IALA GUIDELINE

G1045
STAFFING LEVELS AT VTS CENTRES

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CONTENTS

1. INTRODUCTION

IMO Resolution *A.1158(32) Guidelines for Vessel Traffic Services* identifies competencies for training and qualifications required by VTS personnel and recognizes IALA as the authority for establishing the appropriate standards.

IALA provides guidance in determining how VTS Authorities may recruit, select and train personnel in order to carry out their tasks thereby providing the required VTS standards.

In planning and establishing a VTS, the Contracting Government(s) or the competent authority should:

- ensure that the VTS provider has the equipment and facilities necessary to effectively accomplish the objectives of the VTS; and
- ensure that the VTS provider has 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.

The purpose of a VTS is to contribute to safety of life at sea, improve the safety and efficiency of navigation and support the protection of the environment within a VTS area by mitigating the development of unsafe situations. In fulfilling this purpose, VTS personnel are required to interact with other mariners with responsibility for safety. It is therefore essential that the VTS operational staff demonstrate a high standard of professionalism and that they are trained and qualified according to the current international IALA standards.[1]

VTS personnel should be capable of providing the service in the specified VTS area. Depending on the characteristics of a VTS Area, such as traffic patterns and densities, a VTS Centre may comprise VTS Operators (VTSOs), VTS Supervisors and a VTS Manager. It is for the VTS provider to determine the levels of staffing sufficient to meet its obligations and to ensure that trained personnel are available to undertake these commitments.

Key to all VTS operations is the VTSO. Regardless of the size or complexity of the respective VTS area, all VTS Centres are likely to require VTSOs who have been trained and authorized to *R0103 (V-103)* standards, or similar. In VTS Centres where more than one VTSO is on watch simultaneously, the VTS provider may determine a requirement to establish the position of VTS Supervisor to assist, oversee and/or co-ordinate the activities of the watchkeeping VTSO's.

A VTS provider may elect, as part of its management infrastructure, to establish the post of VTS manager.

1.1. PURPOSE

The purpose of this Guideline is to assist authorities in determining an appropriate staffing level for a VTS Centre. Conferring with existing VTS authorities will provide a general idea of how VTS Centres are staffed. This Guideline applies as far as national law allows.

This Guideline is not intended to be prescriptive, rather it presents factors that should be considered when determining staffing levels.

2. FACTORS AFFECTING WORKLOAD

The availability of 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

1 IALA Recommendation R-103 (V-103) on Standards for Training and Certification of VTS Personnel refers.

of accuracy. Invariably this will be a balance between a number of factors which a VTS provider will need to keep under periodic review:

- Periods of duty
- Operational procedures
- Physical working environment
- Human resource requirements
- Interaction with Allied Services and adjacent VTS
- Technology, equipment and communications
- Incidents, accidents and other emergencies
- Stress-related workload

2.1. PERIODS OF DUTY

Factors for consideration when determining periods of duty for VTSOs and Supervisors include:

- Traffic volumes and densities
- Navigational complexity associated with the VTS Area
- VHF radio traffic volume
- Background noise levels
- The number of VTS interventions anticipated
- The limits within which personnel may develop and maintain situational awareness
- Health and Safety requirements, particularly when working with visual display units
- The working environment
- Shift patterns

2.2. OPERATIONAL PROCEDURES

Operational procedures have an impact on workload and should be clearly defined.[2] Each procedure should set out the actions to be taken in respect to interaction with ships; interaction with other parties and authorities; and internal and external contingency situations.

Operational procedures should be developed to eliminate duplication of tasks and to support decision-making. They should be reviewed and updated at regular intervals in accordance with VTS quality management system standards to ensure their relevance to VTS aims and objectives.

For example, internal procedures may include the keeping of logbooks whether in manual or electronic format. Passage plans[3] may differ in the way in which they are handled, recorded and broadcast which may affect the workload and staffing levels with respect to the preparation and execution of the passage plan. Any possible deviation from the agreed passage plan requires more attention from VTS personnel.

2 IALA Recommendation *R0127 (V-127) VTS Operations* and Guideline *G1141 Operational Procedures for Delivering VTS* - refer

3 IMO resolution *A.893 (21) Guideline for voyage planning*

2.3. PHYSICAL WORKING ENVIRONMENT

The physical working environment includes temperature, ventilation, lighting (including emergency lighting), room dimensions, suitability of workstations and seating. Facilities should be provided for washing, eating, resting, as well as toilet facilities.

VTS providers should make arrangements for enforcing health and safety measures derived from the risk assessment. These measures should cover planning, organization, control, monitoring and review. VTS providers should also consider the working conditions and risks when selecting equipment suitable the identified tasks and ensure the equipment is properly maintained.

Additional considerations include problems associated with continuous viewing of display screens, attention/concentration levels; general ergonomics of working environment and noise/distractions within the work area.

2.3.1. CONTINUOUS VIEWING OF VTS DISPLAYS

Continuous viewing and manipulation of the VTS display may lead to musculoskeletal problems, visual fatigue and stress. Health problems can result from poor work organization, ergonomic design, working environment, job design, posture and inappropriate work methods. Health problems associated with display screen work can be prevented by careful design of the workplace as well as by operator training and consultation.

2.3.2. ATTENTION/CONCENTRATION LEVELS

The performance requirements may demand high levels of attention and concentration, for extended periods of time, where consequences of error may be critical.

2.3.3. ERGONOMIC DESIGN

The immediate environment within which the VTS personnel work should reflect an ergonomic assessment in order to facilitate effective delivery of services and to support the health and well-being of VTS personnel. An analysis should include the optimum ergonomic design of workstations and placement of equipment within the VTS work area.

2.3.4. NOISE/DISTRACTIONS/LIGHTING

Consideration should be given to minimizing noise levels and other possible distractions within the VTS Centre. Careful management of lighting levels may also improve the overall working environment.

An inadequate working environment will have a negative impact on the performance of the VTS personnel and may affect their ability to discharge their responsibilities.

2.4. HUMAN RESOURCES

Collective agreements, contracts and terms of employment for VTS personnel should be taken into consideration when determining the staffing levels.

Staffing levels may need to accommodate training and assessment activities.

Careful assessment of the functions required of VTS personnel should be considered to ensure that their primary safety role is not compromised. The requirement for additional or “call-in” personnel should also be considered when necessary to ensure the primary role is maintained.

Consideration should be given to the rotation of watchkeeping VTS personnel and the need for rest breaks, depending on the intensity of work and the overall working environment. Due to the unique circumstances in each VTS Centre, it is not appropriate, nor possible, to specify the length or number of breaks necessary to avoid fatigue.

2.5. PROVISION OF A VTS

Many variable factors relating to the provision of a VTS can influence the workload, for example:

- Peak and lull periods in vessel traffic
- Extreme weather and emergency situations
- The size of the VTS Area, number of sectors
- Type of traffic, traffic density and monitoring of the VTS traffic image
- The frequency with which the VTS has to respond to developing unsafe situations
- The resolution and accuracy of the VTS equipment and the reliability of the VTS information being processed
- Requirements for the forward planning of movements
- Enforcing adherence to governing rules and regulations
- Issuing traffic clearances in respect of the priority of movements
- Establishing routes to be followed

2.6. INTERACTION WITH ALLIED SERVICES AND ADJACENT VTS

The workload of VTS personnel is likely to be influenced significantly by the degree to which a VTS is required to co-operate with Allied Services, Port Operations, Emergency and Security services and adjacent VTS. Such activities can support the functions of the VTS, and therefore, increase safety and efficiency. To ensure that VTS personnel are not distracted from the primary responsibilities, it may be necessary to carry out a careful analysis of the workload associated with supporting Allied Services.

Co-operation with Allied Services reflects both safety and efficiency. It should be a continuous process and is of particular importance in cases where a passage plan is to be established, and action agreement between services is required. Procedures for the co-operation between parties should be established. The co-operation with port operations relates primarily to efficiency but may be an important factor in establishing a passage plan.

Co-operation with adjacent VTS can be of particular interest where two such services share a common area/region border. In these instances, the VTS may need to coordinate jointly with the master of a ship when the passage plan is being agreed. In other cases, it should be recognized that the exchange of data between VTS could give advance notice of arrivals, thus relieving the vessels the burden of reporting. It could also provide an administration with valuable information on future traffic and cargo flow in its intermediate sea area.

Co-operation with other services such as Search and Rescue, Emergency, Security and Pollution Control should be conducted in accordance with pre-established contingency plans which clearly state responsibilities and procedures for such co-operation.

VTS providers should take into consideration that the main responsibility of VTS personnel should be, at all times, to interact with the traffic and respond to traffic situations developing in the VTS area. Appropriate staffing to cope with overlapping tasks should always be provided.

2.7. TECHNOLOGY AND EQUIPMENT

VTS providers should be aware of the fact that technical equipment may have either a positive or negative effect on workload. It should be noted that the complexity and sophistication of the software and hardware of the systems

used in the VTS Centre may require high levels of attention and concentration by VTS personnel, especially when new systems are installed.

When drawing up the specification for VTS equipment[4], careful consideration should be given to ensure that the equipment is capable of maintaining a high level of reliability and flexible in order to keep up with technological advances. If this is not considered, the system will become less effective and thereby increase the workload of the user. The experience of VTS personnel in operating VTS equipment is useful when drawing up new specifications. When new or updated equipment is introduced, training for VTS personnel should always be considered. The need and degree of equipment redundancy necessary for specific VTS functions offered should be assessed.

Decision support tools (DST) may be used in VTS centres to enhance situational awareness. These tools can assist VTS personnel in decision making activities at operational, tactical and strategic levels. Interaction between VTS personnel and the equipment is through a human/machine Interface (HMI). The goal of the HMI is effective operation and control of the machine on the user's end with feedback from the machine, to aid VTS personnel in making operational decisions[5]. There are elements of equipment or system design in VTS Centres that can significantly change the workload on the VTS personnel, for example:

- Presentation of information
- Ergonomic design of interfaces and workstations
- Reliable voice communications
- Visual and audible indications
- Recording of voice and data

Implications of technology developments may also have an impact on staffing levels. These new technologies may increase or reduce the need for VTS personnel.

2.8. COMMUNICATIONS

Communications between ship and shore are an essential component of a VTS. Each type of communication handled by VTS personnel demands interpretation and action, generating workload. The VTS provider should consider the most effective method for composing and transmitting information.

2.8.1. RADIO

Effective radio communications directly contribute to navigational safety and efficiency; conversely, ineffective communication and misunderstandings may contribute to near misses and accidents. Effective communication is therefore, an essential part of the duties of VTS personnel[6].

A reduction in radio generated workload can be achieved by the introduction of written procedures based on IALA documentation. Radio communications should be conducted in a manner that is clear, concise and procedurally correct. Standardized communication significantly contributes to communication in different languages and aids time management. Standard Marine Communications Phrases (SMCP) - IMO Resolution *A.918(22)* [5] – includes message markers which should be used in standard communication practice. The use of phrases in IALA guidance and SMCP will often reduce workload for VTS personnel and participating vessels.

Radio generated workload can be affected by the use of an alternative means of exchanging information between ship and shore, such as VHF/DSC and AIS. Text based radio messages are often easier to understand and can reduce communication difficulties caused by spoken English. However, text messages can be more time consuming to

4 IALA Guideline *G1111 Preparation of Operational and Technical Performance Requirements for VTS Systems* refers.

5 IALA Guideline *G1110 Use of Decision Support Tools by VTS Personnel* refers.

6 IALA Recommendation *R1012 VTS Communications* and IALA Guideline *G1132 VTS Voice Communication and Phraseology* refer.

compose and may increase workload. Similarly, the need for closed loop communications may generate an increase in workload and affect the staffing level.

The level of radio communications is strongly influenced by the number of reporting points and traffic density and staffing levels should reflect this. The number and location of the reporting points should be kept under review in order to reduce radio communications.

2.8.2. TELEPHONE AND OTHER COMMUNICATIONS

The VTS Centre is the heart of a complex web of information, which can result in the reception of a large number of enquiries by telephone not directly connected with the VTS function. Each telephone call made or received by VTS personnel generates workload.

Where VTS Centres have responsibility for tasks additional to vessel traffic services, staffing levels may need to be enhanced accordingly. VTS providers should develop a clear policy on the nature of telephone communication to and from the VTS Centre.

One way of reducing telephone communication is to ensure that appropriate means are available to facilitate the access of information to relevant parties concerned (i.e., through a computer network or the Internet).

2.9. INCIDENTS, ACCIDENTS AND OTHER EMERGENCIES

The potential for an incident or unexpected event to occur is always present. Any incident within the VTS area or in the VTS Centre will create additional workload for the staff on duty – the more serious the incident, the greater the increase in workload.

A staffing level that is only able to deal with the expected workload will certainly be overloaded when an incident, emergency or unexpected event occurs. VTS Centres should have contingency plans to deal with internal and external incidents in the VTS area. The activation and execution of these plans may have an effect on the staffing levels. Appropriate arrangements should be part of any contingency plan. Debriefing of these events contributes to the ability of the staff on duty to deal with them.

2.10. STRESS RELATED WORKLOAD

Workloads, which are too high or too low, can affect efficiency, operational safety, personal health and/or motivation. This type of individual workload could be characterized as either hyper- or hypo- stress.

Hyper-stress can be caused by high workload. It may impair or prevent personnel from interpreting information, making effective decisions and taking the appropriate action. Appropriate measures (e.g., additional or reallocation of VTS personnel) should be taken in order to maintain the required performance.

Hypo-stress can be caused by either prolonged inactivity or low workload. It can have a negative impact on the performance and motivation of the VTS personnel.

Over-staffing can create boredom and monotony in the workplace and reduce the possibility of gaining and maintaining experience and developing professional skills. An underemployed individual or a team may result in attitudes that might be unacceptable within the VTS organization and the associated stakeholders.

3. PERFORMANCE MEASUREMENT

A VTS should operate within set terms of reference, which should be incorporated into a mission statement or a service level agreement.

VTS managers, supervisors and operators should be aware of the aims and objectives of the VTS. Once the aims and objectives are defined, measurement of performance should be carried out to determine whether these are

being met. Measurement could be determined by the evaluation of internal management information, by a formal survey of stakeholders, or by a combination of both.

The outcomes measured will be driven by the agreed terms of reference and may include:

- Response times to calls and enquiries to the VTS
- Number of targets that each VTSO has to monitor at any one time
- Traffic patterns, density, geography of the area and potential risk of incident
- Risk assessments in terms of probability and impact
- Actual numbers of incidents historically, their distribution in time, and their frequency and impact indicators

Staffing levels may need to be adjusted to ensure desired outcomes are achieved.

4. SUMMARY

A VTS Centre should have a sufficient number of VTS personnel to ensure that the VTS operations can be carried out efficiently and safely under all conditions, with due regard to the safety of navigation within the VTS area. Every VTS Centre should be staffed by personnel appropriately qualified for the tasks required, and with a number corresponding to the size of the VTS Centre and VTS area to be managed.

When determining, approving or revising staffing levels, the VTS provider should consider the principles in applicable international and national instruments on staffing levels, as well as the need to avoid or minimize excessive hours of work to ensure sufficient rest and to limit fatigue.

Further details concerning labour regulations may be found in national/regional or international legislation.

5. DEFINITIONS

The definitions of terms used in this Guideline can be found in the International Dictionary of Marine Aids to Navigation (IALA Dictionary) at http://www.iala-aism.org/wiki/dictionary and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

The following definitions are specifically related to this Guideline:

Allied Services	Allied Services are services actively involved in the passage of the vessel through the VTS area.
Competent authority	Competent authority means the entity made responsible by the Government for vessel traffic services.
Duty	A period of duty is the total time that VTS personnel will be required to be present at the VTS Centre irrespective of whether or not they are carrying out actual watchkeeping duties at a VTS workstation.
Vessel traffic service or vessel traffic services (VTS)	VTS means a service, or services, implemented by a Government with the capability to interact with vessel traffic and respond to developing situations within a vessel traffic service area to improve the safety and efficiency of navigation, contribute to safety of life at sea and support the protection of the environment.
VTS area	A VTS area is the delineated, formally declared service area of the VTS. A VTS area may be subdivided in sub-areas or sectors.

VTS provider	VTS provider means the organization or entity authorized by the Government or competent authority to provide a vessel traffic service.
VTS centre	A VTS centre is the centre from which the VTS is operated. Each sub-area of the VTS may have its own sub-centre.
VTS Manager	Some VTS organizations 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 (VTSO)	A VTS Operator is an appropriately qualified person performing one or more tasks contributing to the services of the VTS.
VTS personnel	VTS personnel means persons performing tasks associated with vessel traffic services, trained in vessel traffic services operations and appropriately qualified.
VTS Supervisor	An appropriately qualified VTSO carrying out supervisory duties in a VTS Centre on behalf of a VTS provider.
VTS traffic image	A VTS traffic image is the surface picture of vessels and their movements in a VTS area.
VTS workstation	A VTS workstation is the place in a VTS Centre from which VTS personnel carry out their duties.
Watchkeeping	Watchkeeping standards, including punctuality, handover, general responsibilities on watch and log-keeping. Technical watchkeeping requirements at a VTS workstation, include standard target tracking routines, VHF/DF monitoring and checks, navigation and operational checks, and equipment performance checks.

6. ABBREVIATIONS

AIS	Automatic Identification System
DSC	Digital selective calling
DST	Decision support tool
HMI	Human/machine Interface
ILO	International Labour Organization
IMO	International Maritime Organization.
ITU	International Telecommunication Union
SAR	Search and Rescue
SMCP	Standard Marine Communication Phrases
VHF	Very high frequency (30 MHz to 300 MHz)
VTS	Vessel traffic service or vessel traffic services (dependent on context)
VTSO	VTS operator

7. REFERENCES

[1] IALA. Guideline G1111 Preparation of Operational and Technical Performance Requirements for VTS Systems

[2] IALA. Guideline G1110 Use of Decision Support Tools by VTS Personnel

[3] IALA. Recommendation R1012 VTS Communications

[4] IALA. Guideline G1132 VTS Voice Communication and Phraseology

[5] IMO. Resolution A.918(22) IMO Standard Marine Communication Phrases

ANNEX A VTS STAFFING CALCULATION SPREADSHEET

This annex is a separate Excel spreadsheet and accompanies this Guideline automating the calculations from Annex B after data has been inputted.

ANNEX B POSSIBLE FORMULA FOR DETERMINING THE NUMBER OF VTS PERSONNEL REQUIRED FOR STAFFING A VTS CENTRE

This formula is designed to guide a VTS provider towards the general considerations that should be addressed in assessing appropriate staffing levels for a VTS Centre. It provides a theoretical starting point for more detailed decision making. Adjustments will then be necessary to convert this theoretical outcome into a practical solution. This approach provides a degree of objectivity in setting and establishing staffing levels. This formula is applicable to both VTS Operator and VTS Supervisor staffing levels.

Given Input Data:

'a'	= hours per day (normally 24)
'b'	= actual days per week (normally 7)
'c'	= actual days per year (normally 365.25)
'd'	= Individual (contracted) hours per working week [1]
'e'	= normal hours per shift [2]
'f'	= hours leave per year [3]
'g'	= hours sickness per year [4]
'h'	= hours training per year [5]
'i'	= Individual mins lost per shift (meals, handovers, position breaks etc.) [6]
'j'	= number of operational VTS work stations

Calculate (see calculation stages below):

'k'	= Individual hours per year before deductions
'l'	= Individual hours after deductions for leave, sickness and training
'm'	= working shifts per year
'n'	= Individual hours lost per shift (break & handover)
'o'	= total hours lost per year
'p'	= total duty hours per VTSO/Supervisor per workstation per year
'q'	= actual hours per year
'r'	= number of VTSOs/Supervisors required per VTS workstation
'T'	**= Total number of VTSOs/Supervisors required for staffing a VTS Centre**

Calculation:

Stage 1:	k = d * (c / b)	Stage 6	p = l - o
Stage 2:	l = k - (f + g + h)	Stage 7:	q = a * c
Stage 3:	m = l / e	Stage 8:	r = q / p
Stage 4:	n = i /60	Stage 9:	T = r * j
Stage 5	o = m * n		

Input data - Normally fixed for a 24/7/365 VTS

Input data - Variable

Calculated

(A separate Excel spreadsheet accompanies this Annex automating the calculations above after data has been inputted)

Notes:

1. Individual (contracted) hours per working week ('d') are the terms of employment for an individual VTSO or Supervisor; typically, between 35 – 45 hrs per week.
2. Normal hours per shift ('e') is typically 6 – 12 hours.
3. Hours leave per year ('f') should be based on the number of days leave granted multiplied only by the shift hours per day (not the full 24 hours).
4. Hours sickness per year ('g') is an estimate based on historic records and averaged across the VTS department.
5. Hours training per year ('h') should include the training hours scheduled for the year.
6. Individual minutes lost per shift for meals, handovers and breaks etc. ('i') should be based only on the individual. This will generate the necessary increase in staff required to enable staff rotation.

Next Steps:

The total, **'T'**, generated giving the "number of VTSOs/Supervisors required for staffing a VTS Centre" is the **theoretical minimum** to provide continuous cover of all workstations whilst also enabling all the criteria of leave, sickness, training, breaks and handover that have been set into the formula to be met.

It is then necessary to design a roster that will achieve this. In practice, designing a practical and workable roster is likely to result in a higher number of staff in order to meet this theoretical minimum requirement. There are, however, other practical considerations that may also need to be addressed in developing a tailored roster that meets the specific requirements of each individual VTS Centre. Some of these considerations may result in increases over the theoretical staffing level and others may result in reductions; these include:

- Consideration of local and cultural issues.
- Consideration of other shift-working arrangements that are already be in place within the organization.
- Consideration of activity levels in office hours during the working week compared with activity levels outside these hours.
- Consideration of varying but predictable traffic levels e.g., those due to tidal constraints.
- The use of a "day-worker" during periods of increased activity levels to enable staff rotation.
- Allowing staff to be stood down selectively but on immediate recall in periods of low activity.
- Substitution of a VTSO with a VTS Supervisor to allow breaks to be taken.
- Using certificated VTS Staff to support other shift work roles collocated with the VTS resulting in greater staffing efficiencies overall in a port's control and/or administration centre.