 VTS Supervisor

The VTS Authority may establish the post of VTS Supervisor. The VTS Supervisor is responsible for assisting, managing and/or co-ordinating the operational activities of the VTS Operators.

A VTS Supervisor should hold a current VTS Operator qualification together with the appropriate endorsements.

The job description for the VTS Supervisor should include the aims and objectives of the operational work carried out by the Supervisor, the tasks and responsibilities involved together with the skills and knowledge required to carry out the work efficiently and effectively. The job description should also clearly state the management responsibilities delegated by the VTS Authority/Manager. Where a VTS Manager is not appointed, the Supervisor may be responsible for the day-to-day running of the VTS centre.

- VTS Authorities should develop detailed job descriptions for VTS Supervisors, based on the services to be provided by the particular VTS centre. In addition to the activities appropriate to a VTS Operator, the job description for the VTS Supervisor may include the following activities:
- Supervising VTS Operators;
- Ensuring that proper co-ordination takes place between the VTS, allied and emergency services;
- Ensuring that the service provided meets the requirements of both the stakeholders and the VTS Authority;
- Ensuring that a log of all incidents/accidents occurring within the area of responsibility is maintained;
- Assisting in training and assessing the VTS Operators as defined by the VTS Authority and/or VTS Manager;
- Performing administrative tasks as defined by VTS Manager; and
- In the absence of a VTS Manager, ensuring that the duties and activities normally carried out by the Manager, are adhered to.

1104 VTS Manager

The VTS Authority may establish the post of a VTS Manager. The VTS Manager is responsible for managing and co-ordinating the activities of the VTS centre on behalf of the VTS Authority. In some cases, a VTS Manager may have the responsibility for more than one VTS centre. Ideally the VTS Manager should also possess a VTS Operator/Supervisor qualification.

Basic knowledge of VTS functions and the tasks performed by the operational personnel at the VTS centre are beneficial to good management. It is important for the VTS Manager to understand the needs of stakeholders and vessels using the VTS and to determine their requirements and expectations.

VTS Authorities should develop detailed job descriptions for VTS Managers, to reflect the services provided by the VTS centre(s). In addition to having knowledge of the activities appropriate to a VTS Operator/Supervisor, the job description for the VTS Manager may include the following responsibilities:

- Ensuring that the aims and objectives of the VTS are met at all times;
- Ensuring that all VTS operations follow current rules, regulations and

legislation;

- Managing and co-ordinating financial, technical and human resources;
- Ensuring that the standards set by the Competent/VTS Authority for operator qualifications and training are met;
- Ensuring that the training and certification of VTS personnel are appropriate to the service types being provided;
- Ensuring VTS quality standards are maintained;
- Maintaining awareness of continuing development for the VTS centre(s);
- Planning and developing of emergency procedures as appropriate to the VTS area of responsibility;
- Ensuring that all adopted standard operating procedures are reviewed and amended as required;
- Developing and maintaining a good public information and relations programme; and
- Be prepared to provide evidence in the event of incidents or accidents occurring in the VTS area. To this end the Manager should ensure that all such events are properly recorded and readily available for examination by the Competent/VTS Authority.

1105 On-the-Job Training Instructor (OJT Instructor)

The VTS Authority should ideally provide for an OJT Instructor who is responsible for managing and coordinating the OJT to the VTS operational personnel. In some instances the responsibilities for OJT the may fall to a VTS Operator or VTS Supervisor.

The OJT Instructor should have the basic skills and appropriate instructional techniques in order to be able to fulfill the training requirements as defined in IALA Recommendation V-103 and Model Course V-103/4. The OJT Instructor should be fully conversant with the processes and procedures required to meet the OJT requirements of the VTS centre(s) in which the training takes place.

The job description for the OJT Instructor should include the aims and objectives of the operational work carried out by the Instructor, the tasks and responsibilities involved together with the skills and knowledge required to carry out the work efficiently and effectively.

The job description for the OJT Instructor may include the following activities:

- Prepare and provide the OJT programme taking into account the requirements of the Competent/VTS Authority;
- Review and update the contents of the OJT programme;
- Assess the trainee's personal ability and adapt the OJT programme accordingly;
- Continuously monitor and assess the trainee's progress and document this in the trainee's task book;
- Provide feedback about the trainee's performance to the VTS Supervisor and/or Manager; and
- Report all pre-OJT training deficiencies to the VTS Supervisor and/or Manager.

1106 Technical Support Personnel

The VTS Authority may use internal technical personnel and/or external technical service providers for support and/or maintenance regarding VTS equipment.

Internal technical personnel

The job description for the own technical support personnel should include the aims and objectives of the technical work carried out as well as the tasks and responsibilities involved together with the skills and knowledge required to carry out the work efficiently and effectively.

External technical service providers

The VTS Authority should ensure that the external technical service providers have the necessary skills and knowledge required to carry out the work efficiently and effectively.

1107 Staffing Level

The availability of appropriately qualified VTS staff is an essential resource without which VTS operations cannot safely be managed. Determining the adequacy of the number of VTSOs on duty is often difficult to quantify with any degree of accuracy. Invariably this will be a balance between numbers of factors that a VTS Authority will need to keep under periodic review.

For further information on this topic, see IALA Guideline No. 1045 *Staffing Levels at VTS Centres.*

CHAPTER 12: TRAINING AND QUALIFICATION

1201 Introduction

A major factor in the efficient operation of a VTS centre is the standard of competence of its personnel. Recognising that VTS personnel are members of a profession whose principal interaction is with mariners and maritime pilots in the safe management of maritime traffic, their competence needs to reflect that professional responsibility.

In a VTS area, as specified by the relevant VTS Authority, VTS personnel should be capable of interacting with vessel traffic by providing information, navigational assistance and traffic organization as and when required by the VTS or vessel concerned. It is for the VTS Authority to ensure that appropriately trained personnel are available to undertake these commitments.

In order to ensure that standards for training VTS personnel meet the appropriate level, the relevant Authority will need to provide the necessary accreditation, according to IALA Guideline No 1014 *Accreditation of VTS Training Institutes for Training VTS Personnel*. This should help to ensure the competence of personnel that occupy operational positions in a VTS Centre.

1202 Publications

IALA has prepared several publications that provide recommended standards and guidelines on most aspects concerning the training and qualification of VTS personnel.

IALA Recommendation V-103	Standards for the Training and Certification of VTS Personnel
IALA Model Course V-103/1	VTS Operator Training
IALA Model Course V-103/2	VTS Supervisor Training
IALA Model Course V-103/3	VTS On-the-Job Training, VTS Operator, VTS Supervisor
IALA Model Course V-103/4	VTS On-the-Job Training Instructor
IALA Guideline No. 1014	Accreditation of VTS Training Institutes for Training VTS Personnel
IALA Guideline No. 1017	Assessment of Training Requirements for existing VTS Personnel, Candidate VTS Operators and the Revalidation of VTS Operator Certificates
IALA Guideline No. 1027	Designing and Implementing Simulation in VTS Training at Training Institutes and VTS Centres

Fig. 12.1: Publications and References for VTS Training

1203 Recommendation V-103 on Standards for Training and Certification of VTS Personnel

Recommendation V-103 describes the principles and objectives of VTS training, proposes entry standards and aptitude testing, and describes the basis for the conduct and award of qualifications, certification, annual assessment and revalidation as well as outlining the possibilities for career enhancement. Training of VTS personnel follows the format used by IMO for the training of shipboard personnel (STCW95) and sets out the requirements for competency-based training for VTS Operators and Supervisors. (See also IMO Resolution A.857(20), SOLAS Chapter V Regulation 12 and MSC Circular 1065).

1204 International Framework – STCW Convention and Code

The STCW Code (1995) provides a specific format to be used in the training and assessing of watchkeeping Officers. The framework includes:

- The competencies that are deemed necessary to perform a task or skill and are required by a candidate;
- Prescribed standards of knowledge, understanding and proficiency that must be achieved by the candidate in order to properly perform their functions aboard a ship in accordance with internationally agreed criteria;
- The methods for demonstrating competence that provide evaluation techniques to assess the candidate; and
- The criteria for evaluating competence that provides the means for an assessor to judge whether or not a candidate can perform the related tasks, duties and responsibilities.

The IALA Competence Charts in Recommendation V-103 follow a similar format to that of the IMO Model Courses, which are based on the STCW 95 Code.

Key Point

1205 Selection and Recruitment

Prospective candidates for VTS Operator training (V-103/1) should meet the minimum entry requirements as defined by the Competent/VTS Authority. The selection procedure for newly recruited VTS Operators should at a minimum include aptitude assessment, medical examination together with an assessment of the personal suitability of the candidate.

The selection of personnel already in possession of a VTS Operator's Certificate together with the appropriate On-the-Job Training (OJT) endorsement will depend largely on

previous operational experience, if any, as a VTS Operator at a VTS Centre.

Personnel may be recruited directly as VTS Supervisors if they can demonstrate to the VTS Authority that they have the required experience to undertake the responsibilities and duties of a VTS Supervisor. The VTS Authority should ensure that such personnel have received VTS Operator training and any additional training as may be necessary to meet the required standards of competence for a VTS Supervisor.

1206 Medical (Physical/Mental) Requirements

Candidates should meet the medical standards of health established by the Competent/VTS Authority prior to recruitment.

1207 Personal Attributes

Personal attributes are important factors in the selection criteria. A continual assessment should be made of the candidates' suitability throughout the selection process. Candidates should at a minimum have an appropriate sense of responsibility, show independence as well as having a willingness to co-operate with others as part of a team.

1208 Aptitude Assessment

Aptitude assessments should be carried out prior to recruitment. All prospective candidates should be assessed even if they have previous maritime experience. Assessments, which employ simulation of traffic movements, can be used.

Assessments should be designed to determine the ability of candidates to:

- Select relevant information from non-relevant information;
- Combine auditory and visual information;
- Demonstrate spatial and situational awareness;
- Demonstrate alertness and decisiveness in all situations;
- Carry out several tasks simultaneously;
- Carry out routine work without losing situational awareness;
- Show initiative while working within a framework of standards, regulations and structured procedures;
- Recognise and manage work related and personal stress; and
- Demonstrate appropriate communication and literacy skills.

1209 IALA Model Courses

The basis of VTS training is set out in the IALA Model Courses. These courses are not intended to be used directly as course material but are a guide that can be adapted in two ways:

- To meet the entry level knowledge of candidates and,
- To enable course design to be matched to the requirements of the appropriate Competent/VTS Authority.

The Model Courses are designed to produce universally common standards of training and performance. These Model Courses provide a basis for VTS training institutes to design courses. It is for the relevant Competent Authorities to approve the courses undertaken at VTS training institutes.

Depending on the recruitment level and background of candidates, some elements of the Model Course could be addressed through an assessment of prior learning and experience, reflecting both the formal training and experience of the candidate. Any such module exemption should be approved by the respective Competent Authorities.

1210 Competence Charts

The competence charts in IALA Recommendation V-103 have been used to develop the detailed teaching syllabus and form the foundation of the Model Courses. The charts show the subjects for which competence is needed, the knowledge, understanding and proficiency that are required, the methods for demonstrating competency and the criteria by which it should be evaluated.

1211 VTS Operator and Supervisor Training

VTS Operator and Supervisor training should be carried out at an accredited VTS training institute and be conducted in accordance with the appropriate IALA Model Courses V-103/1 *VTS Operator Training* and V-103/2 *VTS Supervisor Training*. VTS Operator candidates without previous maritime experience will normally require all modules in Model Course V-103/1.

It is important to note that the training programme concentrates on the learning outcomes, i.e. the degree of competence acquired during formal instruction and structured On-the-Job Training. Where competence can be demonstrated and is documented, training should be developed to reflect this in order to avoid unnecessary instruction. The emphasis should always be on obtaining the end result namely, professionally qualified VTS personnel.

Training institutes and organisations delivering VTS training should provide training services within the framework of a training management system that fulfils the requirements of an approved quality system standard. (see Chapter 18.) It is important to ensure that the programme for the training and assessment of VTS personnel, for the purpose of certification and endorsement is:

- Able to meet and maintain the standard of competence as indicated in IALA Recommendation V-103;
- Structured in accordance with the established training procedures based on clearly communicated, measurable and achievable objectives;
- Conducted, monitored, evaluated and supported by appropriately qualified instructors; and
- Managed in a manner that ensures the relevancy and accuracy according to experience gained, technological advance, regional, national and international recommendations, laws and regulations.

1212 Use of Simulators

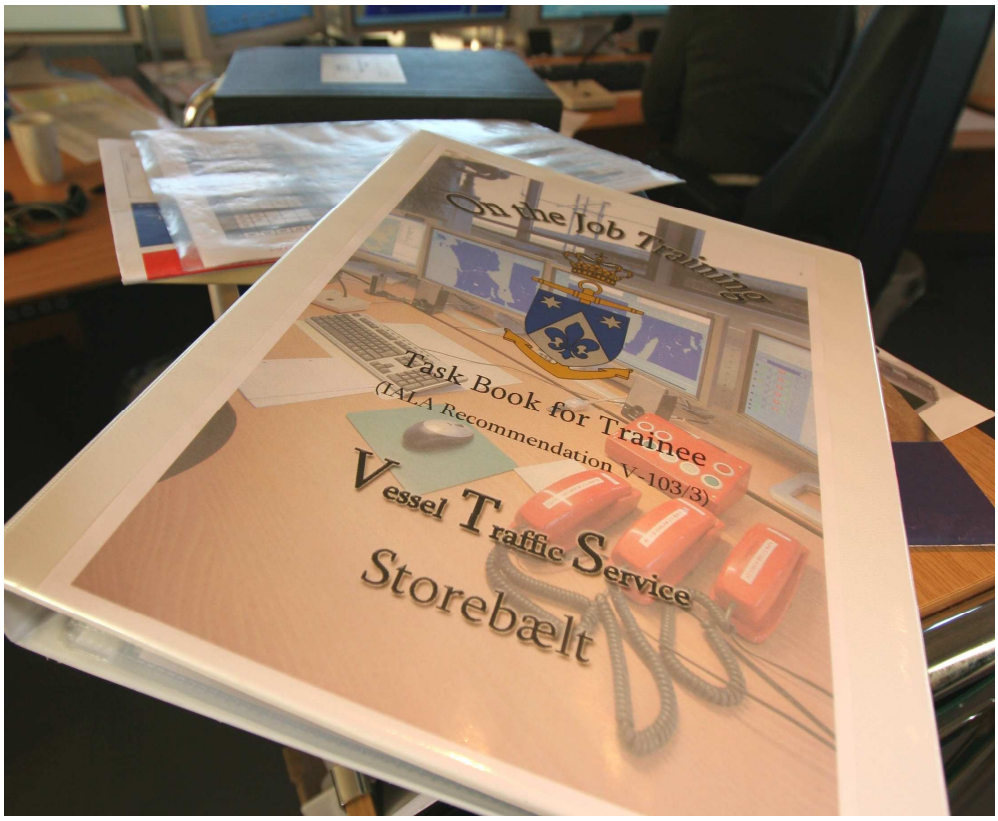
Wherever practical, simulation should be used in the training programme. Simulators offer an excellent interactive environment in which the skills and competencies required of a VTS Operator can be acquired.

VTS simulation should provide sufficient behavioural realism to allow personnel to acquire skills appropriate to the training objectives. VTS simulation can also be augmented with equipment to enhance realism and provide experience of the operating capabilities of the VTS equipment concerned. The level of physical realism should be appropriate to training objectives and include the capabilities, limitations and possible errors of such equipment. Scenarios may also be used that would not normally be encountered in everyday situations. For more information see IALA Guideline No.1027 *Designing and Implementing Simulation in VTS Training at VTS Training Institutes and VTS Centres.*

1213 On-the-Job Training

On appointment to a VTS centre, the Operator trainee will undergo On-the-Job Training (V-103/3) in order to acquire a thorough knowledge of the particular circumstances and requirements appropriate to the VTS centre and its relevant VTS areas. On satisfactory completion of the On-the-Job Training the appropriate endorsement will be entered on the VTS Operator Certificate or Log Book and the VTS Authority will then authorise that person to carry out the duties of a VTS Operator at that particular VTS centre.

It is important to ensure that the On-the-Job Training programme is properly structured and that Operator trainees achieve a common minimum level of knowledge and skill as defined by the VTS Authority. It is useful to deliver this training by utilising a Training Task Book. An example of the VTSO OJT Task Book can be found in Model Course V-103/4. A similar process is followed for a VTS Supervisor endorsement.



Good training requires well-documented training Task Books.

1214 On-the-Job Training Instructor (OJTI) Training

The knowledge, skills and experience of VTS OJT Instructors are key attributes in the successful training of VTS personnel when undertaking On-the-Job training. Potential Instructors should be identified and given the training to meet this demanding role. Model Course V-103/4 (OJT Instructor) has been designed to provide guidance on this training.

CERTIFICATION

This section describes the certification process for new VTS personnel, existing VTS personnel without V-103/1 Course Certificate and how to maintain this certification.

1215 Assessment

IALA Guideline No. 1017 *Assessment of Training Requirements for existing VTS Personnel*,

Candidate VTS Operators and the Revalidation of VTS Operator Certificates describes the assessment of training requirements for existing VTS personnel, candidate VTS Operators and the revalidation of VTS Operator Certificates. The guideline gives advice on prior learning assessment when considering whether training is necessary or not for VTS personnel to be awarded a VTS Operator Certificate in accordance with IALA Recommendation V-103.

1216 Certification of New VTS Personnel

A VTS Operator Course Certificate should be awarded upon successful completion of the IALA Model Course V-103/1 *VTS Operator Training* course at an accredited VTS training institute. Upon successful completion of the necessary requirements for the Competent/VTS Authority a VTS Operator Certificate and/or Log Book can be issued. After successful completion of V-103/3 *On-the-Job Training* at the specific VTS centre, the VTSO will be awarded an endorsement that will authorise the VTSO to operate as such.

Qualification and Authorisation

VTSO Course Certificate (V-103/1) + Competent Authority requirements = VTSO Certificate

VTSO Certificate + OJT Endorsement (V-103/3) = VTS Authorisation to Operate

Key Point

VTS Supervisor training should be carried out at an accredited VTS training institute following the IALA Model Course V-103/2. On successful completion of the training, the appropriate endorsement should be made on the VTS Operator Certificate and/or Log Book. On-the-Job Training may follow according to the requirements of the VTS Authority.

An On-the-Job Training endorsement for the VTS Operator Certificate is only valid at the VTS centre for which the endorsement is made. A VTS Operator or Supervisor transferring to another VTS centre will be awarded a new endorsement, after having satisfactorily completed On-the-Job Training at the new VTS centre.

1217 Certification of Existing VTS Personnel (without V-103/1,2)

Existing VTS centres may have VTS Operators who have operational experience, but have not acquired V-103/1 Course Certificate. The VTS Authority should take necessary steps to ensure that their VTS Operators meet the required level of competence according to V-103/1.

Existing VTS centres may have VTS Supervisors who have operational experience, but

have not acquired V-103/1 and V-103/2 Course Certificates. The VTS Authority should take necessary steps to ensure that their VTS Supervisors meet the required level of competence according to V-103/1 and V-103/2.

The following methods may be used for assessing competence of existing VTS Personnel, for example:

- Portfolio review;
- Review of evidence not presented in a portfolio;
- Review of any previous VTS training;
- Demonstration of skills and knowledge; and
- Standardised tests.

When the assessment indicates that the candidate does not have the required competence, appropriate training should be given.

1218 Maintaining Certification

In order to maintain certification of VTS operational personnel, the VTS Authority should ensure that all operational personnel, under their jurisdiction, undergo an assessment at regular intervals. This could be in the form of a continual assessment at the VTS centre or at a training institute accredited to train according to V-103.

If VTS operational personnel fail an assessment or have had a break in service, for whatever reason and for a period as determined by the VTS Authority, the operator concerned may be required to undergo refresher training, or certificate revalidation as deemed appropriate by the Competent Authority.

1219 Updating/Refresher Training

Updating/Refresher training is training required by the Competent and/or VTS Authority in order to ensure that the level of competence is maintained appropriate to the service type(s) provided by the particular VTS centre when, for example, there has been a break in service, new equipment has been installed or new operating procedures have been introduced.

Refresher training may follow an assessment and/or may be given periodically according to the requirements of the Competent and/or VTS Authority or when deemed necessary by the VTS Authority.

Refresher training may be carried out by a VTS Authority or by means of a formalised course, approved by the Competent Authority.

1220 Revalidation Training

Revalidation training is training required by the Competent and/or VTS Authority in order to revalidate the VTS Operator Certificate. The period of revalidation is determined by the Competent and/or VTS Authority.

1221 Accreditation of VTS Training Institutes

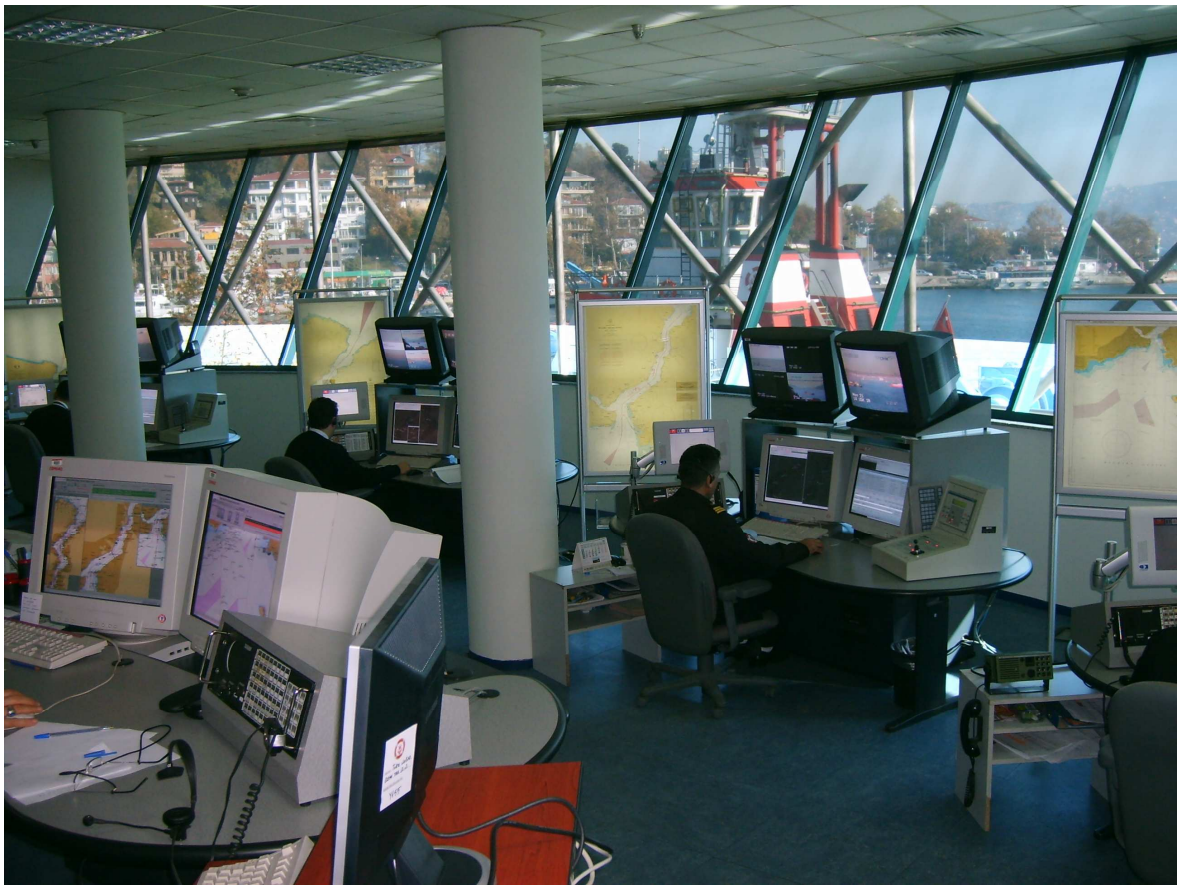
Accreditation is the independent review of VTS educational programs at VTS training institutes. The purpose of accreditation is to ensure, as far as possible, that the services provided by the institute meet the requirements of IALA Recommendation V-103 and are within the framework of a Training Management System thus meeting the requirements of an approved quality system standard.

The IALA Guideline No 1014 *Accreditation of VTS Training Institutes for Training VTS Personnel* set out the process by which VTS Training Institutes can achieve accreditation to conduct education training leading to the issue of V-103/1, V-103/2 and V-103/4 Course Certificates.

VTS Training - An international training consultant conducts an exercise at Arko in Sweden. Below, a typical training simulator for refresher training.

Promulgation of Information. Whether a VTS is responsible for a significant international waterway or a small commercial port, the proper promulgation of accurate and up-to-date information to the mariner is a vital part of its duty of care. Does the information about your VTS meet these criteria?

Shown here are the VTS responsible for the Singapore Straits, above, and The Istanbul Strait, below.



CHAPTER 13: PROMULGATION OF VTS INFORMATION

1301 Introduction

The purpose of this chapter is to draw attention to the requirements for promulgating information about vessel traffic services and to provide advice as to the information that might be considered appropriate for publication.

1302 Requirement

The IMO has set out the requirement for the publication of VTS information as follows:

> The VTS Authority should, in a timely manner, provide mariners with full details of the requirements to be met and the procedures to be followed in the VTS area. This information should include the categories of vessels required or expected to participate; radio frequencies to be used for reporting; areas of applicability; the times and geographical positions for submitting reports; the format and content of the required reports; the VTS authority responsible for the operation of the service; any information, advice

In setting this requirement it was recognized that VTS information is published in a variety of nautical publications, including the IALA/IMPA/IFSMA/IAPH/IMHA World VTS Guide, that are widely made available to the mariner, and by individual VTS authorities. In the latter case the data provided may refer to only the local VTS area. It is important that mariners have ready access to the range of information and procedures that they may require when entering or passing through a VTS area, this includes information about vessels that may be encountered when using a waterway.

1303 Promulgation of Information

VTS authorities are advised to consider the extent and means of publishing information about the services that they provide and particularly to ensure that all potential marine users of their services are fully briefed about the facilities available and the requirements to report information about their vessel and its movements when approaching or entering a VTS area. It is recommended that VTS Authorities should maintain up-to-date entries in the World VTS Guide, the appropriate Lists of Radio Signals and marine publications about ports and port entry. Additionally, it is recommended that other, more immediate means of promulgation should be considered: such as a website, e-mail or other text transfer media, recognizing that an appropriate degree of security may be required to avoid the possibility of malicious action resulting from the deliberate misuse of sensitive information.

1304 Information

The following list of headings is intended as a guide to the type of information that might need to be promulgated:

Title of VTS	The name of the VTS or VTS area.
Description	Brief overview of the services and whether participation is voluntary or mandatory and to which vessels it applies.
VTS area	Define the area boundaries
VTS sectors	Where an area is sub-divided into separate operational sectors provide details of boundaries
VTS centre	Define location (s) and details of VTS centre(s) (Location, Telephone, Fax and e-mail identities)
Communications	VHF channels to be used. Other communications channels Language, or languages that may be used. Circumstances when SMCP is required
Reporting	Details of reports required and when these should be made.
Reporting points	Identify geographical locations at which reports are to be made.
Callsigns	Callsigns to be used where this differs from the VTS name. Sector or local area callsigns.
Hours of operation	Where services are not provided on a continuous basis specify hours of operation.
Radar surveillance	Radar coverage and, if appropriate, its availability when less than 'continuous'.
Types of Service	Types of service provided (INS, NAS or TOS)
VTS Procedures	Procedures for vessels entering, transiting and departing VTS area and/or VTS sectors.
Accident Procedures	Procedures for vessels involved in specific accidents or emergencies.
Information Broadcasts	Details of the schedule, content and purpose of local broadcasts to shipping.
Amplifying Notes	Local regulations and practice, and other relevant items not included above
Diagrams	Include diagrams to indicate key features of the VTS area, anchorages and berths, with particular reference to dangers and areas to avoid.

1305 World VTS Guide

VTS authorities that have entries in the World VTS Guide are requested, in addition to providing the information listed above, to forward information in the format shown at Annexes A & B to this chapter.

ANNEX A: CATEGORISATION OF VTS

When considering the development and implementation of VTS, the Competent/VTS Authority will need to decide on the type of service that is to be provided, the availability of the service and the training standards of the staff that will provide the service. The type and availability of service, when considered together, make up the Categorisation of the VTS.

There are two potential beneficiaries of "categorising" VTS, namely:

- The mariner, who needs to know what services and activities a specific VTS is able to provide and perform and under what circumstances;

- The VTS Authority and/or the Competent Authority, in deciding what VTS may be required to mitigate identified risks, and thereby what type and availability of VTS should be procured.

The categorisation of a VTS, designed to benefit the mariner, is expressed in terms of a coding mechanism (overleaf), which is based on similar regimes already in place in the aviation and maritime worlds. The code is designed to offer essential information, on the type and availability of the service, to the mariner in a simple, easy to read format. It is a compilation of VTS elements that are the core requirements for categorisation, as identified by IALA. The use of the code enables sub-areas or sectors within a VTS area to be categorised differently, if necessary.

Categorisation Coding

1. Service Availability	
X = 24 hours	
Y – Other, for example Code Number	Explanation
1	24 hours except holidays
2	24 hours weekdays only
3	All others (between the hours specified)

An entry of **Y3(0900-1700)** indicates a service that is provided only between 0900 and 1700 daily.

2. Traffic Image Generation	
Indicated by **"T"** and code number from table	
Code Number	**Explanation**
1	Automatic Identification System (AIS)
2	Real-time Tracking
3	Radar
4	Closed Circuit Television (CCTV)
5	Visual
6	Radio Direction Finder (RDF)
7	VHF Radio Position Reporting
8	Satellite Position Reporting
9	Satellite Surveillance

An entry of **T136** indicating that the service provided incorporates the following: AIS; RADAR, and RDF.

3. VTS type of Service	
Information Service	Indicated by **INS**
Navigation Assistance Service	Indicated by **NAS**
Traffic Organisation Service	Indicated by **TOS**

4. Availability to Allied Services	
A service that includes information exchange with other VTS or allied services.	Indicated by **AS**

Example of the Code:

"VTS/Y3(0900-1700)/T136/INS+TOS/AS"

This example describes a VTS that is available from 0900 to 1700 daily; that builds its traffic image using AIS, radar and RDF, that provides information and traffic organisation services, and has communications with other VTS or allied services.

ANNEX B : SOME EXAMPLES OF ESTABLISHED VTS CODES

PORT/VTS	CODE
Melbourne (Australia)	VTS/X/-
Hong Kong (China)	VTS/X/T1234567/INS+NAS+TOS/AS
Storebelt (Denmark)	VTS/X/T23467//INS/-
Archipelago (Finland)	VTS/X/T12347/INS+NAS+TOS/AS
Helsinki/Kotka (Finland)	VTS/X/T12347/INS+NAS/AS
West Coast (Finland)	VTS/X/T2347/INS+NAS+TOS/AS
Akashi Kaikyo (Japan)	VTS/X/T23457/INS+NAS+TOS/-
Bisan Seto (Japan)	VTS/X/T23457/INS+NAS+TOS/-
Kanmon Kaikyo (Japan)	VTS/X/T23457/INS+NAS+TOS/-
Kurushima Kaikyo (Japan)	VTS/X/T23457/INS+NAS+TOS/-
Nagoya (Japan)	VTS/X/T23457/INS+NAS+TOS/-
Tokyo Bay (Japan)	VTS/X/T123457/INS+NAS+TOS/-
Den Helder (Netherlands)	VTS/X/T2357/INS+NAS+TOS/AS
Ijmuiden (Netherlands)	VTS/X/T234567/INS+NAS+TOS/AS
Rotterdam (Netherlands)	VTS/X/T234567/INS+NAS+TOS/AS
Scheveningen (Netherlands)	VTS/X/T23457/INS+NAS+TOS/AS
Scheldemond (Netherlands)	VTS/X/T234567/INS+NAS+TOS/AS
Brevik (Norway)	VTS/X/T1234567/INS+NAS+TOS
Oslofjord (Norway)	VTS/X/T123467/INS+NAS+TOS
Fedje (Norway)	VTS/X/T2357/INS+NAS+TOS/-
Kvitsoy (Norway)	VTS/X/T12357/INS+NAS+TOS/-
Vardo (Norway)	VTS/X/T1237/INS
Nakhodka (Russia)	VTS/X/T2357/INS+NAS/AS
Goteborg (Sweden)	VTS/X/T12367/ INS+NAS+TOS/-
Dover (UK)	VTS/X/T234567/INS+TOS/-
London (UK)	VTS/X/T123457/INS+NAS+TOS/AS

CHAPTER 14: ADMINISTRATIVE REQUIREMENTS

1401 Introduction

Effective administration and support is essential for the proper functioning of a VTS. Administrative guidance and instructions should be documented and available to all VTS staff.

The extent of the supporting activities is likely to be related directly to the size of the VTS area, the number of sub-areas and sectors, the service being provided and the hours of service of the VTS. The existing administrative infrastructure of the VTS Authority or Competent Authority will also dictate the extent to which additional VTS administrative support will be required.

1402 Strategy and Planning

VTS Authorities will to a greater or lesser extent be involved in the strategy, planning and continuous development of VTS. This will drive the provision of administration support required for the proper operation of vessel traffic services. This will involve:

- Personnel;
- Legal;
- Equipment and Facilities;
- Procedures;
- Finance;
- Security; and
- Other Activities

1403 Personnel

It is a key function of support to ensure that trained, qualified and well-motivated staff is available for duty, both routine and in an emergency. Detailed guidance about personnel matters, training and qualifications are contained in Chapters 11 and 12.

Personnel administrative activities include:

- Maintenance of personnel rosters, including watch schedules and duty rosters providing assurances for adequate staff rest, working hours and vacations;
- Maintenance of training records, including:
  - Training schedules
  - Records of training completed
  - Training procedures

- Recruitment;
- Management of pay and allowances, including management of overtime;
- Completion of performance evaluations;
- Development and maintenance of the VTS chain of command and organisation, including position descriptions;
- Personal health monitoring; and
- Workplace health and safety management and training.

1404 Legal Matters

The international legal basis for VTS is addressed in Chapter 2. These obligations are normally amplified by national laws and regulations and invariably include powers derogated to VTS Authorities. Guidance should be available to VTS staff on the extent of the powers delegated to them through the VTS Authority and the limits of their liability.

One of the tasks of a VTS may be the enforcement of regulations within the VTS Area. This may lead to prosecutions. It is important that administrative procedures are in place to ensure the accurate reporting and recording of violations and infringements that may be used as evidence.

1405 Equipment and Facilities

Details on equipment requirements are contained in Chapter 10. This section deals with administrative support of equipment and facilities. The proper operation of VTS equipment to its designed specification is critical to ensure the continuity of vessel traffic services.

Procedures should be in place for:

- Scheduled preventive maintenance;
- Regular monitoring of equipment against set performance targets;
- Reporting equipment defects;
- Reporting repair intentions;
- Reporting progress or completion of repairs; and
- Acceptance that equipment is operating to standard by the operator/watch supervisor.

If a VTS incorporates equipment and/or facility redundancy arrangements, administrative procedures should be in place for the seamless transition to maintain operational functions.

1406 Processes and Procedures

Administrative activities in support of operational procedures include:

- Establishment, maintenance and audit of a Quality Management System. (See Chapter 18) This may draw on the external support from a classification society;
- Documentation of procedures including configuration management to capture and implement operational changes;
- Management of Pilotage Exemption Certificate (PEC) procedures (if applicable);
- Liaison with allied services;
- Ensuring completion of required reports and records for Competent Authority and other agencies;
- Maintenance of reference library, including Notices to Mariners, tidal information, other reference data; and
- Handling data storage, voice tapes/video/sensor recordings and responding to routine external requests for such data. Guidance on archives and records is contained in Chapter 15.

1407 Finance

There are two aspects of finances that may need consideration: internal - control of the budget of the VTS centre in terms of income and expenditure: and external billing associated with use of the port or waterway services. Specific tasks associated with finances include:

- Accounting/book-keeping;
- Billing services - if there are charges for VTS services, recordkeeping for other services (e.g., pilotage, port tariffs, etc.);
- Auditing - there will be requirements for the VTS Centre to account for expenditures to the relevant Authority;
- Budgeting; and
- Pay and allowances.

1408 Security

The IMO has established international guidance on maritime security. Many of these requirements are discussed in more detail in the International Ship and Port Facilities Code (ISPS) and in Chapter 4, paragraph 0408.

Two aspects of administration of security requirements for the VTS must be considered: security of the VTS infrastructure and VTS contribution to maritime security.

Administrative arrangements for security of the VTS infrastructure may include:

- Physical security of the VTS Centre and remote sites;
- Security of information systems supporting VTS; and
- Personnel security, including the security clearance of VTS staff and visitors

Administrative processes that support VTS contribution to maritime security may include:

- Gathering security related data;
- Validation of security related data;
- Data storage;
- Authorization for access to security related data;
- Liaison and agreements with other agencies; and
- Exchange of data with security services.

1409 Other Administrative Activities

Depending upon the size of the operation, other functions may need to be considered such as transportation, provision of parking facilities, fire fighting arrangements, visits by VIPs or school parties and other public relations activities. Public information is covered in more detail in Chapter 16. However, administrative instructions should be in place to ensure that VTS staffs are aware of their delegated authority for the release of information gathered by the VTS.

1410 Distractions

Care should be taken not to distract VTSOs from their primary duties of ensuring safety of navigation. Systems, processes and procedures should support the needs of VTSOs.

CHAPTER 15: OPERATIONAL RECORDS, ARCHIVES AND REPLAY

1501 Introduction

The nature of VTS operations is such that there may be a requirement to access, analyse and review previous events. There is a requirement, therefore, for the capture, secure storage, retrieval and presentation of VTS related information.

Advances in data storage techniques now make possible archiving and retrieval options that may have appeared unachievable only a short period ago. For example, storage and retrieval of basic raw data may be enhanced by the added capability of recording operator actions, the Human Machine Interface (HMI), which may prove invaluable in justifying the actions of VTS Staff in post incident analysis as well as improving the efficiency of VTS operations.

This chapter provides guidance on recording, archiving and replay techniques that a VTS Authority may wish to consider in selecting systems and procedures that are appropriate to their needs.

1502 Purpose of Recording and Replay

Recordings may be required for the following purposes:

- Review of an accident or incident investigation;
- Use as evidence following an accident or incident;
- Technical evaluation and to check the function and performance of sensors etc;
- Quality monitoring of the operation of VTS as a whole and to allow for continuous improvement;
- Statistical analysis of traffic patterns etc within the VTS area; and
- Training purposes.

1503 Types of Data to be Recorded

The following areas should be considered for data capture (IALA Recommendation V-127 art 2.1.1), as appropriate:

- Radio Communications;
- Telephone Communications;
- Sensor data used to generate the traffic image such as:
  - Radar

  - AIS
  - CCTV
  - VHF DF
  - Long-range sensor data.
  - Fused sensor data (track data, traffic image, etc.)
- Port Management Information Systems which may include:
  - Shipping information i.e. vessel and cargo data, including vessel movement information.
  - Pilotage management
  - Allied service provisions i.e. tug and line handing allocations.
- Meteorological and hydrological data;
- Logs and textual records; and
- Operator actions (HMI).

1504 Recording frequency and sampling rates

The frequency of sampling for recorded data sets should be appropriate for each specific type of data (e.g. continuously for audio, but not so for Met or Hydro data).

The relevant authority should define the period of time and temporal resolution of sensor data and other tracking performance parameters depending on traffic density and types of tracks.

While the frequency of individual data items may differ from item to item, the recording of all data sets should be continuous and time stamped to a common time frame. A VTS system should have a master time reference to which all components and recordings are aligned.

Proper care should be taken by the relevant authority when considering the recording process and data storage with regard to failure to record or unwanted loss of recordings.

1505 Storage of Recordings

IMO recommends a minimum of 30 days for other shore side activities (such as SAR) as the time-period to allow for the full retrieval of data post-incident/accident. It can be assumed that this requirement is appropriate for VTS and applies to all data sets that may be used for incident replay. As this data will be recorded in a rolling loop of, for example the most recent 30 days data, there is a requirement to store recordings for a period of time to safeguard recorded data in case of an incident. It should be easy for a VTS operator or

supervisor to archive a period of recorded data to other media (e.g. DVD-ROM, tape storage or similar).

Certain data should be considered for longer term storage in support of such benefits as analysis of traffic patterns and their changes over time, waterway usage changes, input for analysis of changes to buoyage and other aids to navigation and other such strategic vessel traffic management uses. It is possible that such long-term archival of data is beyond the capability or responsibility of the VTS; the capabilities of other entities should be considered for this purpose (e.g., archival or statistical administrations).

A capability should be provided to store recordings of specific incident data beyond the minimum storage time or to produce a permanent record for legal, regulatory or analysis purposes. Consideration should be given to securing recordings from unauthorized access or tampering, particularly those to be used in accident investigation or legal action.

The large file size of some data items such as audio or CCTV images, may necessitate moving of the data to another media (DVD-ROM or similar) for longer term storage. This may also be a consideration in deciding whether to record and store original (raw) video, or digital (extracted) images as presented to an operator.

To ensure that records are consistent and complete, the data recording process should normally be automated and consideration should be given to the provision of a stand-alone replay system that does not interfere with the VTS function. Consideration should be given to allow the retrieval of VTS information in standard formats (e.g., delimited text files or extensible mark-up language (XML) and non-proprietary audio and video/image files (.wav and .bmp or .avi)).

1506 Replay System

Any replay system must ensure that times are accurately identified so that the traffic situation can be rebuilt during replay. VTS Authorities may consider the integrated and synchronised replay of different data sources to aid incident review. Replay may be required for the following purposes:

- Technical replay – using previously recorded data to fine-tune the system;
- Operator replay – replay of data sets as seen by VTSO for internal analysis;
- External replay – ‘standalone’ replay functionality, for example when replaying to a court or official inquiry.

CHAPTER 16: PUBLIC INFORMATION

1601 General

Vessel Traffic Services operate in the public interest. VTS authorities have a duty to inform the public of their activities and to cooperate with stakeholders. The VTS authority has access to a large amount of information through the VTS centre and this information can be used to inform stakeholders, either directly or through the media, and to improve public awareness of their activities and of events in the VTS area.

1602 Information Policy

VTS authorities should adopt an information policy. If the VTS centre is part of a larger organisation, its policy will need to align with those of the parent organisation. This policy should set out the procedures for dealing with inquiries from the public and media.

VTS authorities should consider appointing a staff member responsible for media liaison. This person should have a thorough knowledge of VTS operations and, ideally, should not be a regular watch-keeper. The main role is to provide a focal point for public information and to be known to the media as a point-of-contact for enquiries. Tasks should include routine contact with the local media, the arrangement of exchange visits, the provision of briefings on day-to-day or small-scale operations, and the arrangement of press facilities during large-scale operations. Where a VTS Authority does not appoint a media liaison person, a suitable person should be nominated to liaise with the media, as necessary, on a case-by-case basis.

In an emergency or incident situation, the media will probably try to contact the VTS centre directly and use every means at their disposal in order to obtain information. However, VTS personnel should not express opinions, or speculate on outcomes of incidents, but direct the media to the appointed media liaison person according to the procedures.

When providing information on events of immediate and/or particular interest to the media, the VTS Authority should endeavour to provide that information through the nominated media liaison person at regular intervals during operations and/or whenever important developments occur. The VTS Authority should ensure that released information is timely, factual, accurate and related only to the details of the particular incident. Information should not be provided that could:

- be harmful to security in general;

- hamper or interfere with VTS operations;
- have a negative effect on a persons privacy; or
- affect the outcome of any investigation or future legal action.

Due care shall be taken not to release proprietary information, unless those sources approve of the release, or the passage of time has eliminated the commercial value of the proprietary information.

1603 Relationships with the Media

The maintenance of good working relationships with the media is of considerable potential benefit to a VTS Authority, as it keeps the public routinely informed of matters of general interest. This helps to keep the work of the VTS in the public mind and promotes an awareness of the associated benefits that are derived by the community.

Routine contact and press releases enables an authority to develop a relationship with the public on key matters such as environmental protection and maritime safety, particularly where other stakeholders might have shared responsibilities or concerns.

For events where the media interest is likely to be high, such as a major incident, it is advisable to have in place a pre-determined media plan, as an integral part of the VTS incident contingency plan. Such a plan should help ensure that the main resources of the VTS authority are devoted to the incident, without being distracted by media enquiries. At the same time, it will be necessary to ensure that the media are kept fully and accurately informed. The VTS authority may, in cooperation with other relevant authorities, arrange for separate facilities in order to conduct press briefings. It is important to note that, whilst every assistance should be given to the media, their presence should not be allowed to interfere with VTS operations.

1604 Provision of Information

The data collected by a VTS centre may be of great value to many stakeholders and also be of great interest to others. The increase in the ability to collect and access data with electronic systems has made this data easier to share. However, at the same time, unauthorised eavesdropping has become easier, particularly for those intent on malpractice or sabotage.

VTS authorities should establish procedures for the release of different types of information to authorised stakeholders and to safeguard information whose unauthorised use could, in the wrong hands, jeopardise safety and security. VTS authorities have a duty-

of-care to ensure that these procedures are robust.

1605 User Education and Public Awareness Programs

A VTS may find it beneficial to implement a program to target members of the maritime community who desire or need knowledge of VTS operations. It should be flexible enough to adapt to the operational needs of any audience including pilots, licensed mariners, fishermen, yachting organizations and non-traditional VTS stakeholders/users, such as marine construction companies, shipping agents, and transportation authorities for other modes of transportation.

The program should include an overview of the VTS mission, geographic boundaries, equipment capabilities and limitations, and personnel duties. It should also provide an explanation of VTS participation and communications requirements, and national and local regulations for VTS users.

Public awareness programs are intended to promote the philosophy that mariners and the VTS work together to make ports and waterways safer and more efficient. The maritime community and the VTS authority should continually discuss ways in which they can help each other achieve common goals for the benefit of all.

1606 Ship/VTS Interaction and Related Facility Visits

Experience gained by VTS personnel aboard vessels and visits to maritime facilities operating in their VTS area can provide great benefit to the VTS and to the maritime community. Such activities serve to:

- provide information directly to VTS stakeholders;
- enable VTS stakeholders to give feedback directly to VTS personnel; and
- improve VTS personnel's understanding of the duties, responsibilities, and concerns of the VTS stakeholders.

Competent and/or VTS authorities may consider making their facilities accessible to the general public, taking into consideration the security of the VTS centres, the impact on VTS operations and other constraints. The benefits of the public visiting a VTS centre in operation helps to promote a better understanding of their work and fosters more positive attitudes towards the safety of navigation and the protection of the environment.

1607 Participation in Advisory Committees

The VTS authority should be responsive to public attitudes and interests, and execute a plan of action to promote public understanding and respect. A public relations programme

might include:

- Liaison and co-operation with various associations and organisations.
- Establishing a marine industry advisory committee.
- Public visits to VTS centres.
- Participating in special events.
- Humanitarian actions.

VTS authority representation in local maritime committee meetings, consultative groups and other public forums provides an opportunity to exchange information and discuss maritime related issues. Active participation in such committees also advances the development of strong working relationships with local stakeholders

Public Information policy should ensure that a VTS organisation deals effectively with the good news and is equally capable of handling the less welcome events that inevitably occur.

CHAPTER 17: VTS OPERATIONAL PROCEDURES

1701 Introduction

Operational Procedures are an integral part of a verifiable safety management system for VTS. A properly implemented quality control system, approved by the competent authority, can ensure that the standards set for the type and level of service are consistently maintained and that the service is delivered safely and effectively.

The development and maintenance of VTS centre specific operational procedures is a continuous process. To ensure the safe and efficient management of the service it is critical that:

- VTS Staff are made aware of changes and amendments; and
- Auditable and documented processes are developed that enable the early and effective update of operational procedures

Best practice indicates that new or changed procedures should be communicated at the Watch Handover and incorporated into the operational procedures handbooks/manual. This chapter summarises the key points in developing operational procedures for VTS Centres.

1702 Overview

IALA Recommendation V-127 *Operational Procedures for VTS (Edition 1.0 – June 2004)* has been prepared to assist VTS authorities in identifying key aspects that should be considered when developing operational procedures for a VTS Centre.

1703 Communications and VTS Procedures

Recommendation V-127 provides a checklist for preparing Operational Procedures and this chapter provides guidance in developing recommended procedures. To assist a common and consistent approach to the development of Operational Procedures, key terminology utilised by the maritime sector has been defined. The key terminology includes:

- Result Oriented Messages;
- Standard Phrases; and
- Types of Communication Messages and Message Markers.

1704 Result Oriented Messages

A fundamental principle of VTS communications is that advice and instructions should be "result oriented" only; leaving the execution to the vessel. The execution, such as courses to be steered or engine manoeuvres to be ordered, remain the responsibility of the person on board accountable for navigational decision making at that time.

The interpretation of "Result Oriented" will depend on the situation and context. Phrases that are used for vessel conning, such as, "Stop Engine", "Hard to Starboard" or "Steer Course "XXX"" should not be used.

1705 Standard Phrases

Guidance on maritime communications can be found in:

- Standard phrases for ship-to-shore communications are defined in IMO;
- Resolution A.918(22) *Standard Marine Communication Phrases* ; and
- Standard Reporting Procedures, IMO Resolution A.851(20) *General Principles for Ship Reporting Systems and Ship Reporting Requirements.*

1706 Types of Communication Messages and Message Markers

To facilitate shore-to-ship and ship-to-shore communication in a VTS environment, one of the following eight message markers should be used to increase the probability of the purpose of the message being properly understood. It is at the discretion of the shore personnel or the ship's officer whether to use one of the message markers and, if so, which marker is applicable to the situation. If used, the message marker is to be spoken preceding the message or the corresponding part of the message. The contents of all messages directed to a vessel should be clear; IMO Standard Marine Communication Phrases should be used where practicable.

1707 Message Markers

There are eight types of Communication Messages that are frequently used in VTS (These are defined in SMCP, see 1709) each with its own discrete message marker. These are:

Information	**Warning**	**Advice**	**Instruction**
Question	**Answer**	**Request**	**Intention**

1. Information: Marker "INFORMATION"

This Marker is used to convey observed or predicted facts and situations; it is generally used for navigational and traffic information. The action taken by the recipient is at their

Example 1.	"INFORMATION, The vessel "No Name" predicted to overtake to the west of you in the vicinity of Buoy "XXXX".
Example 2.	"INFORMATION, Next high water at Port "YY" predicted at "XX:XX" at a height of "ZZ" metres.

discretion. Any decision taken onboard using this message could be influenced by additional information that may not be available to the VTS centre.

2. Warning: Marker " WARNING."

This Marker is used to convey potentially dangerous situations or observed developing situations. The contents of a Warning Message should be immediately assessed in conjunction with any additional information that may not be available to the VTS centre and corrective action taken where necessary.

The outcome of any action taken based on the warning is the responsibility of the recipient.

Example 1.	WARNING, Vessel 'Piero, VTS radar indicates you are heading towards shallow water".
Example 2.	"WARNING, Vessel 'Piero, Information available to the VTS suggests you are dragging your anchor. Check your condition and confirm your intentions".

3. Advice: Marker "ADVICE"

This Marker conveys that the message contains a recommendation that should be considered by the recipient in making navigation related decisions.

Advice Messages must not contain extraneous information. As circumstances warrant, VTS shall update information provided to mariners to ensure that the most recent information is available on which to base navigation related decisions.

The duty VTSO should use their professional judgement and all available information in deciding when interaction to provide an Advice Message is appropriate. When interaction to provide an Advice Message is appropriate, the message should be concise and relevant.

Example 1.	"ADVICE, Motor Vessel Nonesuch, the Large Container Vessel 'LCV Europa', has passed the "x" Buoy inward bound and will be taking her tugs at "y" location. Wide berth requested".
Example 2.	"ADVICE, By my display you are leaving the channel. Recommend you transit within the channel".

4. Instruction: Marker "INSTRUCTION"

This Marker conveys that the message is a direction given by the VTS centre under the provisions of a statutory regulation.

The sender must have delegated authority to send such a message. The recipient has a legal obligation to comply with this message unless contradictory safety reasons exist, which then have to be reported immediately to the sender.

Generally masters of vessels will respond promptly and carry out instructions given by a VTS. However, it should be recognised that there may be occasions when an instruction by a VTS is disregarded because the master has additional information not available to the VTS Centre and he decides on another course of action. For example, a vessel not visible to the VTS may be a contributing factor to the navigational situation.

Example 1.	"INSTRUCTION. Vessel “No Name” Do not cross the fairway."
Example 2.	“INSTRUCTION. The large Container Vessel ‘LCV Europa’ is experiencing some difficulty swinging in the fairway off your berth. Do not leave your berth without further instructions.”

5. Query: Marker “QUESTION”

This Marker indicates that the following message is of an interrogative character and calls for a reply. The use of this marker removes any doubt as to whether a question is being asked or a statement is being made, especially when interrogatives such as what, where, why, who, how are additionally used at the beginning of the question. The recipient is expected to reply with an answer.

Example.	"QUESTION. Vessel “Tatsua Maru (What is) your present maximum draft?"

6. Response: Marker “ANSWER”

This Marker indicates that the following message is the reply to a previous question. It should be noted that an answer should not contain another question.

Example.	"ANSWER. My present maximum draft is zero seven metres."

7. Request for Action: Marker “REQUEST”

This Marker indicates that the following message is asking for action from others with respect to the vessel. The use of this marker is intended to signal: “I want something to be

arranged or provided." For example, ship's stores requirements, tugs, or permission to proceed.

Example.	"REQUEST. Please stand by on this channel."

8. Statement of Intent: Marker "INTENTION"

This Marker indicates that the following message informs others about immediate navigational action intended to be taken. The use of this message marker is logically restricted to messages announcing navigational actions by the vessel sending this message.

Example.	"INTENTION. I will reduce my speed."

1708 Developing Operational Procedures

Operational procedures should be drawn together into an Operations Manual available to all VTS Staff. Consideration should be given to including information relating to Policy, Organisation and Administration, linked to Chapter 14, to provide guidance for VTSOs in appreciating their role within the agency providing the service either as a part of the Operations Manual or as a stand alone linked document.

The Recommendation V-127 provides a reference list to assist VTS authorities to identify the key requirements that should be considered when developing operational procedures. The list is neither mandatory nor exhaustive and should be adapted to suit individual needs.

The Recommendation V-127 recognises that:

- The nature of the tasks and activities to be performed will depend on the capability of the VTS, the VTS area and the type and level of services to be provided. In general, these tasks and activities all involve collecting, processing, evaluating and disseminating information. The collection and dissemination of this information will involve both internal and external communications, while information will be processed within the VTS Centre itself. The level of decision-making that can be taken within the VTS centre should be clearly identified and promulgated.
- The objectives of the VTS can only be met through co-operation and trust among users of the service, VTS personnel and allied services. This can only be achieved through the reliability of the VTS information, which is

dependent on the assured availability, continuity and quality of the service provided to all stakeholders.

IALA Recommendation V-127 identifies a distinction between Internal and External Operational Procedures:

Internal Procedures – procedures that cover the day-to-day running of a VTS centre or sub-centre, including the operation of systems and sensors, interactions among the staff and the internal management of data.

External Procedures – procedures that govern the interaction with participating vessels and allied services (defined as services actively involved in the safe and efficient passage of the vessel through the VTS area).

A further distinction is made between routine procedures and those related to incidents such as search and rescue and environmental protection. The latter are generally referred to as emergency procedures. A summary of the procedures that need to be considered are at Annex A to this chapter.

1709 Standard Marine Communication Phrases (SMCP)

Attention is drawn to the importance of using standard terminology as prescribed in SMCP. IMO Resolution A.918(22) - *IMO Standard Communication Phrases*.

Good Operational Procedures are a vital element in obtaining a consistently effective and efficient VTS operation.

ANNEX A: EXAMPLES OF VTS OPERATIONAL PROCEDURES

Internal Procedures	External Procedures
Routine Procedures • Gathering and Recording of information • Operational staff • Equipment operation, maintenance, calibration and updating • interaction with allied services • Public Relations • Security • Training • Watch handover • Vessel handover • Maintenance of marine publications	**Routine Procedures** **Pre-Arrival Information** • Vessels Entering VTS Area • Vessels Transiting VTS Area • Vessels at Anchor • Vessels at Berth • Vessels Departing the VTS Area • Transition between Adjacent VTS Areas • Adverse environmental conditions
Emergency Procedures • System Failure • Internal emergencies, for example fire and flood • Forced evacuation of VTS centre • Personnel medical emergencies • Security incidents.	**Emergency Procedures** • Collision, Capsize, Sinking, Grounding, Fire On Vessel, Man Overboard • Pollution • Places of Refuge • Medical Emergency • Vessel Not Under Command (NUC) • Security incident • Protest Action • Natural Disaster

CHAPTER 18: QUALITY MANAGEMENT IN VTS

1801 Background

At its twenty-fourth session, the IMO Assembly adopted resolution A.973(24) on the Code for the Implementation of Mandatory IMO Instruments and resolution A.974(24) on Framework and Procedures for the Voluntary IMO Member State Audit Scheme. The two resolutions are complementary, and the Voluntary IMO Member State Audit Scheme described in resolution A.974(24) is based on the implementation of the Code contained in resolution A.973(24).

IALA is committed to the provision of high quality service and encourages navigation authorities to adopt internationally recognised standards for the management and delivery of services as set out in IALA Recommendation O-132 *Quality Management for Aids to Navigation Authorities,* December 2006. For the purposes of this recommendation, VTS is deemed to be an aid to navigation. IALA Recommendation O-132 recommends that:

- Authorities responsible for aids to navigation implement and maintain a Quality Management System;
- Authorities ensure the ongoing integrity of the QMS through periodic:
  - Certification by an accredited third party; and/or
  - Assessment by a third party; and/or
  - Self assessment.
- Authorities responsible for aids to navigation use related IALA documentation, including:
  - IALA Guideline 1052 on the Use of Quality Management Systems for Aids to Navigation Service Delivery;
  - IALA Guideline 1034 on the Certification of Marine Aids to Navigation Products.

The requirement for service providing organisations to adopt quality management principles is well established throughout the world. The IMO introduced a mandatory system for shipping and ship operators in 2002, the International Safety Management (ISM) Code.

> The purpose of the Code is to provide an international standard for the safe management and operation of ships and for pollution prevention. *Preamble, ISM Code 2002*

1802 Quality Management System

A Quality Management System is defined as a business management system to direct and control an organization with regard to quality, i.e., to achieve its objectives. It is not a simple set of documents but a dynamic process that brings resources, activities and behaviours together and focuses on the achievement of objectives.

The focus in modern quality management is not only to control the final product, but with the focus on process rather than procedures. A basic but fundamental approach to quality is the quality improvement loop. This can be seen as containing four steps:

- Preparing and planning;
- Realisation of the product;
- Checking of the results also in view of the client's satisfaction; and
- Reacting to this information to improve further actions.

There are many ways to implement a quality management system. Some VTS authorities may choose to use a third party assessment or audit. Others may opt to develop their own mechanisms for certification and review.

1803 Benefits derived from a Quality Management System

An active Quality Management System provides a tool to ensure that the objectives of the VTS are met and that the standards set by the Competent Authority for levels of service and operator qualifications continue to be met.

Properly conducted, a Quality Management System will ensure that a consistent quality of service is maintained to meet the demands of local maritime traffic. The benefits resulting from having a quality management system are well recognized and wide-ranging. Some of benefits include:

- Improve stakeholder confidence and satisfaction;
- Continual process improvement;
- Increased productivity and efficiency;
- Prompt and effective action on faults or complaints;
- Improved teamwork and communication;
- Enhanced quality awareness in the organization;
- Availability of proper documentation; and
- Assurance of effective management.

1804 Quality Management Principles

The International Organisation for Standardisation defines eight quality management principles (References, see 1815). The basic principles that need to be considered when establishing a quality management environment are:

Principle 1 — Customer-Focused Organisation

Organisations depend on their customers and therefore should understand current and future customer needs, meet customer requirements and strive to exceed customer expectations.

Principle 2 — Leadership

Leaders establish unity of purpose and direction of the organisation. They should create and maintain the internal environment in which people can become fully involved in achieving the organisation's objectives.

Principle 3 — Involvement of People

People at all levels are the essence of an organisation and their full involvement enables their abilities to be used for the organisation's benefit.

Principle 4 — Process Approach

A desired result is achieved more efficiently when related resources and activities are managed as a process.

Principle 5 — System Approach to Management

Identifying, understanding and managing a system of interrelated processes for a given objective improves the organisation’s effectiveness and efficiency.

Principle 6 — Continual Improvement

Continual improvement should be a permanent objective of the organisation.

Principle 7 — Factual approach to decision making

Effective decisions are based on the analysis of data and information.

Principle 8 — Mutually beneficial supplier relationships

An organisation and its suppliers are interdependent, and a mutually beneficial relationship enhances the ability of both to create value.

1805 Quality Management and the Maritime Industry

Although quality management systems were originally developed for the manufacturing industry, there are a growing number of ship management and marine service companies that have or are in the process of obtaining quality management certification. International regulations are also under review, which may require the certification of flag state administrations. The IMO Flag State Implementation (FSI) Subcommittee has also addressed the ability of maritime administrations to provide quality management and implement the international maritime conventions and rules properly.

Quality certification of a maritime administration's management system can be of significant benefit in overcoming the negative connotations about open ship registries and verifying a flag state's ability to implement and administer international rules and regulations in today's evolving maritime regulatory climate. ISO 9001:2000 certification provides an opportunity for well-run ship registries and flag states to have their management operations and administrative functions documented by internationally recognized, unbiased third-party auditors, such as the Classification Societies

1806 ISO and Quality System Management

ISO is the acronym for the International Organization for Standardization. ISO 9000 is a series of five international standards on quality management and assurance. For example, ISO 9001:2000 is the quality standard used by companies whose products or services have already been marketed, tested, improved and approved. These companies focus their quality efforts on maintaining and improving existing quality systems. ISO defines a quality system as: "The organizational structure, responsibilities, procedures, processes and resources needed to implement quality management."

In the case of a maritime administration, this certification encompasses vessel registration, crew examination, officer licensing, seafarers' identification and qualification documents, radio authority, vessel inspections, technical assistance and investigations.

1807 Key Elements of a Quality Management System

Key elements of a Quality Management System that should be considered by a VTS authority include:

1. Scope
2. Policy
3. Responsibilities
4 Planning and Reporting
5. Operational Procedures
6. Continuous Improvement
7. Audits

1808 Scope

The scope of activities to be covered under a Quality Management System need to be clearly defined at the highest management level. An example of a scope statement is:

EXAMPLE OF A SCOPE STATEMENT
Scope of Port Snoopy VTS Management System The scope of activities covered under Port Snoopy Management System is the development and administration of standards to: • Deliver VTS services that contribute to achieving the Authority's objectives of improving maritime safety and minimise the risk of ship sourced pollution and environmental damage within region; • Provide an ability to respond more quickly in the event of any safety or pollution incident; • Provide VTS capabilities to interact with and respond to developing traffic situations, including assisting with distress situations; • Improve processes and systems, and capitalise on existing and emerging technologies; • Deliver services that are relevant to current shipping management practice, user expectations, and community perceptions; • Enhance relationships with allied services, stakeholders and other interested parties; • Monitor and analyse the strategic environment to identify future directions, resource requirements etc as the role of other agencies, allied services and client groups increasingly impact on the VTS; • Adopt best practice governance arrangements; • Provide corporate wide support for the delivery of VTS services in relation to legal, financial, human resources, contractual arrangements, business services, information technology (including records management), quality management, government liaison, public relations and corporate planning; • Provide training (both competency and course based) leading to the granting of qualifications for staff.

Fig. 18.1: Example of a Scope Statement

1809 Policy

The objectives of the VTS should be clearly defined in a Business Policy Statement that highlights the authorities commitment to good governance, best practice operations, risk management and continuous improvement and key strategies to meet these commitments.

Only at the highest management level of an organisation can the policy for its conduct be set and the resources allocated. It is encumbent on those at board or director level to establish clear policy objectives, particularly with regard to quality of performance and delivery, if all personnel involved in the undertaking are to operate effectively. An example of a policy statement is shown below.

EXAMPLE OF A QUALITY POLICY STATEMENT

1.The Aim of the Cape Utopia VTS is:

'To Deliver a Reliable, Efficient and Cost Effective "VTS Service" For The Benefit And Safety of all Mariners and other Stakeholders'

2.Health & Safety And Environmental Objectives Policy Statement:

The Health & Safety and Environmental objectives of Cape Utopia are:

- To ensure safety at sea;
- Prevention of human injury or loss of life;
- Avoidance of damage to the environment.

In pursuance of these objectives of Cape Utopia VTS is committed to:

- Providing for safe practices in operations both in ships and ashore;
- Providing a safe working environment;
- Establishing safeguards against all identified risks;
- Continuously improving health and safety management skills of employees including preparing for emergencies related both to safety and environmental protection;
- Continuously improving our health and safety performance by proven conformity to accepted British and International safety management standards and quality systems, recognising legal requirements are the minimum standard;
- Striving to maintain a positive health and safety culture with the ultimate goal of reducing ill health and accidents to an absolute minimum, eliminating them where possible;
- Optimising the consumption of non-renewable resources within practical constraints;
- Investing sufficiently in its assets and resources to meet regulatory obligations in respect of safety and the environment.

The Cape Utopia Management System will ensure:

- Compliance with legislation, mandatory rules and regulations;
- Applicable codes, guidelines and standards are taken into account.

Fig. 18.2: Example of a Quality Policy Statement

1810 Responsibilities

The high-level responsibilities for the primary elements of the Quality Management System should be clearly defined and documented; examples are shown overleaf.

EXAMPLE OF DEFINING THE RESPONSIBILITIES	
Direction	**Responsibility**
Establish Direction (e.g. Strategic Plan	Board
Develop and review policy documents	Board
Develop overall objectives, targets and programmes • Business Plan • Identify Risks	Board / Manager
Monitor and review performance • Management Review	VTS Manager
Assure regulatory compliance	Manager Legal
Identify, record and report on customer expectations {e.g. VTS customer compliments/complaints process, service charter}	VTS Board, Managers and Staff
Policies and procedures: • Develop and maintain policies and procedures • Document Control • Review and Update, as required	Managers and Staff Document Controller(s)
Comply with defined procedures	Staff
Conduct internal audits and report on outcomes	Nominated internal auditor
Identify and record opportunities for improvement	Staff /Managers
General awareness of the Quality Management System	Staff / Managers

Fig. 18.3: Examples of Responsibilities that need to be Defined

1811 Planning

To ensure there is a robust framework to plan, prioritise and define areas of emphasis to ensure the objectives of the VTS are delivered in the best possible manner, consideration should be given to ensuring the operations and delivery of VTS services are reflected in high level documents such as:

- Strategic Plan;
- Annual Report;
- Risk Management Plan; and
- Business Continuity Planning.

1812 Operational Procedures

The objectives of the VTS can only be met through co-operation and trust among users of the service, VTS personnel and allied services. This can only be achieved through the reliability of the VTS information, which is dependent on the assured availability, continuity and quality of the service provided to all stakeholders

The responsibility for meeting the standards of an individual VTS Centre will normally rest with the Manager of the VTS or a VTS Supervisor who should ensure that everything in the Centre, particularly the staff, function at maximum efficiency at all times.

Adoption of a Procedures Manual prepared in line with this document and IALA Recommendation V-127 – *Operational Procedures for VTS (Edition 1.0 – June 2004)* is seen as an integral part of a verifiable safety management system for the VTS.

Operational procedures will evolve on a continuing basis. It is important that any changes made to operational procedures are properly documented. Temporary changes to procedures should be auditable and formally cancelled when expired or regularly incorporated into the appropriate parent document.

1813 Continuous Improvement

All staff / managers should be responsible for identifying opportunities for improvement within the scope of the Quality Management System.

To facilitate this, the process for reporting and managing opportunities for improvement should be documented to ensure continuous business improvement is achieved and there is a systematic approach to planning and taking corrective and/or preventive action.

Opportunities for Improvement should apply to elements such as:

- Continuous business improvement;
- Non-conforming product and/or service;
- Corrective action;
- Preventive action; and
- Customer feedback.

When acting on an Opportunity for Improvement results in a change to a process, the VTS manager should ensure that:

- The change is evaluated to ensure that the desired result has been achieved; and

- Resultant changes in relationships between the process and the service characteristics are documented and communicated.

1814 Audit

Audits are an effective management tool used to examine processes and activities and gauge the degree to which they are conforming to standards and procedures and whether there are any opportunities for improvement.

- VTS Authorities should ensure the ongoing integrity of the QMS through periodic;
- Certification by an accredited third party; and/or
- Assessment by a third party; and/or
- Self assessment.

1815 References

References published by the International Organisation for Standardisation for quality management systems are:

- ISO 9000:2000, Quality management systems Fundamentals and vocabulary,
- ISO 9001:2000, Quality management systems
- ISO 9004:2000, Quality management systems Guidelines for performance improvements.

'… make it a quality service on every occasion.'

APPENDIX 1: IMO RESOLUTION A. 857(20)

Guidelines For Vessel Traffic Services

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety and the prevention and control of marine pollution from ships,

RECALLING ALSO resolution A.158(ES.IV) entitled "Recommendation on Port Advisory Services", resolution A.851(20) entitled "General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants" and resolution MSC.43(64) entitled "Guidelines and Criteria for Ship Reporting Systems",

BEARING IN MIND the responsibility of Governments for the safety of navigation and protection of the marine environment in areas under their jurisdiction,

BEING AWARE that vessel traffic services have been provided in various areas and have made a valuable contribution to safety of navigation, improved efficiency of traffic flow and the protection of the marine environment,

BEING ALSO AWARE that a number of Governments and international organizations have requested guidance on vessel traffic services,

RECOGNIZING that the level of safety and efficiency in the movement of maritime traffic within an area covered by a vessel traffic service is dependent upon close co-operation between those operating the vessel traffic service and participating vessels,

RECOGNIZING ALSO that the use of differing vessel traffic service procedures may cause confusion to masters of vessels moving from one vessel traffic service area to another,

RECOGNIZING FURTHER that the safety and efficiency of maritime traffic and the protection of the marine environment would be improved if vessel traffic services were established and operated in accordance with internationally approved guidelines,

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its sixty-seventh session,

1. ADOPTS the Guidelines for Vessel Traffic Services and the Guidelines on Recruitment, Qualifications and Training of VTS Operators set out in annexes 1 and 2 to the present resolution;

2. INVITES Governments to take account of the annexed Guidelines when developing, implementing and operating vessel traffic services;

3. RECOMMENDS Governments to encourage masters of ships navigating in areas for which vessel traffic services are provided to make use of such services;

4. REVOKES resolution A.578(14).

ANNEX 1: GUIDELINES AND CRITERIA FOR VTS

PREAMBLE

1 These Guidelines are associated with SOLAS regulation V/8-2 and describe the principles and general operational provisions for the operation of a vessel traffic service (VTS) and participating vessels.

2 Contracting Governments should take account of these Guidelines when planning, implementing and operating vessel traffic services.

3 These Guidelines should be used in conjunction with the applicable Guidelines and Criteria for Ship Reporting Systems, resolution MSC.43(64) and the IALA VTS Manual.

1 DEFINITIONS AND CLARIFICATIONS

1.1 The following terms are used in connection with vessel traffic services:

.1 Vessel traffic service (VTS) - 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.

.2 Competent authority - the authority made responsible, in whole or in part, by the Government for safety, including environmental safety, and efficiency of vessel traffic and the protection of the environment.

.3 VTS authority - the authority with responsibility for the management, operation and co-ordination of the VTS, interaction with participating vessels and the safe and effective provision of the service.

.4 VTS area - the delineated, formally declared service area of the VTS. A VTS area may be subdivided in sub-areas or sectors.

.5 VTS centre - the centre from which the VTS is operated. Each sub-area of the VTS may have its own sub-centre.

.6 VTS operator - an appropriately qualified person performing one or more tasks contributing to the services of the VTS.

.7 VTS sailing plan - a plan which is mutually agreed between a VTS Authority and the master of a vessel concerning the movement of the vessel in a VTS area.

.8 VTS traffic image - the surface picture of vessels and their movements in a VTS area.

.9 VTS services - VTS should comprise at least an information service and may also include others, such as a navigational assistance service or a traffic organization service, or both, defined as follows:

.9.1 An information service is a service to ensure that essential information becomes available in time for on-board navigational decision-making.

.9.2 A navigational assistance service is a service to assist on-board navigational decision-making and to monitor its effects.

.9.3 A traffic organization service is a service to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the VTS area.

.10 Allied services - are services actively involved in the safe and efficient passage of the vessel through the VTS area.

.11 Hazardous cargoes - include:

.11.1 goods classified in the International Maritime Dangerous Goods (IMDG) Code;

.11.2 substances classified in chapter 17 of the IMO International Code for Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC) Code, and in chapter 19 of the IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC) Code;

.11.3 oils as defined in MARPOL Annex I;

.11.4 noxious liquid substances as defined in MARPOL Annex II;

.11.5 harmful substances as defined in MARPOL Annex III; and

.11.6 radioactive materials specified in the Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes in Flasks on board Ships (INF) Code.

2 GENERAL CONSIDERATIONS FOR VESSEL TRAFFIC SERVICES

2.1 Objectives

2.1.1 The purpose of vessel traffic services is to improve the safety and efficiency of navigation, safety of life at sea and the protection of the marine environment and/or the adjacent shore area, worksites and offshore installations from possible adverse effects of maritime traffic.

2.1.2 A clear distinction may need to be made between a Port or Harbour VTS and a Coastal VTS. A Port VTS is mainly concerned with vessel traffic to and from a port or harbour or harbours, while a Coastal VTS is mainly concerned with vessel traffic passing through the area. A VTS could also be a combination of both types. The type and level of service or services rendered could differ between both types of VTS; in a Port or Harbour VTS a navigational assistance service and/or a traffic organization service is usually provided for, while in a Coastal VTS usually only an information service is rendered.

2.1.3 The benefits of implementing a VTS are that it allows identification and monitoring of vessels, strategic planning of vessel movements and provision of navigational information and assistance. It can also assist in prevention of pollution and co-ordination of pollution response. The efficiency of a VTS will depend on the reliability and continuity of communications and on the ability to provide good and unambiguous information. The quality of accident-prevention measures will depend on the system's capability of detecting a developing dangerous situation and on the ability to give timely warning of such dangers.

2.1.4 The precise objectives of any vessel traffic service will depend upon the particular circumstances in the VTS area and the volume and character of maritime traffic as set forth in 3.2 of these Guidelines and Criteria.

2.2 Responsibilities and liability

2.2.1 Where two or more Governments have a common interest in establishing a VTS in a particular area, they should develop a co-ordinated vessel traffic service on the basis of an agreement between them. Where a co-ordinated vessel traffic service is established, it should have uniform procedures and operations.

2.2.2 In planning and establishing a VTS, the Contracting Government or Governments or the competent authority should:

.1 ensure that a legal basis for the operation of a VTS is provided for and that the VTS is operated in accordance with national and international law;

.2 ensure that objectives for the VTS are set;

.3 ensure that a VTS authority is appointed and legally empowered;

.4 ensure that the service area is delineated and declared a VTS area; where appropriate, this area may be subdivided in sub-areas or sectors;

.5 determine the type and level of services to be provided, having regard to the objectives of the VTS;

.6 establish appropriate standards for shore- and offshore-based equipment;

.7 ensure that the VTS authority is provided with the equipment and facilities necessary to effectively accomplish the objectives of the VTS;

.8 ensure that the VTS authority is provided with sufficient staff, appropriately qualified, suitably trained and capable of performing the tasks required, taking into consideration, the type and level of services to be provided and the current IMO Guidelines on the recruitment, qualifications and training of VTS operators given in annex 2;

.9 establish appropriate qualifications and training requirements for VTS operators, taking into consideration the type and level of services to be provided;

.10 ensure that provisions for the training of VTS operators are available;

.11 instruct the VTS authority to operate the VTS in accordance with relevant IMO resolutions;

.12 establish a policy with respect to violations of VTS regulatory requirements, and ensure that this policy is consistent with national law. This policy should consider the consequences of technical failures, and due consideration should be given to extraordinary circumstances that result.

2.2.3 In operating a VTS the VTS authority should:

.1 ensure that the objectives of the VTS are met;

.2 ensure that the standards set by the competent authority for levels of services and operator's qualifications and equipment are met;

.3 ensure that the VTS is operated in conformity with relevant IMO resolutions;

.4 ensure that the VTS operations are harmonized with, where appropriate, ship reporting and routeing measures, aids to navigation, pilotage and port operations;

.5 consider, where appropriate, the participation of the pilot both as a user and provider of information;

.6 ensure that a continuous listening watch on the designated radio frequencies is kept and that all published services are available during the operational hours of the VTS;

.7 ensure that operating procedures for routine and emergency situations are established;

.8 in a timely manner, provide mariners with full details of the requirements to be met and the procedures to be followed in the VTS area. This information should include the categories of vessels required or expected to participate; radio frequencies to be used for reporting; areas of applicability; the times and geographical positions for submitting reports; the format and content of the required reports; the VTS authority responsible for the operation of the service; any information, advice or instructions to be provided to participating ships; and the types and level of services available. This information should be published in the appropriate nautical publications and in the "World VTS Guide"*.

2.2.4 The liability element of an accident following compliance with VTS guidance is an important consideration which can only be decided on a case-by-case basis in accordance with national law. Consequently, a VTS authority should take into account the legal implications in the event of a shipping accident where VTS operators may have failed to carry out thei* r duty competently.

2.2.5 Contracting Governments should ensure that ships flying their flag comply with the requirements of vessel traffic services. Those Contracting Governments which have received

* *Refer to MSC Circular 586 on the IALA/IAPH/IMPA World VTS Guide

information of an alleged violation of a VTS by a ship flying their flag should provide the Government which has reported the offence with details of any appropriate action taken.

2.3 VTS services

The following guidance concerning the services that are rendered by a VTS should be taken into account:

2.3.1 The information service is provided by broadcasting information at fixed times and intervals or when deemed necessary by the VTS or at the request of a vessel, and may include for example reports on the position, identity and intentions of other traffic; waterway conditions; weather; hazards; or any other factors that may influence the vessel's transit.

2.3.2 The navigational assistance service is especially important in difficult navigational or meteorological circumstances or in case of defects or deficiencies. This service is normally rendered at the request of a vessel or by the VTS when deemed necessary.

2.3.3 The traffic organization service concerns the operational management of traffic and the forward planning of vessel movements to prevent congestion and dangerous situations, and is particularly relevant in times of high traffic density or when the movement of special transports may affect the flow of other traffic. The service may also include establishing and operating a system of traffic clearances or VTS sailing plans or both in relation to priority of movements, allocation of space, mandatory reporting of movements in the VTS area, routes to be followed, speed limits to be observed or other appropriate measures which are considered necessary by the VTS authority.

2.3.4 When the VTS is authorized to issue instructions to vessels, these instructions should be result-oriented only, leaving the details of execution, such as course to be steered or engine manoeuvres to be executed, to the master or pilot on board the vessel. Care should be taken that VTS operations do not encroach upon the master's responsibility for safe navigation, or disturb the traditional relationship between master and pilot.

2.3.5 A VTS area can be divided into sectors, but these should be as few as possible. Area and sector boundaries should not be located where vessels normally alter course or manoeuvre or where they are approaching areas of convergence, route junctions or where there is crossing traffic. VTS centres in an area or sector should use a name identifier. The boundaries should be indicated in the appropriate nautical publications and in the "World VTS Guide"*.

2.4 Communication and reporting

2.4.1 Communication between a VTS authority and a participating vessel should be conducted in accordance with the Guidelines and Criteria for Ship Reporting systems and

should be limited to information essential to achieve the objectives of the VTS*. IMO Standard Marine Communication Phrases should be used where practicable.

2.4.2 In any VTS message directed to a vessel or vessels it should be made clear whether the message contains information, advice, warning, or an instruction.

2.5 Organization

2.5.1 Elements of a VTS

In order to perform the required tasks a VTS organization requires adequate staff, housing, instrumentation and procedures governing operations and interactions between the various elements. The requirements in each field are determined by the particular nature of the VTS area, the density and character of the traffic and the type of service that is to be provided. Consideration should be given to the establishment of back-up facilities to sustain and maintain the desired level of reliability and availability.

2.5.2 Tasks that may be performed in accordance with the service rendered

2.5.2.1 A VTS should at all times be capable of generating a comprehensive overview of the traffic in its service area combined with all traffic-influencing factors. The VTS should be able to compile a traffic image, which is the basis for its capability to respond to traffic situations developing in its service area. The traffic image allows the VTS operator to evaluate situations and make decisions accordingly. Data should be collected to compile the traffic image. This includes:

.1 data on the fair*way situation, such as meteorological and hydrological conditions and the operational status of aids to navigation;

.2 data on the traffic situation, such as vessel positions, movements, identities and intentions with respect to manoeuvres, dest**ination and routeing;

.3 data of vessels in accordance with the requirements of ship reporting and if necessary any additional data, required for the effective operation of the VTS**.

2.5.2.2 Vessel's reports by communication between vessels and the VTS Centre should also be used as a major source of necessary data.

2.5.2.3 To respond to traffic situations developing in the VTS area and to decide upon appropriate actions, the acquired data should be processed and evaluated. Conclusions from the evaluation need to be communicated to participating vessels. A distinction should be made between the provision of navigational information, being a relay of information extracted from the VTS sensors and the traffic image, and the provision of navigational advice, where a professional opinion is included.

* * Refer to the Guidelines and Criteria for Ship Reporting Systems, paragraph 2.2, Communication. Resolution MSC.43(64)

** ** Refer to the Guidelines and Criteria for Ship Reporting Systems. Resolution MSC.43(64)

2.5.3 Operating procedures

Where operating procedures are concerned, a distinction should be made between internal and external procedures. Internal procedures cover operating instruments, interactions among the staff and the internal routeing and distribution of data. External procedures cover interactions with users and allied services. A further distinction should be made between procedures governing the daily routine and procedures governing contingency planning such as search and rescue and environmental protection activities. All operational procedures, routine or contingency, should be laid down in handbooks or manuals and be an integral part of regular training exercises. Adherence to procedures should be monitored.

2.5.4 Database

A VTS authority should have, if necessary for the operation of the service, a database with the capacity to retain, update, supplement and retrieve data once collected. Any data retained in a system for further use should be made available only on a selective and secure basis.

2.6 Participating vessels

2.6.1 Vessels navigating in an area where vessel traffic services are provided should make use of these services. Depending upon governing rules and regulations, participation in a VTS may be either voluntary or mandatory. Vessels should be allowed to use a VTS where mandatory participation is not required.

2.6.2 Decisions concerning the actual navigation and the manoeuvring of the vessel remain with the master. Neither a VTS sailing plan, nor requested or agreed changes to the sailing plan can supersede the decisions of the master concerning the actual navigation and manoeuvring of the vessel.

2.6.3 Communication with the VTS and other vessels should be conducted on the assigned frequencies in accordance with established ITU and SOLAS chapter IV procedures, in particular where a communication concerns intended manoeuvres. VTS procedures should stipulate what communications are required and which frequencies should be monitored. Prior to entering the VTS area, vessels should make all required reports, including reporting of deficiencies. During their passage through the VTS area, vessels should adhere to governing rules and regulations, maintain a continuous listening watch on the assigned frequency and report deviations from the agreed sailing plan, if such a plan has been established in co-operation with the VTS authority.

2.6.4 Masters of vessels should report any observed dangers to navigation or pollution to the VTS centre.

2.6.5 In case of a complete failure of the vessel's appropriate communication equipment the master shall endeavour to inform the VTS centre and other vessels in the vicinity by any other available means of communication of the vessel's inability to communicate on the assigned frequency. If the technical failure prevents the vessel from participation or

continuing its participation in a VTS, the master should enter in the vessel's log the fact and reasons for not or further participating.

2.6.6 Vessels should carry publications giving full particulars on governing rules and regulations regarding identification, reporting and/or conduct in the VTS area to be entered.

.11.4 noxious liquid substances as defined in MARPOL Annex II;

.11.5 harmful substances as defined in MARPOL Annex III; and

.11.6 radioactive materials specified in the Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes in Flasks on board Ships (INF) Code.

3 GUIDANCE FOR PLANNING AND IMPLEMENTING VESSEL TRAFFIC SERVICES

3.1 Responsibility for planning and implementing a VTS. It is the responsibility of the Contracting Government or Governments or competent authorities to plan and implement vessel traffic services or amendments to such services.

3.2 Guidance for planning a vessel traffic service

3.2.1 Local needs for traffic management should be carefully investigated and determined by analysing casualties, assessing risks and consulting local user groups. Where the risks are considered VTS addressable, in cases where monitoring of the traffic and interaction between Authority and participating vessel is considered to be essential, the implementation of a VTS, as an important traffic management instrument, should be considered.

3.2.2 A VTS is particularly appropriate in an area that may include any of the following:

.1 high traffic density;

.2 traffic carrying hazardous cargoes;

.3 conflicting and complex navigation patterns;

.4 difficult hydrographical, hydrological and meteorological elements;

.5 shifting shoals and other local hazards;

.6 environmental considerations;

.7 interference by vessel traffic with other marine-based activities;

.8 a record of maritime casualties;

.9 existing or planned vessel traffic services in adjacent waters and the need for co-operation between neighbouring States, if appropriate;

.10 narrow channels, port configuration, bridges and similar areas where the progress of vessels may be restricted;

.11 existing or foreseeable changes in the traffic pattern resulting from port or offshore terminal developments or offshore exploration and exploitation in the area.

3.2.3 In further deciding upon the establishment of a VTS, Contracting Governments or competent authorities should also consider the responsibilities set forth in 2.2 of these Guidelines and Criteria, and the availability of the requisite technology and expertise.

3.3 Further guidance on vessel traffic services

3.3.1 VTS Authorities should, in the planning of the VTS to be established, make use of available manuals prepared by and published by appropriate international organizations or associations.

3.3.2 The following references should also be consulted for further details:

.1 IMO Guidelines and Criteria for Ship Reporting Systems (resolution MSC.43(64))

.2 General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants (resolution A.851(20))

.3 The IALA vessel traffic services Manual

.4 IALA/IMPA/IAPH/World VTS Guide

ANNEX 2 - GUIDELINES ON RECRUITMENT, QUALIFICATIONS AND TRAINING OF VTS OPERATORS

PREAMBLE

1 These Guidelines elaborate specifically on 2.2.2.8 of annex 1, which requires the VTS authority to be provided with sufficient staff, appropriately qualified, suitably trained and capable of performing the tasks required, taking into consideration the type and level of services to be provided in conformity with the current IMO Guidelines on the subject.

2 These Guidelines describe the skill and knowledge qualifications required by VTS operators to provide these services. They are intended for application in both planned and existing VTS. They provide guidance in determining how VTS authorities can recruit, select and train personnel in order to carry out their tasks to provide the required VTS standards.

3 These Guidelines do not confer any powers on VTS operators, nor shall they be construed as prejudicing obligations or rights of vessels established in other international instruments.

1 INTRODUCTION

1.1 Background

1.1.1 In recent years, there has been a rapid expansion in vessel traffic services, which has led to a significant increase in the number of VTS operators required world-wide. The services offered by VTSs vary considerably, and range from simple broadcasts of meteorological and hydrological information, through exchange of information to sophisticated navigational advice and, in circumstances where the authority exists, navigation-related instruction.

1.1.2 Investigation of existing services reveals a wide variety of VTS operator entry requirements, ranging from personnel with no nautical background to those with a Master's and/or Pilot's licence. There is an equally wide variation in the type and extent of training provided to VTS operators.

1.1.3 The various levels of knowledge and skill required of the operator, and the standard of training necessary to achieve these levels, have never been fully defined on a world-wide basis. At present there are no internationally recognized qualifications for VTS operators, and the approach to recruitment and training varies widely from country to country.

1.1.4 Given the role of VTS in the provision of safety and efficiency services to shipping and in the protection of the environment, the need to avoid confusion on the part of users travelling from one VTS to another and the importance of professionalism on the part of operators in determining the extent of trust placed in the functioning and effectiveness of a VTS, it is essential that VTS personnel be adequately qualified and trained to carry out their

functions, and that the standards for such qualification and training be agreed upon internationally to a large extent.

1.2 Definitions

For the purpose of this annex, the following terms shall have the meanings defined below; however, all other terms used which have already been defined in annex 1 (Guidelines and Criteria for VTS) shall have the meanings defined therein:

.1 Advanced training - training usually carried out at the supervisory level, designed to enhance and utilize the employees' knowledge and experience to the fullest;

.2 Basic training - the training required in order to carry out the functions assigned to a position. This type of training requires a high level of supervision;

.3 Classroom training - training carried out in a classroom environment that enables trainees to acquire the knowledge and skills necessary to reach the level of proficiency required to fully perform the duties of a position;

.4 Knowledge - information about certain facts, theories, systems, procedures and other subject matter relevant to the duties and responsibilities of the position;

.5 On-the-job training - training within the work environment which is considered formal and reportable when it involves non-productive person hours; it is instructor- or computer-managed, has specific learning objectives, and has milestones to measure progress. It is structured, has specific resources devoted to or consumed by it, and the trainee within the work environment is relieved of his/her regular or normal duties;

.6 Operator competence means having the qualifications essential to effectively and efficiently carry out the functions or sub-functions assigned to a particular VTS operator position;

.7 Personal suitability means personal traits and characteristics affecting the application of knowledge and skills in the performance of the duties of the position;

.8 Qualifications - education, knowledge, skill, experience or any other attribute which are necessary or desirable for performing the duties of the position;

.9 Recruitment and selection - staffing process in which prospective job candidates are identified or considered for a position in terms of their relative suitability for a position based on certain criteria, e.g., knowledge and experience or any other matters that are necessary or desirable having regard to the nature of the duties to be performed. Candidates are selected by conducting examinations, tests, interviews and investigations;

.10 Refresher training - training carried out to maintain a certain level of performance, skill in areas or knowledge which are infrequently used and where consequence of non-performance is great;

.11 Simulator training - training carried out in an appropriate environment in order to practice skills and perform the duties of the position;

.12 Skill - relevant aptitudes or prescribed level of occupational achievements which are basic to the performance of the duties and responsibilities of the position;

.13 Standards - criteria, features, methods or processes which are recognized as or agreed to be models for imitation against which like activities will be compared or measured;

.14 Sub-functions - specific processes and procedures which are component activities of a particular function;

.15 Training - a process of combining instruction and practice to provide employees with the skill, knowledge and experience necessary to perform in their present/future jobs both efficiently and effectively;

.16 Upgrading training - training to improve existing skills;

.17 VTS category - refers to a means of identifying the type and level of services provided by a VTS based on geographical or organizational considerations. For example, a VTS operating in a port and its approaches could be categorized as a port VTS. A VTS in which participation is required by law could be categorized as a mandatory VTS, as opposed to a voluntary VTS;

.18 VTS functions - can be subdivided into internal and external functions. Internal functions are the preparatory activities that have to be performed to enable a VTS to operate. These include data collection, data evaluation and decision making. External functions are activities executed with the purpose of influencing the traffic characteristics. They relate to the primary traffic-management functions of rule-making, allocation of space, routine control of vessels and manoeuvres to avoid collisions, as well as to other management functions such as enforcement, remedial and ancillary activities. The reasoning behind these traffic-management functions and their relationship to the VTS services is set out in paragraph 6.4;

.19 VTS operator - a VTS operator is an appropriately qualified person performing one or more tasks contributing to the services of the VTS. However, for the specific purposes of these Guidelines, VTS operator further means a person who provides, if duly authorized, instructions and information to vessels and decides what action should be taken in response to data received. This person may be directly responsible for communications within a defined geographical area within a VTS area, or may relay such information and decisions through an intermediary; and

.20 VTS operator position - a position in a specific VTS from which a VTS operator carries out the VTS functions as defined for purposes of these Guidelines.

2 OBJECTIVES AND AUTHORITY

2.1 Objectives

2.1.1 The objectives of these Guidelines are:

.1 to provide authorities with a logical process to follow in selecting and recruiting VTS operators, and in establishing qualification and training standards which will ensure that the necessary knowledge and skill profiles exist to enable them to carry out their functions to appropriate standards; and

.2 to establish knowledge and skill requirements and standards which VTS operators should meet with respect to certain functions.

2.2 Competent authority

2.2.1 Subject to their own national and local requirements and constraints, authorities will need to establish training requirements for their VTS operators. Authorities will also need to set specific knowledge, skill and personal suitability standards which operators must meet. Nothing in these Guidelines derogates from that power or imposes any obligation on authorities.

2.2.2 These Guidelines should not be construed as conferring any additional power on authorities with respect to the operation of a VTS outside territorial seas.

3. FRAMEWORK

3.1 Explanation of framework

3.1.1 These Guidelines provide a framework within which authorities can meet their obligations as laid down in annex 1 to provide VTS operators with the competence to carry out their designated functions, independent of the level of qualifications of personnel recruited. This framework is shown in figure 1.

3.1.2 The framework outlines the steps that should be taken by a VTS authority to ensure that its VTS operators are competent to carry out assigned tasks. These steps are in two stages:

.1 Stage 1:

Preliminary steps to be able to take decisions relative to operator competencies (prerequisites for the system).

.2 Stage 2:

Steps to ensure that operators possess or achieve, and then maintain, the level of competence required to carry out their assigned functions (system parameters).

3.1.3 In order to implement the steps outlined above, VTS authorities must be prepared to bring to bear certain competencies which are normally available to them. Specifically, input is required from VTS operations and from training and human resources expertise in order to successfully design and implement a programme to match VTS operator competencies with operational need. The particular areas where such expertise is required are indicated in figure 1.

4 PREREQUISITES FOR THE SYSTEM

4.1 In order to be able to identify, develop and implement a system for VTS operator qualification and training, authorities should first take a number of preliminary steps in order to ensure that the operator's competencies are appropriately aligned with the functions for which he/she is responsible. These steps are as follows:

.1 Implementing a VTS - make a decision, or have made a decision to implement a VTS.

.2 Identification of VTS functions - identify and describe the detailed functions relevant to the given VTS. These detailed functions have been developed from the general VTS functions described in 2.3 and 2.5 of annex 1.

.3 Organization of VTS centre functions - organize the functions according to how they are to be carried out in accordance with the organization of the internal VTS operation.

.4 Establishment of VTS operator positions - be prepared to establish, or have already established, operator positions within a VTS, determine what functions will be carried out from which positions, and be prepared to ensure that there will be personnel occupying those positions who have been given responsibility for carrying out the identified functions.

4.2 Plans for recruitment and selection of VTS operators can be developed once these steps have been completed.

SYSTEM PARAMETERS

5.1 General

5.1.1 The views of authorities on recruitment qualifications may vary between a preference for a low qualification entry requiring a high degree of training, to a preference for a high qualification entry requiring a low degree of training. Clearly, if a high entry qualification is combined with relevant local experience, training requirements will be minimized.

5.1.2 Ideally, authorities should have the ability to specify the background and prior experience a VTS operator should have, but due to circumstances, this is often beyond their control. They should, however, be able to specify the level of skill and knowledge that a recruit must have achieved based on this prior experience (e.g., master mariner, top level air traffic controller).

5.1.3 VTS authorities should therefore establish methods of assessing the skill and knowledge of recruits and existing VTS operators relative to the requirements of the tasks or functions they perform.

5.1.4 Depending on the skill and knowledge levels previously acquired, and the tasks or functions to be performed, authorities may need to supplement existing qualifications with appropriate training to make up any deficiencies.

5.2 Recruitment and selection

5.2.1 Authorities should establish entry standards for new VTS operators coming into the system in terms of prior skills, knowledge, and personal suitability characteristics relevant to the tasks or functions they will be required to perform. These skills and knowledge may in part be assessable through existing qualifications (e.g., master or pilot's licence).

5.2.2 VTS authorities may wish to consider introducing additional screening mechanisms to ensure that recruits have the necessary aptitudes, personal suitability characteristics, and

ancillary skills for the functions they will be assigned. These mechanisms will assess, inter alia, ability to meet medical standards commensurate with the working conditions of the VTS position in question, spatial problem-solving capabilities and other job-related aptitudes, ability to work under pressure; and language capability required for the particular VTS.

5.3 Qualifications

5.3.1 Authorities must be able to determine what competencies a VTS operator must possess to carry out assigned functions, in order to establish the combination of prior qualifications and subsequent training required to ensure that their operators are competent.

5.3.2 To this end, they should analyse in detail the tasks which the operator will have to carry out in order to accomplish the specified functions, in terms of the skills and knowledge which he/she must possess to implement them successfully.

5.3.3 Having carried out the task analysis, authorities must specify the types of skill and knowledge which operators must possess in order to perform their functions. These skill and knowledge components should relate directly to the functions to be performed, and should be specified in such a way that authorities will be able to determine whether:

.1 VTS operators possess them in terms of their prior qualifications and experience; or

.2 whether additional training will be needed to provide them.

5.3.4 Once the necessary types of skill and knowledge have been established, authorities should determine to what level they must be possessed by a VTS operator. Authorities therefore have a responsibility to establish performance standards for skill and knowledge types to be acquired.

5.3.5 Because not all VTSs carry out the same range of functions, and because some operators may only carry out limited functions within a particular service, authorities may be required to identify different knowledge and skill levels for operators based on the tasks they perform in the VTS in which they work.

5.4 Training

5.4.1 Where the types and/or levels of skill and knowledge possessed by a VTS operator, by virtue of his or her prior experience and qualifications, do not fully conform to those required in order to carry out assigned tasks, authorities should provide compensatory training in areas of deficiency.

5.4.2 Authorities should establish concomitant training standards for those areas where they train VTS operators to the proficiency requirements of their positions. These training standards should form the basis of any training programme to be developed and delivered to VTS operators.

5.4.3 Based on the training standards, authorities should then be prepared to develop and implement a training programme which, when taken together with relevant existing

experience, will provide the VTS operator with necessary skills and knowledge to perform his/her tasks to the required standards.

5.4.4 There are a variety of mechanisms by which training can be carried out. These include training provided by authorities directly, contracted-out training or any other training establishment common to interested Administrations, which trains VTS operators for a number of authorities.

5.4.5 Authorities may also wish to consider the need to provide different types of training, with different levels relative to each type, in order to ensure the acquisition and maintenance of the relevant skills and knowledge necessary to meet job requirements, according to the following matrix:

TYPE OF TRAINING LEVEL OF TRAINING	**CLASSROOM**	**SIMULATOR**	**ON THE JOB**
BASIC	X	X	X
ADVANCE	X	X	X
UPGRADING	X	X	X
RFEFRFESHER	X	X	X

Authorities should be aware of the advantages of a modular approach to training for ease and cost-effectiveness of training delivery.

5.4.6 Authorities may wish to institute a system of examinations to determine whether or not operator experience, qualifications and training are resulting in performance to required standards.

5.4.7 Once suitably qualified and trained employees are performing on the job, their performance must be observed and monitored to ensure that it continues to meet the established standards.

5.4.8 Authorities should be aware that for an operator to carry out VTS functions effectively, training may be required in areas not specifically related to VTS (e.g., typing, supervisory skills), and which are not specifically covered in these Guidelines.

5.5 Certification

Authorities may wish to introduce a formal system of certification as a means of ensuring and demonstrating to system users that a mechanism is in place which matches employee competence with task requirements.

6 DETERMINING SKILL AND KNOWLEDGE REQUIREMENTS ASSOCIATED WITH VTS FUNCTIONS

6.1 The process used to determine the knowledge and skill types and levels required by VTS operators to carry out specific VTS functions is outlined below. It can also be used by authorities to determine how they might wish to establish the difference between skill and knowledge levels required of VTS operators on recruitment (prior qualifications) and those which will be provided after recruitment (training). Additionally, it can be used to determine the type and degree of training which should be provided to operators already employed by VTS and who may possess some form of prior qualification.

NOTE: It must be noted by authorities that this process is a model only. Authorities wishing to make use of this process must keep in mind that it will need to be adapted to meet their specific local requirements.

Also, because it is not a mathematical model, authorities must also keep in mind the importance of the human decision-making function, which cannot be scientifically measured, and therefore cannot be completely addressed in this process.

Consequently, in determining skill and knowledge types and levels for VTS functions, authorities will need to decide on the level of freedom VTS operators will have in making decisions based on judgement.

6.2 The general process for determining skill and knowledge requirements is as follows:

.1 define terms and identify functions to be considered. Functions or sub-functions may be classed as H(igh) or L(ow) to indicate the involvement of VTS operators;

.2 divide functions identified into sub-functions. This process of subdivision will be continued as long as necessary to identify the skill and/or knowledge requirements necessary on the part of the VTS operator in order to perform the function. The results of this breakdown will be a list of skill and knowledge components, all of which are detailed actions to be performed, the sum of which constitutes carrying out the function (this process is illustrated in figure 2 and an example of it shown in figure 3);

.3 at the final level of sub-division, make each component action sufficiently detailed to enable it to be classified as either skill or knowledge to be performed; and

.4 review and verify that sub-division is complete.

6.3 Once the individual component actions have been classified in this manner, the level of skill or knowledge required for their performance will then be evaluated. The following criteria will be used, on a weighted basis:

.1 frequency - how often the task is performed;

.2 percentage of time used in performance of the task relative to other tasks;

.3 value - importance of the particular skill or knowledge in the performance of the task, whether "must know" (mandatory), "should know" (important), or "nice to know" (optional);

.4 liability - consequence of error or omission during the performance of a function;

.5 performance standard - how well must the individual perform in the conduct of the task and the learning difficulty associated with it;

.6 verification and intervention - whether the individual can perform the task with or without supervision;

.7 performance tools - equipment and established procedures involved in the implementation of the function; and

.8 reasons why the performance of the task is important.

Skills involved include, but are not necessarily restricted to: ability to operate communications and surveillance equipment; ability to do chart work; ability to provide navigational assistance; and ability to operate ancillary equipment such as telephones, telex, tide and meteorological equipment. Examples of knowledge which may be required include: local geography; principles of navigation; applicable acts, regulations, agreements and publications; communications procedures and vocabulary*; principles of organization of vessel traffic.

6.4 In the definition in 1.2.18 a number of traffic management functions have been identified. A VTS can play an important role in the execution of these functions, which may be taken as the basis for the process described in 6.1 to determine the skill and knowledge types and levels for VTS operators contributing to the execution of traffic-management functions. The objectives of traffic-management functions and their relationship to the VTS services are briefly described below:

.1 Internal VTS functions:

- data collection; and

- data evaluation/decision making.

.2 Traffic management functions:

.2.1 Primary function:

allocation of space. This is effecting separation in space and/or time between vessels, or certain categories of vessel, by forward planning. It is a strategical function that can be performed by a traffic organization service;

routine control of vessels. This is a shipboard process to which a VTS contributes by supplying data relevant to the navigational decision-making process on board. This function relates to an information service and/or a navigational assistance service;

manoeuvres to avoid collisions. This is a shipboard function concerning ships in encounter situations. It may be assisted by a VTS. It is a tactical function and relates to an information service and/or a navigational assistance service.

.2.2 Enforcement function

The objective of this function is to encourage and monitor adherence to applicable rules and regulations and to take appropriate action where

required and within the authority of the VTS. Some aspects of this function might be covered by a traffic organization service.

* Refer to the Standard Marine Navigational Vocabulary as replaced by the IMO Standard Marine Communication Phrases

Remedial functions

These functions are aimed, primarily, at reducing the effects and consequences of incidents, such as search and rescue, salvage and pollution. These functions may be performed by a VTS in support of allied activities.

Other functions

These functions relate to co-ordination and liaison between vessels and third parties. They may be performed by a VTS as support of allied activities.

vessel" as well as for the "area". Under "area" we can understand:

The **general approach** to determine the benefits is as follows:

A VTS can improve the safety of traffic by foresighted prevention of situations of an unacceptable risk, by contributing to safe encounters from the above foresighted measures and by assisting ships to keep within navigable waters. The benefits to safety of traffic achievable by a VTS depend on its type, i.e. the services provided and the functions performed.

Information Service ensures that essential information is available in a timely manner to the shipboard decision process, either by broadcast at fixed times or if deemed necessary by the VTS, and is normally provided to the general traffic. The benefits may be limited by the lower update rate and the fact that certain information may be available from other sources (wind and tide indicators, weather forecasts, signals, etc.). In any case, the ships may be better able to adapt their behaviour to the prevailing conditions and thus achieve a safer flow of traffic and avoidance of unnecessary delays.

Traffic Organisation Service concerns the forward planning of movements to prevent the development of dangerous situations. Enforcement is an integral part. Special care can be given to ships with dangerous or noxious cargoes. The benefits mainly refer to the reduced risk from situations which ships even with careful observation can not foresee as well as better use of resources and reduction of high speeds followed by unnecessary waiting times. They depend on the knowledge of not only ships' positions, but also identities, sizes, cargoes, movements and destinations. It further depends on the range and reliability of the traffic extrapolations.

Navigational Assistance Service assists the navigational decision making process on board, participating by information and advice. Special care can be given to ships with dangerous or

noxious cargoes. The achievable benefits depend on resolution and accuracy of the VTS equipment, the reliability of VTS information and the capabilities of the VTS personnel. If information on the fairway related position, the adjacent traffic and on demand course advice is provided on a continuous basis, this service has proven to remarkably contribute to the safety of traffic. It also reduces the "down time" and delays for both vessel and other activities in the area, in particular in bad conditions.

Co-operation with allied services and other interested parties is a supporting service exchanging information, using common data bases and action agreements. It can achieve benefits by taking into account the availability of resources of allied services when establishing sailing plans, by assisting emergency services according to pre-established plans, by providing adjacent VTSs with advance information and by interacting with the traffic in accordance with agreed actions. In this way, it may reduce the probability or consequences of accidents and avoid adverse interactions on the traffic as well as improving the (economic) performance of the allied and other services and the reporting burden of the ships and agents.

After determination of the types and associated level of the above mentioned services which are going to be offered by the VTS a calculation of the benefits can be carried out by the following steps:

- registration of incidents which happened in the area under consideration when there was no VTS (types of accidents, e.g. standings, collisions, circumstances during the incidents, e.g. visibility, tide, storms, behaviour of affected ships, probable reasons which led to the incidents)

registration of traffic

Figure 1 – A system for development of recruitment, qualifications and training of Vessel Traffic Service

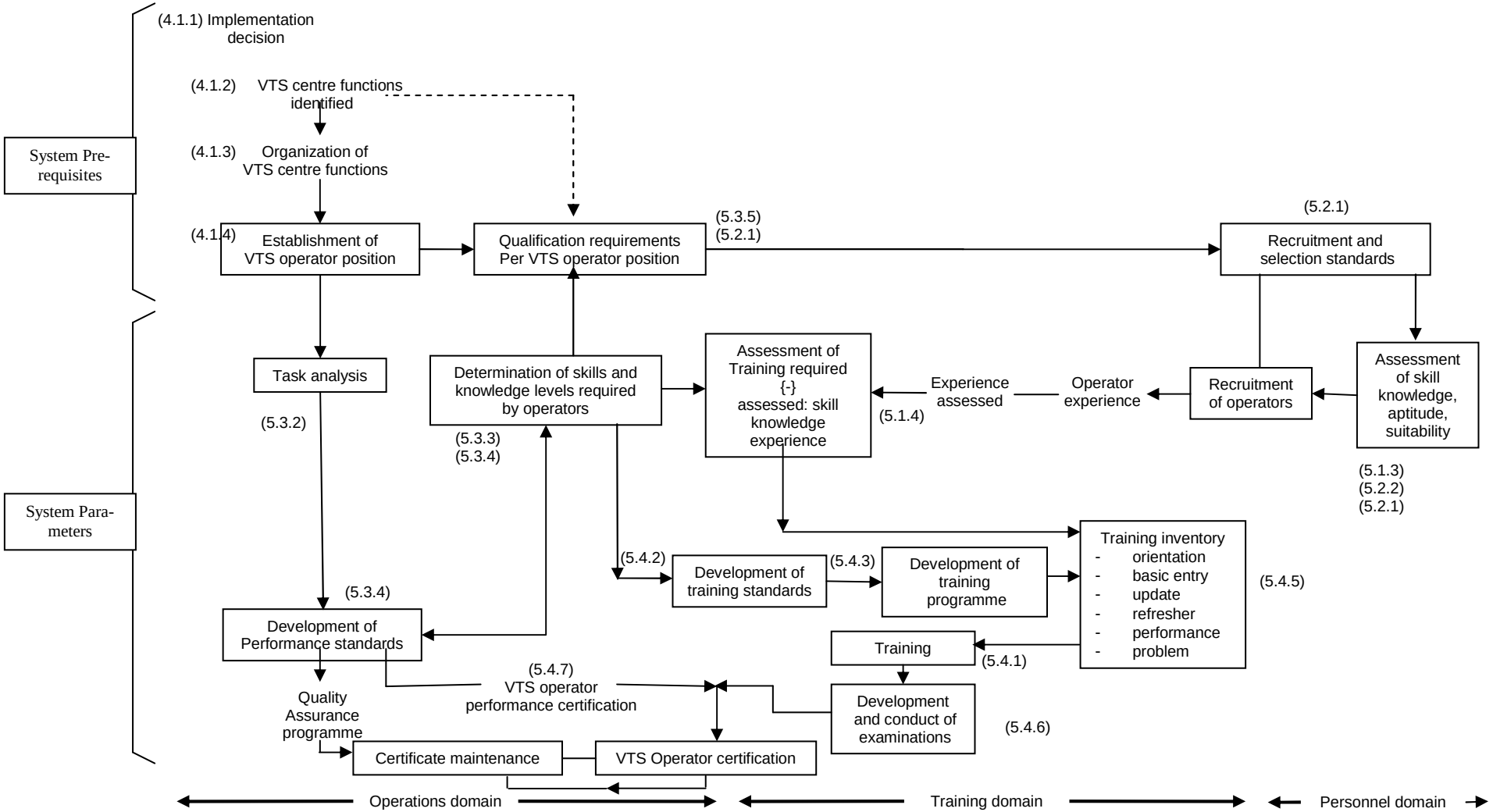


Figure 2. ANALYSIS OF FUNCTION INTO SKILL AND KNOWLEDGE COMPONENTS

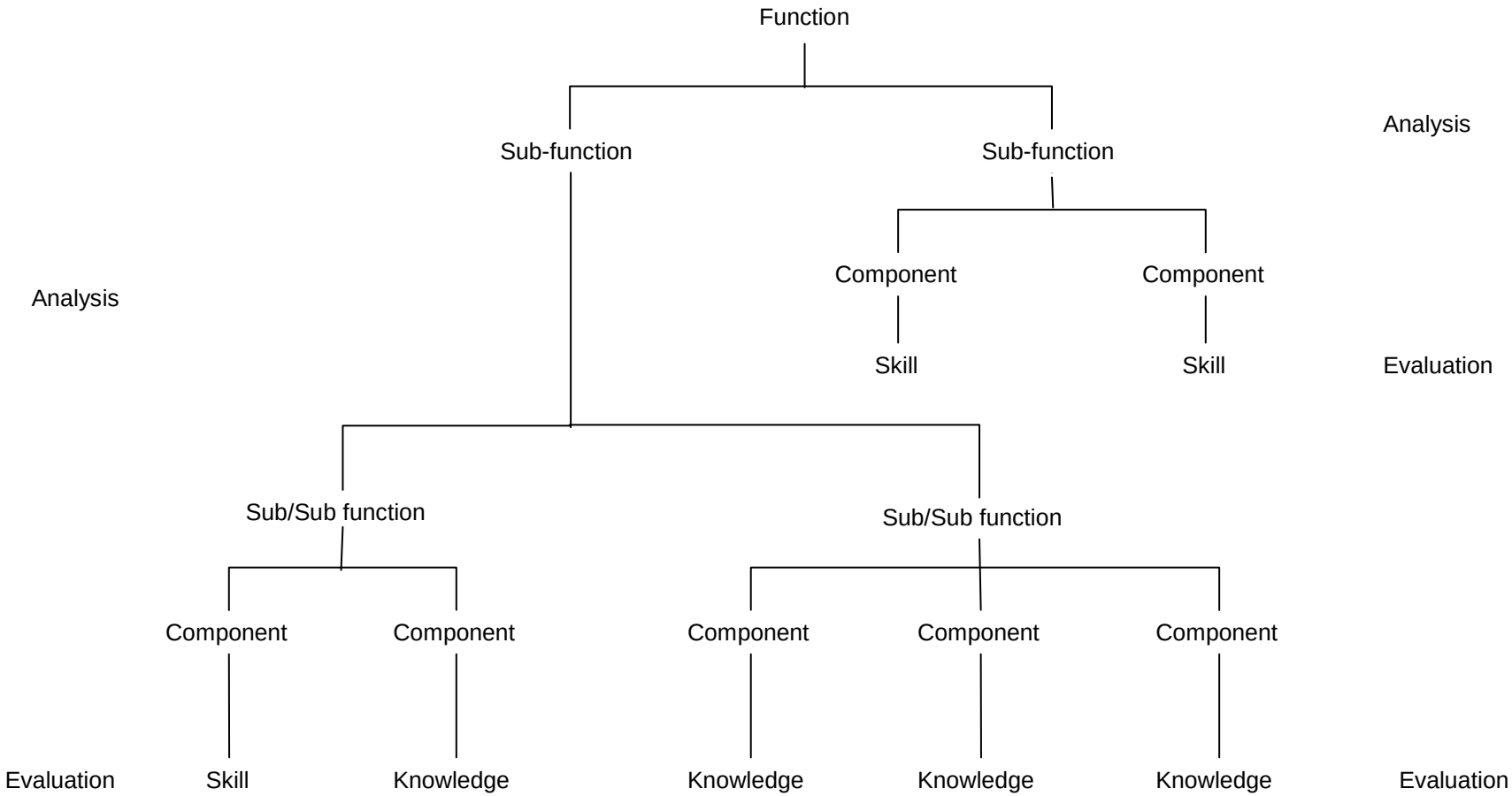
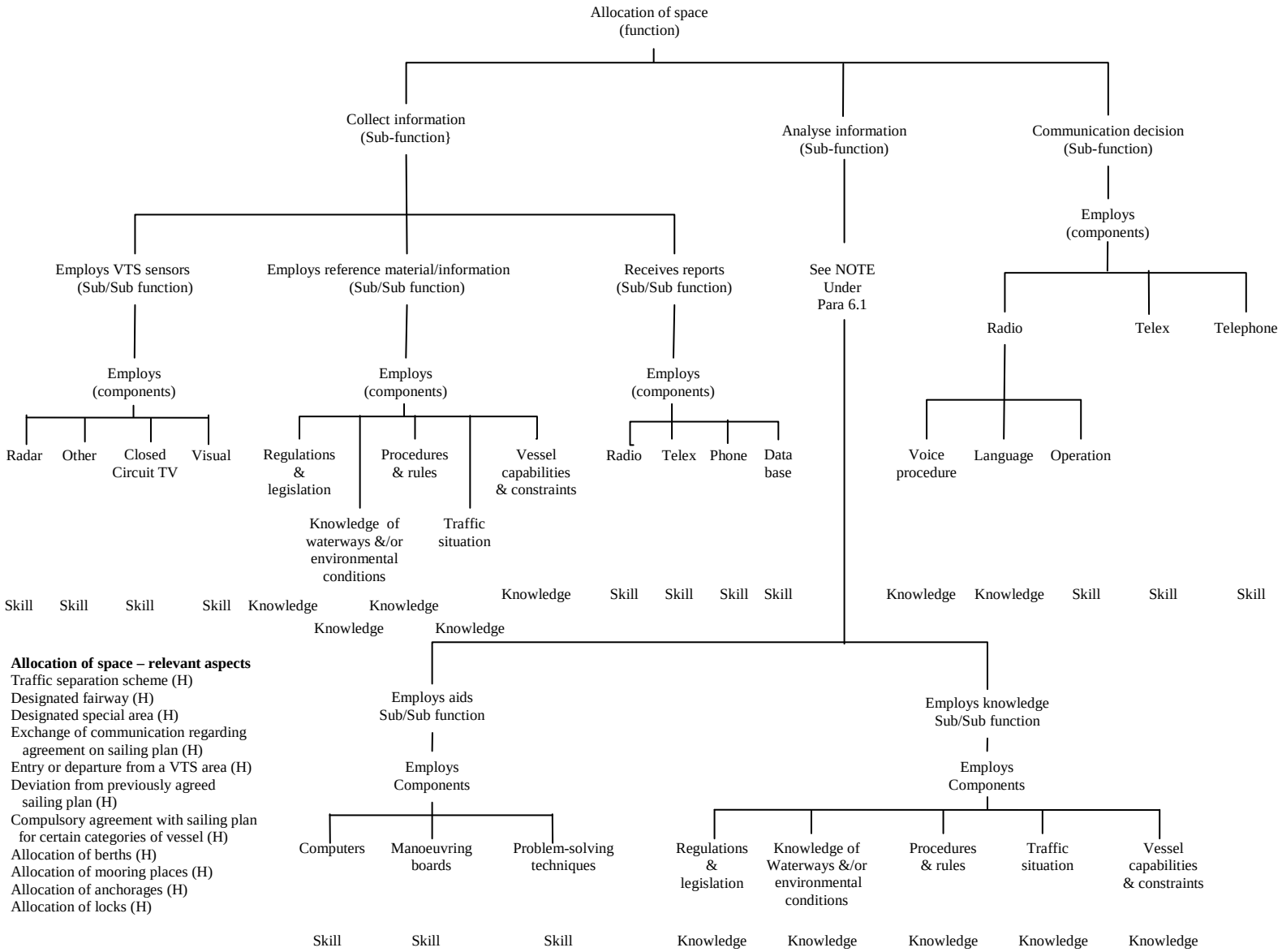



Figure 3 – Analysis of traffic-management functions into skill and knowledge