

## IALA GUIDELINE

# G1110 USE OF DECISION SUPPORT TOOLS FOR VTS PERSONNEL

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## 1. INTRODUCTION

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According to IMO Resolution A.857(20) [1], Vessel Traffic Services should be implemented to improve the safety and efficiency of vessel traffic and protection of the environment. The Vessel Traffic Service should have the capability to interact with traffic within its area of responsibility and to respond to developing situations as necessary.

Decision Support Tools (DST) are used to help enhance situational awareness and the decision-making process of VTS personnel by providing analysis and insight to developing or emergency situations, in real time, near real time and for long-term planning.

Due to the perpetually evolving nature of VTS related concepts and technologies, consideration should be given to the continual development and refinement of DSTs as appropriate to meet future needs.

### 1.1. PURPOSE

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The purpose of this guideline is to assist authorities on the use of decision support tools to manage identified risks, enhance situational awareness and support VTS personnel providing timely and relevant information, monitoring and managing ship traffic and responding to developing unsafe situations.

### 1.2. RELATIONSHIP TO OTHER DOCUMENTS

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IALA Guideline G1110 Use of Decision Support Tools for VTS Personnel is associated with Recommendation R0127 *VTS Operations*, a normative provision of IALA Standard S1040 *Vessel Traffic Services*. To demonstrate compliance with the Recommendation the provisions of this Guideline need to be implemented.

## 2. UTILIZATION OF DECISION SUPPORT TOOLS

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### 2.1. GENERAL PRINCIPLES

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Depending on the needs of the VTS authority, DSTs may require user interaction to fully realize the capabilities of the DST or may be set to run autonomously until the set parameters trigger an alert for the VTSO to attend to.

The operational procedures of the VTS should clarify the use of DST according to the local environment of the VTS area.

The DST can be implemented during or after the establishment of VTS, and if necessary, should be based on the outcome of a formal risk assessment.

### 2.2. DST USER PERSPECTIVE

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Decision Support Tools may be implemented in different ways and with differing levels of complexity. In general DSTs provide assistance to the VTS operator by integrating a mechanism to alert the operator in real time or near real time to bring awareness and the opportunity to take action where and if required.

In some situations, a DST may provide some suggestions regarding an appropriate course of action. These suggestions may be based on pre-defined solutions, previously agreed between the VTS Authority and the DST provider or may be based on machine learning of previous similar situations. It will be for the VTS personnel to decide whether, or not, to make use of such suggestions.

The DST may also prompt the VTS operator for additional input in order to help derive a solution to a current situation. This may be based on pre-defined questions that will help to guide the VTS Operator's thought process or based on machine learning of previous similar situations.

Long term planning of DSTs involves the implementation of defined Operational Procedures within a VTS system in order that the DSTs are correctly configured to address identified risk situations within the VTS area.

## 2.3. ALERTS AND INDICATORS

The use of different levels of alerts could increase the situational awareness for VTS operators. In accordance with IALA Recommendation R0125 [5], it is recommended that the terminology used for alerts (alarm, warning and caution) reflects the maritime standards contained in IMO Resolution A.1021(26) *Code on alerts and indicators* [2] unless particular local circumstances require otherwise.

The increasing levels of alerts provided by the DST are emergency alarm, alarm, warning and caution (Figure 1).

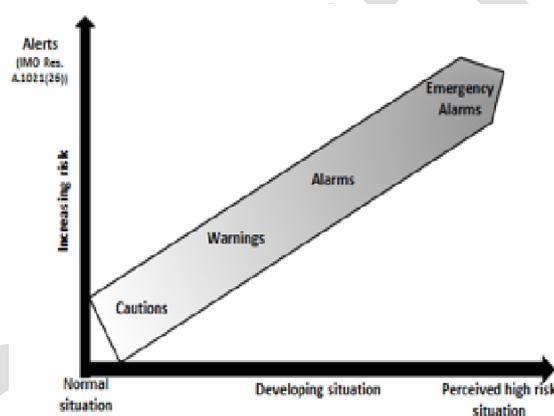


Figure 1 DST increasing alerts

### 2.3.1. EMERGENCY ALARMS

For conditions which indicate immediate danger to human life, vessels or the environment that require the immediate initiation of emergency procedures, the DST should provide emergency alarms. Emergency alarm alerts may remain after acknowledgement indicating the alert situation still exists, until the alert parameters are no longer detected.

*Example of emergency alarm:*

“Vessel is not able to avoid shallow water.”

### 2.3.2. ALARMS

For conditions requiring immediate attention and immediate interaction, the DST should provide an alarm. Alarms are presented to make the VTS personnel aware of a situation that requires an immediate response. Alarm alerts may remain after acknowledgement indicating the alert situation still exists, until the alert parameters are no longer detected.

*Example of alarm:*

“Vessel approaching shallow water with minimum time and manoeuvring space to avoid shallow water.”

### 2.3.3. WARNINGS

For conditions requiring immediate attention, but not immediate interaction, the DST should provide a warning. Warnings are presented for precautionary reasons to make the VTS personnel aware of changed conditions which



are not immediately hazardous but may become hazardous if no action is taken. These warning alerts may disappear once the alert has been acknowledged.

*Example of warning:*

“Vessel approaching shallow water with sufficient manoeuvring space to avoid shallow water.”

#### **2.3.4. CAUTIONS**

In a routine condition, the DST should provide a caution alert. A caution alert is a condition of awareness which does not warrant an alarm or warning condition, but still requires attention out of the ordinary consideration of the situation or of given information.

*Example of caution:*

“Speed vector gives basic information which can be set by the VTS personnel.”

### **2.4. ADMINISTRATION OF DECISION SUPPORT TOOLS**

Administrator functionalities should be provided to authorised users to enable the adjustment of alert thresholds and management of other pre-determined requirement parameters. Alert parameters should be set at levels appropriate to support the goals of the VTS service, being careful to avoid excessive notifications that may cause operator fatigue, distraction, and other factors that may negatively impact overall safety and efficiency.

Management reports may be generated from alert statistics and/or VTSSO actions for analysis.

### **2.5. OPERATIONAL REQUIREMENTS OF DECISION SUPPORT TOOLS**

DSTs may be based upon real-time, near real-time and long term planning assessment of risks associated with navigational safety and efficiency and the prediction of traffic situations. The DST should:

- provide alerts and indicators (audible and / or visible);
- reduce the workload;
- enhance efficiency;
- be accurate and in real time;
- be configurable with local VTS operational procedures;
- facilitate the result-oriented decision making by VTS personnel in accordance with the purpose of the VTS;
- comply with IALA Recommendation *R0125 The use and presentation of symbology at a VTS centre* [5]
- have recording capacity; and
- analyse data for the prediction of future situations.

When the risk level exceeds a pre-defined threshold, the VTSSO may be advised of the recommended risk mitigation options.

### **2.6. TRAINING**

The VTS Authority should ensure that VTS personnel are adequately trained in the use of DSTs.

General training on the general principles of, types and common uses of DSTs should be provided in IALA Model Course *V-103/1 Vessel Traffic Services Operator Training* [13].



Specific training on the use and application of DSTs within specific VTS centres should be provided as a component of IALA Model Course V-103/3 *Vessel Traffic Services On-The-Job Training* [14]. Additionally, further training should be provided when new DSTs are introduced, or modifications are made to existing DSTs and covered within V-103/5 *The Revalidation Process for VTS Qualification and Certification* [15].

Emphasis should be given on the inputs and limitations of the DSTs.

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### 3. EXAMPLES OF WHEN DECISION SUPPORT TOOLS MAY BE USED

The following table provides examples of where DSTs may assist in ensuring the safety and efficiency of navigation, through route and traffic management, monitoring and protection of assets, environmental and fairway monitoring, incident response and anomaly detection.

The table demonstrates the harmonized relationship between the pre-requisites necessary for the alert to work, the type of alert which may be appropriate and the user interface for each use case. These are further categorised according to whether they are deemed long term planning, near real-time or real-time, which indicates how the system may be used for analysis to identify risks, quantify throughput, and adjust operational procedures as well as real-time incident and situational awareness.

Table 1 Examples of DST use

No	DST Group	Description	Pre-requisites	Alert Type	User Interface/ comments
<b>1 Route management</b>					
	Long term (Planning)	Long term traffic flow management solutions	Route plan entry and management for each voyage and long term planning of vessel arrivals (previous port to next port)	None	Identification of vessel route from port to port, association of route plan for each vessel arrival
	Near real-time	Following schedule on route	Vessel position updates outside of VTS area and configuration of vessel estimated time of arrival (ETA) tolerance	Caution	Identification of vessel prior to entry and time to VTS area and notification of vessel not meeting scheduled route plan
		Draft/ air draft on route alert	On route risk situation analysis	Warning / Alarm	Identification of vessel exceeding draft/ air draft
		Berth occupation	Berth occupied at time of intended arrival	None	Berth availability
		Convergence prediction alert	Calculation of vessel speed and identification of convergence/ overtaking points on route	Warning	Optimal corrected speed for vessel



No	DST Group	Description	Pre-requisites	Alert Type	User Interface/ comments
		Vessel outside expected route alert	Configuration of expected route and vessel course alteration in relation to time thresholds	Emergency Alarm	Notification of vessel meeting course alteration and speed thresholds
	Real-time	Traffic Separation Scheme (TSS) route compliance alert	Configuration of expected course, time to entry and exit of the TSS	Warning	Identification of vessel not following TSS
		Cross Track Error limits alert	Configuration of cross-track error limits on each section of route	Warning	Identification of vessel exceeding set cross-track error
		Speed alert	Configuration of speed thresholds	Warning	Identification of vessel exceeding speed threshold. Revised ETA calculation
		Approaching waypoint alert	Time and distance to waypoint	Warning	Notification of vessel's time and distance to waypoint
		Large alteration of course alert	Configuration of vessel course thresholds	Alarm/ Emergency alarm	Identification of vessel exceeding course alteration threshold
<b>2 Traffic Management</b>					
	Long term (Planning)	Long term active traffic management	Identification of traffic management requirements (time slots, Just-in-time, separations etc.) for advance planning of vessel arrivals	None	Analysis of Traffic patterns to determine and identify risks, quantify throughput, and adjust operational procedures
		Close quarter collision avoidance planning	Human or machine learning to develop and define alerting mechanism and alert thresholds (definition of close quarters situation for high-risk areas of the VTS area)	None	Determining near miss risk areas and determining near miss thresholds and to support IALA requirements for publication of near miss



No	DST Group	Description	Pre-requisites	Alert Type	User Interface/ comments
		Grounding avoidance planning	Identification of areas where grounding risk exists by vessel type and size. Human or machine learning to develop and define alerting mechanism and alert thresholds	None	Identification of grounding risk areas by vessel type and determining grounding limits for vessel types
		Anchorage management	Planning of anchorage capacity and layout	None	Size, spacing and limits of vessels within anchorage
		Vessel portrayal classification /grouping	Configuration of rules for classification groups (e.g., tankers, cargo, vessels of interest)	None	Simple identification of vessels by group
Near real-time		Tactical prediction of traffic situations	Assessment of timely arrival in VTS area and risks to route timing in VTS area	Warning	Identification of vessels arrival to VTS and risk to route timing
		Air draft limits monitoring alert	Configuration of air draught thresholds	Advisory	Identification of vessel exceeding air draft thresholds. Maybe real-time when real time height measurement is possible
Real-time		Close quarter collision avoidance alert	Configuration of collision thresholds (CPA, TCPA)	Warning / Alarm / Emergency alarm	Notification of vessel exceeding collision thresholds
		Grounding avoidance alert	Configuration of grounding warnings in relation to maximum draft data	Warning / Alarm	Identification of vessel with risk of grounding
		Grounding alert	Configuration of distance and time to coast/ hazard threshold or system analysis of minimum distance and time to coast/ hazard	Emergency Alarm	Notification of vessel below minimum distance and time to coast/ hazard
		Anchor watch alert	Configuration of drift limit thresholds	Warning	Identification of vessel exceeding drift limit thresholds



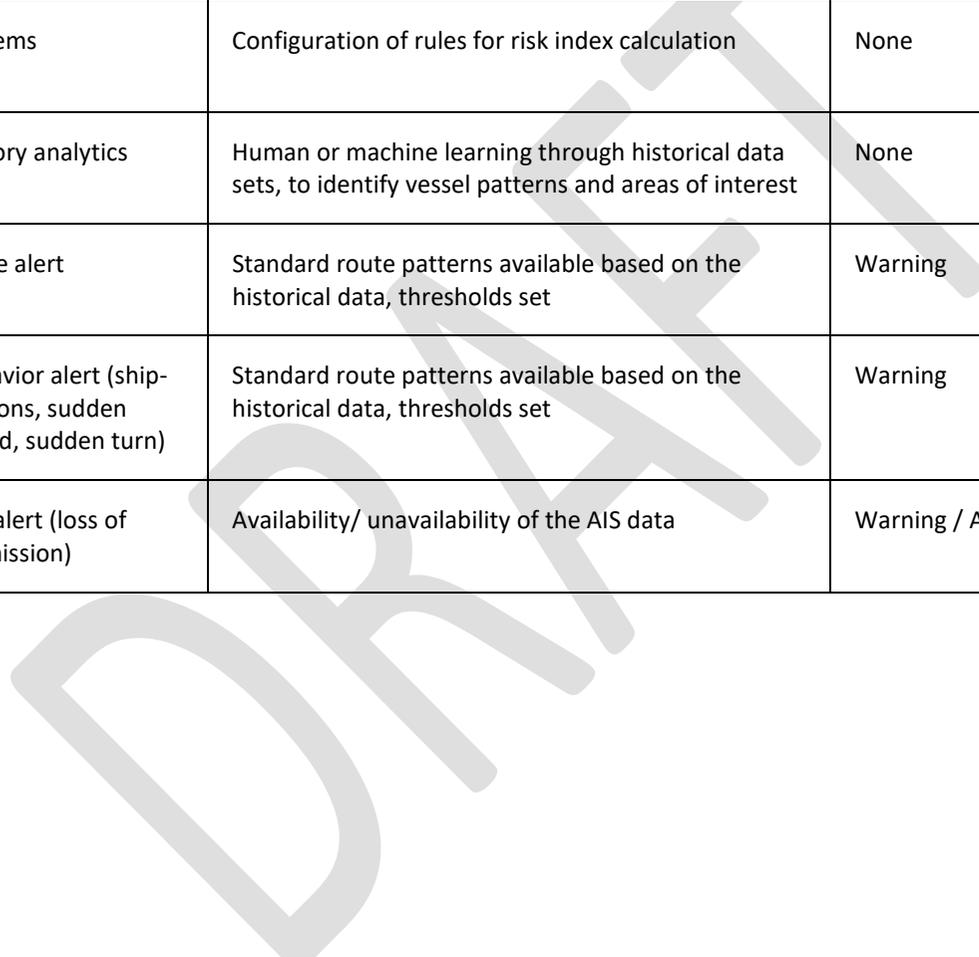
No	DST Group	Description	Pre-requisites	Alert Type	User Interface/ comments
		Speed alert	Configuration of speed thresholds	Warning / Alarm	Identification of vessel exceeding speed thresholds
<b>3 Monitoring and protection of assets</b>					
	Long term (Planning)	Historic patterns, analytics, reporting	Analysis of traffic patterns to determine and identify risks, quantify throughput and adjust, operational procedures. Analysis of near misses / violations of protected areas. Human or machine learning to develop and define alerting mechanism and alert thresholds	None	Awareness of traffic patterns in VTS area and alert requirements for VTS area. Will support IALA requirements for publication of near miss
	Near real-time	Approaching protected area alert	Configuration of protected/ sensitive areas, time to approach	Warning	Identification of vessel approaching protected area
	Real-time	Entering / inside protected area alert	Configuration of protected/ sensitive areas	Warning / Alarm	Identification of vessel entering or inside protected area
		Anchoring within pipeline / cable area alert	Configuration of protected/ sensitive areas	Warning / Alarm	Notification of vessel anchoring in vicinity of pipeline or cable
		Violation of International or local regulations alert	Configuration of regulations	Warning	Notification of vessel appearing to violate regulations
<b>4 Environmental and fairway monitoring</b>					
	Long term (Planning)	Weather forecasts for the planning of operations	Analysis of effects of weather on regular operations, weather limits (wind, currents, visibility etc)	None	Awareness of effects of weather on VTS area



No	DST Group	Description	Pre-requisites	Alert Type	User Interface/ comments
		Tidal predictions	Configuration of tidal window	None	Awareness of tidal prediction effect on VTS area
	Near real-time	Dynamic under keel clearance systems	Modelling of area, data collection from vessel /fairway	Warning	Identification of vessels due to pass through areas, of which they will exceed under keel clearance
	Real-time	Oil spill detection alert	Oil spill detection equipment available	Warning / Alarm	Notification of potential oil spill
		Weather alert	Real-time sensors available	Warning / Alarm	Notification of adverse weather
		AtoNs malfunction or off-position alert	Fairway equipment available	Warning / Alarm	Notification of loss of AtoN
<b>5</b>	<b>Incident response</b>				
	Long term (Planning)	Incident analysis and debriefing	Ability for system to record and playback traffic situation	None	Playback available for analysis
	Near real-time	Incident recording	Data from sensors available and recorded	None	Playback of data from sensors available for incident analysis
		SAR planning tools	To assist in the execution of SAR procedures	None	Overlay of SAR tools
	Real-time	Not under command	System identification of navigational status change	Caution	Identification of vessel switching navigation status to 'not under command'
		Distress call alert	System identification of distress alert received	Alarm	Notification of distress received



No	DST Group	Description	Pre-requisites	Alert Type	User Interface/ comments
<b>6 Anomaly detection</b>					
	Long term (Planning)	Risk index systems	Configuration of rules for risk index calculation	None	Vessel classification for vessels which reach specified risk measurement
		Long term history analytics	Human or machine learning through historical data sets, to identify vessel patterns and areas of interest	None	Use of historical data to determine likely vessel patterns and areas of interest
	Near real-time	Abnormal route alert	Standard route patterns available based on the historical data, thresholds set	Warning	Identification of abnormal route
	Real-time	Abnormal behavior alert (ship-to-ship operations, sudden change of speed, sudden turn)	Standard route patterns available based on the historical data, thresholds set	Warning	Identification of abnormal behaviour
		AIS anomalies alert (loss of track or transmission)	Availability/ unavailability of the AIS data	Warning / Alarm	Identification of loss of AIS data





## 4. ACRONYMS AND DEFINITIONS

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To assist in the use of this guideline, the following acronyms and definitions, mainly based on IMO Resolutions, have been used:

### 4.1. ACRONYMS

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AIS	Automatic Identification System
CPA	Closest Point of Approach
DST	Decision Support Tools
ETA	Estimated Time of Arrival
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IMO	International Maritime Organization
SAR	Search and Rescue
TCPA	Time to Closest Point of Approach
TSS	Traffic Separation Scheme
VTS	Vessel Traffic Services
VTSO	VTS Operator

### 4.2. DEFINITIONS

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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.

Alarm	A high priority alert requiring immediate attention and action (IMO Res. A.1021(26)).
Alert	An announcement of abnormal situations and conditions requiring attentions (IMO Res. A.1021(26)).
Caution	Lowest priority of an alert. Awareness of a condition which does not warrant an alarm or warning condition, but still requires attention out of the ordinary consideration of the situation or of given information (IMO Res. A.1021(26)).
Decision-maker	A person or group authorized to make decisions.
Decision support tool (DST)	A tool to assist the decision-maker at an operational, tactical and strategic level. This may be in real-time or at a tactical or strategic level.
Emergency alarm	Highest priority of an alert. Alarms which indicate immediate danger to human life or to the ship and its machinery exits and require immediate action (IMO Res. A.1021(26)).
Long term planning	Refers to the action of analysing currently available information to proactively manage predicted future events.
Near real-time	Refers to predictions of developing situations.
Real-time	Refers to the immediate action taken to respond to current or developing situations.



Warning

Condition requiring immediate attention, but not immediate action (IMO Res. A.1021(26)).

## 5. REFERENCES

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