**IALA XXXX YYYY1 on**

International Association of Marine Aids to

Navigation and Lighthouse Authorities

**Measures to Evaluate the Effectiveness of VTS**

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| **1** *Consideration should be given to whether this document should be a Guideline or a Recommendation.*  *Under the new IALA document structure a recommendation is a recommended practice to aid in meeting an IALA Standard, and which may be suitable for citation in legislation or regulations.*  *Ensures that a product or service meets Expectations*  *Implicit is expectation that governments are obliged to give effect to SOLAS and 857 in domestic law.*  *A.857(20) highlights the importance of setting and meeting objectives (Refer 2.2.2.2, 2.2.2.5, 2.2.2.7 and 2.2.3.1). Further, IMSAS audit questions relating to VTS include measures to evaluate the effectiveness in implementing*  *SOLAS regulations V/12 and measures taken to evaluate effectiveness of and VTS?”* |

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# Aims and objectives

The aim of this document is to provide guidance for VTS Authorities and Competent Authorities evaluate the effectiveness of a VTS. In particular, the guidance focuses on providing assistance to:

* Meet their obligations in accordance with Regulation 12 of Chapter V of SOLAS (Vessel traffic services) and IMO Resolution A.857(20) Guidelines for Vessel Traffic Services with regards to ensuring that objectives for a VTS are set (Refer 2.2.2.2.2) and that these objectives are met (Refer 2.2.3.1).
* Respond to the IMO Resolution A.1067(28) Framework and Procedures for the IMO Member State Audit Scheme with regards to how they implement and enforce SOLAS Chapter V (Safety of Navigation) Regulation 12. In particular, to ensure measures are in place to evaluate the effectiveness in implementing SOLAS regulations V/12 and the effectiveness of VTS.

# overview

The establishment and on-going operation of a VTS is a considerable investment. To achieve the purposes for which it was implemented it needs to be effective and routinely evaluated to ensure that the operational objectives are being met, the technical and operational performance is acceptable and the issues identified and defined in determining the need for the VTS have been either alleviated or at least reduced to an acceptable level.

# international framework / OBLIGATIONS

## International Convention on the Safety of Life at Sea 74/78 (SOLAS)

Vessel Traffic Services are recognised internationally as a navigational safety measure through the International Convention on the Safety of Life at Sea 74/78 (SOLAS). In particular, the provisions in SOLAS Chapter V (Safety of Navigation) Regulation 12 provides for Vessel Traffic Services and states, amongst other things, that:

* *“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.”*

*“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.”*

SOLAS also states that contracting Governments planning and implementing VTS shall, wherever possible, follow the guidelines developed by the International Maritime Organization*.*

## International Maritime Organisation (IMO)

### IMO Resolution A.857(20) Guidelines for Vessel Traffic Services

Recognising 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 the IMO Assembly adopted IMO Resolution A.857(20) Guidelines for Vessel Traffic Services.

The Resolution describes the principles and general provisions for the operation of a VTS and participating vessels and the roles and responsibilities of contracting governments, competent authorities and VTS Authorities.

Specifically, IMO Resolution A.857(20) Guidelines for Vessel traffic Services states that in planning, establishing and operating a VTS, the Contracting Government or Governments, Competent Authority and VTS Authority should:

* Ensure that ***objectives for the VTS are set*** (Refer 2.2.2.2).
* Determine the type and level of services to be provided, having regard to ***the objectives of the VTS*** (Refer 2.2.2.5).
* Ensure that the VTS authority is provided with the equipment and facilities necessary to ***effectively accomplish the objectives of the VTS*** (Refer 2.2.2.7).
* Ensure that the ***objectives of the VTS are met*** (Refer 2.2.3.1).

Further IMO Resolution A.857(20) states that the Guidelines should be used in conjunction with the IALA VTS Manual.

### IMO Member State Audit Scheme (IMSAS)

Under the general provisions of treaty law and of IMO conventions, States are responsible for promulgating laws and regulations and for taking all other steps which may be necessary to give those instruments full and complete effect so as to ensure safety of life at sea and protection of the marine environment.

Key IMO documents regarding IMSAS include:

Resolution A.1067(28) on the Framework and Procedures for the IMO Member State Audit Scheme

The purpose of this framework is to describe the objective, principles, scope, responsibilities and capacity‐building aspect of the IMO Member State audit, which together constitute the strategy for the audit scheme.

This framework is supported by the procedures for the IMO Member State audit and the IMO Instruments Implementation Code (III Code).

Resolution A.1070(28) on IMO Instruments Implementation Code (III Code)

The objective of this Code is to enhance global maritime safety and protection of the marine environment and assist States in the implementation of instruments of the Organization.

The Code seeks to address those aspects necessary for a Contracting Government or Party to give full and complete effect to the provisions of the applicable international instruments to which it is a Contracting Government or Party, including SOLAS Chapter V (Safety of Navigation) Regulation 12.

This Manual has been developed as guidance to assist in the planning, conducting and reporting by auditors in the execution of their duties as defined in the Framework and Procedures for the IMO Member State Audit Scheme, which was adopted by the Assembly through resolution A.1067(28)

IMO Circular Letter No. 3425 ‐ Auditor’s Manual for the IMO Member State Audit Scheme (IMSAS)

This manual has been developed as guidance to assist in the planning, conducting and reporting by auditors in the execution of their duties as defined in the framework and procedures for the IMO Member State Audit Scheme, which was adopted by the Assembly through resolution A.1067 (28). Specifically the Manual refers to demonstrating measures are in place to evaluate the effectiveness of VTS, for example:

* Measures to evaluate effectiveness in implementing IMO mandatory instruments

Please describe the measures, if any, taken to evaluate the effectiveness in implementing SOLAS regulations V/12).

* Evaluation and review

Please describe the measures taken to evaluate effectiveness of AtoN and VTS (e.g. vessel tracking analysis, incident analysis, service availability, AtoN planning and inspection).

## IALA

IALA Recommendation V-119 on The Implementation of Vessel Traffic Services states that:

* Operational objectives should be established with the ultimate aim of alleviating the defined problems (Refer 2.1.1).
* It is important for the Competent/VTS Authority to carry out an evaluation after introduction of the new or re-assessed VTS, to ensure that the VTS operational objectives have been met, and the problems identified and defined in the Preliminary Assessment phase have been either alleviated or at least reduced to an acceptable level (Refer 4), and
* The evaluation should ensure that the VTS operational objectives are met (Refer 4).

IALA Guideline 1101 on Auditing and Assessing VTS states that to achieve the purposes for which it was implemented a VTS:

* Needs to be effective and routinely evaluated to ensure that the operational objectives are being met, the technical and operational performance is acceptable and the issues identified and defined in determining the need for the VTS have been either alleviated or at least reduced to an acceptable level (Refer 2).

# Setting Objectives

## Introduction

The objectives set for individual VTS’s may vary significantly, noting the diversity of VTS services provided by individual VTS’s (e.g. High traffic areas, types of service provided, low risk/high consequence scenarios, primary focus of the VTS (e.g. efficiency compared to protection of the environment, etc.). Setting appropriate objectives requires careful consideration, noting that:

* Often no one ultimate criteria exists
* Organisations pursue multiple and sometimes conflicting goals
* Effectiveness may change over time and with organisational and system maturity
* Criteria may be different at different levels within the organisation.
* Criteria relate to outcomes and well as processes.

In determining appropriate objectives for a VTS consideration should be given to the three pillars that underpin the effective management of safe operations:

1. Effective hazard identification and risk management
2. Effective development of a robust safety culture and positive safety climate
3. Effective mechanisms of governance and oversight

## What is an Objective

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| **Proposed Definition for “(VTS) Objectives”**  (VTS) **Objective** - a statement with direct and practical interpretation for management purposes and against which performance can be evaluated quantitatively (i.e., targets/thresholds) and measured practically. In particular, it should:   * Be a clear statement of a specific, measurable outcome to be achieved. * Not be a listing of strategies or actions that will be performed during the fiscal year |

In setting the objectives for a VTS consideration should be given to defining statements that contribute to one or more of the following:

* The principles of VTS
* The purpose/reason for VTS
* Operational considerations to deliver the requisite service/s
* The compelling need for implementing the VTS

## Principles of VTS

The key principles of VTS include:

* **Overview of Traffic / Maintaining a Traffic Image**

IMO Resolution A.857(20) states that:

* 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 (Refer 2.5.2.1).
* 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 (Refer 2.5.2.1).
* The traffic image allows the VTS operator to evaluate situations and make decisions accordingly (Refer 2.5.2.1).

Examples of objectives that contribute to generating an Overview of Traffic / Maintaining a Traffic Image are provided at Annex 1.

* Interacting with the traffic

A.857(20) states that the service should have the capability to interact with the traffic (Refer 1.1.1).

Examples of objectives that contribute to ensuring the capability to interact with traffic are provided at Annex 1.

* Responding to traffic situations developing

A.857(20) states that the service should have the capability to respond to traffic situations developing in the VTS area (Refer 1.1.1).

Examples of objectives that contribute to ensuring the capability to respond to traffic situations developing in the VTS area are provided at Annex 1.

## The purpose/reason for VTS

That is, how the VTS contributes to the purpose of VTS as defined by the International Convention on the Safety of Life at Sea (SOLAS) Chapter V (Safety of Navigation) Regulation 12 provides. That is:

* Safety of life at sea
* Safety and efficiency of navigation
* Protection of the marine environment, adjacent shore areas, work sites and offshore installations from possible adverse effects of maritime traffic (SOLAS).

Examples of objectives that contribute to the purpose/reason for VTS are provided at Annex 1.

## Operational considerations

Key operational attributes to consider in determining objectives may include:

* Equipment

A.857(20) states that 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 (Refer 2.5.2.1).

* Staff

<To follow>

* Procedures

<To follow>

* Quality Management

<To follow>

Examples of objectives that contribute to achieving the operational considerations are provided at Annex 1.

## The compelling need for establishing the VTS

That is, the objectives should be established with the ultimate aim of alleviating the issues identified when determining the need to establish the VTS as described in IALA Recommendation V-119 on the Implementation of Vessel Traffic Services.

Examples of objectives that contribute to addressing the compelling need for establishing the VTS are provided at Annex 1.

# setting measures to evaluate effectivenEss

Once the objectives for the VTS have been set the VTS Authorities should implement a regime to:

* ensure the objectives established by a VTS Authority are met
* ensure the services are delivered in the best possible manner
* continually monitor performance against objectives
* progressively improve the delivery of service by measuring key measures, which reflect the performance of VTS with respect to process and risk reduction, to ensure appropriate measures can be adopted and introduced
* identify, monitor and enable VTS Authorities to keep pace and manage change and facilitate planning, prioritising and defining areas of emphasis

The key step to implementing an evaluation regime is establishing measures as a means to evaluate how the objectives are set for the VTS are being met.

## Measuring Effectiveness

Evaluation measures need to be determined to monitor and assess that the objectives set for the VTS are effectively contributing to alleviating, or at least reducing to an acceptable level, the issues / problems the VTS was introduced to mitigate (eg risk of collisions/groundings, navigational hazards, complexity of waterway).

Both positive (leading) and negative (lag) performance measures should be considered. This ensures that operational outcomes are measured in terms of the success of good practice and the preventative measures that need to be implemented.

Positive performance measures consider the operational outcomes; they are a measurement of the success of good practice and therefore preventive measures that avoid accidents, incidents, workplace injury and ill-health. In contrast, negative performance measures consider accidents, other adverse outcomes, injury and ill-health.

## Defining performance measures

When testing the suitability of key performance measures the following issues may be considered:

* Are they relevant?
* Are they clearly defined?
* Are they readily measurable?
* Are they acceptable to people across the organisation?
* Are they comparable from one measurement to the next?
* Are they unambiguous?
* Are they statistically valid?
* Can it be collected in a timely and cost effective manner?

This should lead to a set of measures which:

* Accurately and consistently measure the parameter to monitor
* Are easily understood by users
* Are relatively simple to collect
* Are timely in that they support Authorities to identify and implement a response that can influence the outcome
* Readily relate to the objectives of the organisation

## Risk Assessments

Risk assessments can provide input into the development of performance measures by identifying outcome areas that may need to be addressed. The following process can be followed:

* List the hazards that are present in the workspace that have been identified and assessed. To do this it may be wise to refer to risk assessments that have been carried out in the past.
* Identify which organisational and/or operational objective the hazard is associated with.
* For each hazard found the current hazard controls that are in place must also be identified, these will be procedures that have been implemented to improve results already.
* When these have been identified, a choice must be made as to which area it is most beneficial for the organisation to measure. This could be areas that need further improvement than the current system is providing, or those that you want to measure the operational performance from.
* Then it is a case of creating and developing the measures. It is measuring aspects of performance in a positive way, to ensure that everything that is being implemented is working effectively.
* After the measures have been developed it is necessary to develop the methodology, so select measures that are the most relevant and cost effective to collect, easily understood by the majority of people in the workplace and can be quickly and easily measured. It must be understood how the information will be collected; and also how often this information needs to be collected for it to be useful.
* Finally the performance and effectiveness of the measures must be reviewed by checking whether they are effective measures of the areas that have been identified. This review must be undertaken periodically or when processes and equipment changes, as measure management is an on-going and ever changing process.

# Review

A review should be undertaken regularly, preferably annually when reviewing risk analyses or the Business Continuity Plan.

Undertaking a regular review provides the opportunity to examine the objectives set for the VTS, bearing in mind changes in operations, operational methods, personnel and the availability of technology, to ensure they remain applicable and are being achieved. This may identify areas that require attention in order for the operational objectives to be met.

**Annex A**

**Examples of Objectives and Measures to Evaluate the Effectiveness of VTS**

1. Principles of VTS (A.857(20))

*Note: Some example objectives and associated measure may address a combination of Principles/Purpose Reason for VTS/Operational Considerations/ Delivery of Service/ The compelling need for establishing the VTS.*

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| **Principles of VTS (A.857(20))** | **Example Objectives** | **Example Measure** |
| **Overview of Traffic / Maintaining a Traffic Image**  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 (Refer 2.5.2.1).  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 (Refer 2.5.2.1).  The traffic image allows the VTS operator to evaluate situations and make decisions accordingly (Refer 2.5.2.1).  *Related Responsibilities under (A.857(20))*   * *establish appropriate standards for shore- and offshore-based equipment (Refer 2.2.2.6).* * *ensure that the VTS authority is provided with the equipment and facilities necessary to effectively accomplish the objectives of the VTS (Refer 2.2.2.7).* | * That the sensor coverage and system is capable of compiling a traffic image throughout the VTS area and in a manner consistent with the types of service delivered. * Capability 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 * Capable to generate a comprehensive overview of traffic in its service area combine with all traffic influencing factors | * That the availability of the traffic image is greater than or equal to 99.8%. * That the availability of key sensors (eg. AIS, radar, etc) is greater than or equal to 99.8%. * The positional data from sensors (eg. AIS, radar, etc) is available throughout the VTS area. |
| **Interacting with the traffic**  The service should have the capability to interact with the traffic (Refer 1.1.1). | * That the VTS communications system provides the capability to interact with traffic throughout the VTS area * Provide VTS capable of dealing with and responding to developing situations | * That the communications system coverage provides a traffic image throughout 100% of the VTS area. * That the availability of the communications system (eg. VHF Voice, Telephones, etc) is greater than or equal to 99.8%. |
| **Responding to traffic situations developing**  The service should have the capability to respond to traffic situations developing in the VTS area (Refer 1.1.1).  *Related Responsibilities under (A.857(20))*  establish appropriate qualifications and training requirements for VTS operators, taking into consideration the type and level of services to be provided; (Refer 2.2.2.9). | * That the decision support tools provide the capable to detect and escalate abnormal behaviour to the attention of the VTSO in a manner that enables a timely response to developing traffic situations. * Capability to interact with a vessel to influence the decision-making process on board the vessel * VTSO training conducted (for example. Number or days, quality of course etc.) * Behavioural markers - conducting routine safety observation sessions with VTSOs using other colleagues or external parties | * That the decision support tools escalate 100% of defined abnormal behaviour to the VTSO that enables interaction * % of interactions which successfully influenced the decision-making process on board the vessel * Availability of VTS system (The percentage availability of key equipment on a monthly and annual basis). * Port / VTS area traffic statistics / density |

1. The purpose/reason for VTS

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| **Delivery of Service** | **Example Objectives** | **Example Measure** |
| **Safety of life at sea** | * Capable of responding and providing assistance to others | * Number of instances where VTS responded and assisted with safety of life events (eg Mayday’s, SAR, Medivac’s) |
| **Safety and efficiency of navigation**  VTS can improve the efficiency of vessel traffic in two ways through:   1. Reducing accidents   Prevention of an accident directly leads to an improvement in the efficiency of vessel traffic. An accident causes delays, not only for the vessels involved but also for other vessels in the vicinity. Serious accidents can lead to lengthy delays, especially when the movement of vessels is being restricted and possibly being re-routed, or in extreme cases when the VTS has to close the navigable waterways to vessel traffic.   1. Better utilisation of the infrastructure (eg waterway, locks, ports)   An infrastructure will have a certain capacity, both in the size of and the number of the vessels that can be accommodated. A VTS can safely increase the capacity by enabling:   * larger vessels to use the infrastructure (e.g. larger draught, beam, length, air draught); * 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). | * Improvement for the carrying capacity of vessels and reduction in delays increases the efficiency of these vessels * Achieve economic benefits to the stakeholders * increase the utilisation of infrastructure * eliminate delays or reduce the need for costly investments in the expansion of this infrastructure * correct and timely information about actual and expected vessel positions, movements, destinations and times of arrival provided to allied services | * Reduction in cost overheads by XXX * Up time of service XXX |
| **Protection of the marine environment, adjacent shore areas, work sites and offshore installations from possible adverse effects of maritime traffic (SOLAS)**  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, for example, 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 IMO Resolution A.982(24) - ‘Revised Guidelines for the Identification And Designation of Particularly Sensitive Sea Areas’, for the establishment of 'Particularly Sensitive Sea Areas' (PSSA).  In certain ports, narrow straits and inland waterways, vessels sail in close proximity to populated areas, industrial activities and their associated infrastructure. 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 colliding with habited areas on waterfronts. The additional impact of a chain reaction in oil or chemical plants on a waterfront initiated by an accident with a vessel needs to be considered. | * Mitigating the consequences of incidents, accidents and disasters * Preventing incidents and accidents occurring or developing into disasters * Protection of the Adjacent Communities and Infrastructure | * % of proactive interventions by VTS Operator which mitigated potential accident / incident greater than XX.X% * number of grounding less than XX per 10,000 transits * number of collisions less than XX per 10,000 transits: * number of near misses less than XX per 10,000 transits: |

1. Operational considerations

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| **Operational Considerations** | **Example Objectives** | **Example Measure** |
| **Equipment**  This should be compared to the availability targets determined for the key equipment as per IALA Recommendation V-128 on Operational and Technical Performance Requirements for VTS Equipment | Availability of VTS system  Technical performance of the VTS equipment. | The percentage availability of key equipment on a monthly and annual basis |
| **Staff**  *Related Responsibilities under (A.857(20))*  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 (2.2.2.8). | All staff to have V103 qualifications | Accident Statistics – lost time incidents |
| **Allied Services**  In delivering VTS services a VTS maintains close interaction and communication with its key stakeholders, that is, masters/OOW/Pilots of vessels transiting the VTS area. This provides a continuous and ongoing mechanism to receive and record stakeholder satisfaction with the delivery of service. All feedback in such circumstances should be recorded and where applicable an Opportunity for Improvement raised within the Quality Management System. | Relationships are enhanced with allied services, stakeholders and other interested parties  Regular information meetings with stakeholders. Measured by numbers of people attending, over a time period.  Measurement of customer satisfaction surveys  Conduct interviews with pilot exempt masters – to obtain their views on VTS operators | * Stakeholder feedback * Feedback received including:   + Direct feedback from individual Stakeholders - whether received in writing (letter, email) or verbally (VHF radio)   + Feedback at forums with Stakeholders/via websites or social media   + Regular meetings with allied services, stakeholders and other interested parties * Formal working agreements with allied services |
| **Procedures** |  |  |
| **Compliance and Enforcement**  *Related Responsibilities under (A.857(20))*  establish a policy with respect to violations of VTS regulatory requirements, and ensure that his 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. (2.2.2.12) |  |  |
| **Quality Management** |  |  |

1. The compelling need for implementing the VTS

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| **Compelling Need for Implementing the VTS** | **Example Objectives** | **Example Measure** |
| Implementing a VTS may be one solution to address potential tr4affic management problems such as:   * interaction of maritime traffic; * volume and composition of traffic; * protection of the marine environment and the surrounding area; * the local conditions such as geography, hydrological/meteorological, and tides.   Other benefits of implementing a VTS may include:   * supporting maritime security; * supporting law enforcement; and * protection of adjacent communities and infrastructure. | Minimise the risk of maritime accident and consequential ship sourced pollution and damage to the marine environment  VTS assists with …  VTS alleviates … | Reduction in ……   * Percentage of vessels passing the VTS area without accidents / incidents / near misses * Number of vessels where VTS provided information / interacted which resolved the situation prior to it further developing. * How many times has a grounding been prevented (e.g. avoidance before entering shallow waters). * How many times has a collision been prevented * Relativity number of incidents / event by route or passage or VTS area |