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| IALA Guideline |

DraFT G1111-5

Producing Requirements for Environment Monitoring Sensors

Functions, Performance And (XXXX) specifIC AcceptANce

Working paper, output from VTS ##

Edition x.x

Date (of approval by Council)

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Revisions to this document are to be noted in the table prior to the issue of a revised document.

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|  | Edition 1.0  *Replace text as appropriate to series-specific sensor.*  ~~This document originated from Guideline G1111 which has been subdivided into 13 sub-guidelines, including this document. Document structure revised, Basic, Standard and Advanced substituted with guidance on specific areas including Inland VTS, Ports, Ports Approach and Coastal VTS. Guidance on offshore related VTS and Acceptance of VTS Radar Systems added.~~  ~~Measurements in Metric terms adopted for Inland Waterways only.~~  ~~(Note - G1111 originated from annex of Recommendation V-128 Ed 3 in May 2015)~~ |  |
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# INTRODUCTION

This Guideline presents a common source of information to assist VTS Providers in the understanding of Environment Monitoring Sensors and their contribution to the VTS traffic image (situational awareness) as well as guidance of how the VTS Provider should specify the Functional and Performance Requirements. The VTS Provider should note that it is important to determine the performance requirements of the Environment Monitoring Sensors. The required performance should be clearly defined relative to the area / vessels / targets that are to be monitored.

Copying parameters from a manufacturer’s data sheet is not recommended.

This guideline considers the application of Environment Monitoring sensors to different VTS operational areas (e.g. inland waterways, Harbours, Coastal regions and offshore).

Specific maritime security requirements, possibly identified by the International Ship and Port Security code, are not considered within this guideline.

## The IALA G1111 guideline series

This Guideline is one of the G1111 series of guideline documents. The purpose of the G1111 series is to assist the VTS Provider in preparing the definition, specification, establishment, operation, and upgrading of a VTS system. The documents in this series address the relationship between the operational requirements and VTS system performance (technical) requirements and how these reflect into the overall system design requirements.

The G1111 series of guideline documents present system design, sensors, communications, processing, and acceptance, without inferring priority. The guideline documents are numbered and titled as follows:

* G1111 Establishing Functional & Performance Requirements for VTS Systems
* G1111-1 Producing Requirements for the Core VTS System
* G1111-2 Producing Requirements for Voice Communications
* G1111-3 Producing Requirements for RADAR
* G1111-4 Producing Requirements for AIS and VDES
* G1111-5 Producing Requirements for Environment Monitoring Systems
* G1111-6 Producing Requirements for Electro Optic Sensors
* G1111-7 Producing Requirements for Radio Direction Finders
* G1111-8 Producing Requirements for Long Range Sensors
* G1111-9 Framework for Acceptance of VTS Systems

# DEFINITIONS

## General Terms

## Specific Terms

## Specific IALA Definitions

**Specific Term in bold –** details in normal text. Include items specifically related to the series topic where IALA has additional clarifying details to common definition (if common definition exists. If no common definition exists, use the IALA definition on its own.)

# References

[1] WMO - Guide to Meteorological Instruments and methods of Observation.

[2] WMO - International Meteorological Vocabulary.

[3] IMO. Resolution A.686(17) - Code on Alarms and Indicators (and MSC.39(63) Adoption of amendments to the Code on Alarms and Indicators).

[4] IMO. Resolution A.694(17) - General Requirements for Shipborne Radio Equipment forming Part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids.

[5] IEC 529 - Degrees of protection provided by enclosures (Ingress Protection (IP) Code).

[6] IEC 721-3-6 - Classification of environmental conditions.

[7] IEC 60945 - Maritime Navigation and Radiocommunication Equipment and Systems.

[8] IEC 61162 - Digital Interfaces for Navigation Equipment within a Ship.

[9] IMO. Resolution A.915(22) - Maritime Policy for the Future Global Navigation Satellite System (GNSS).

[10] IMO Greenhouse Gas Strategy

[11] IMO MARPOL Convention Annex VI Prevention of Air Pollution from Ships

# Abbreviations

Please refer to IALA G.1111 Establishing Functional and Performance Requirements for VTS systems for an extensive list of abbreviations and acronyms covering the entire G1111 series. This section identifies abbreviations that are related to Environment Monitoring Sensors only.

# Operational OVERVIEW

This guideline is a part of the overall G1111 guideline and considers the operational application of Environment Monitoring sensors. The use of such sensors can assist the VTS Operator in understanding the navigational conditions that are being experienced by the bridge crew of an incoming or departing vessel. In addition, VTS Providers are advised to consider the implementation of pollution monitoring sensors to ensure that recent IMO regulations on sulphur in fuel are being correctly observed.

Hydrological, meteorological, Oil Spill, air pollution monitoring and any other environmental information, that the VTS Authority requires, should be integrated into VTS applications to provide the VTSO with a real-time assessment of the environmental situation in the VTS area. Information collected from this equipment may be provided to ships to assist in their assessment of the prevalent conditions.

The protection of the environment is an issue that has grown significantly in importance, both politically and socially, over recent years. The environmental impact of normal commercial activities is analysed such that risk reduction measures can be determined and implemented. Traditionally, VTS Authorities have collected environmental data simply to support their VTS activities. However, many VTS Authorities have their VTS areas in, or alongside, marine protected areas or maritime reserves where any damage to the environment should be avoided. In addition, the VTS Area may be located close to an area of population and therefore VTS Providers should aim to ensure minimal impact of air pollution from ships on the areas of population.

Therefore, the VTS should consider two aspects of environmental monitoring:

• navigation data collection;

• environment protection.

Navigation Data Collection includes the traditional environment monitoring sensors but VTS Providers should also consider integrating forecast information so that weather conditions related to the expected time of arrival can be communicated to incoming ships.

Typically referred to as the hydrological / meteorological (hydro/meteo) systems, navigation data collection variables are those provided by real time, locally sited, weather stations and include air temperature and humidity, wind velocity and direction, rainfall, air pressure and visibility. In certain locations, hydrological variables such as tidal level, and current direction and velocity may also be required. Hydrological data may be obtained through real sensors or available in predictive tables/databases from national authorities. Sensors, providing this data, may be located at remote sites and communicate data to a VTS centre via a telecommunications or radio link. Alternatively, wave height, direction and surface current could be derived from the main VTS radar through software processing. The accuracy of such measurements from dedicated sensors and from analysis of radar-originated data should be evaluated as part of the VTS design process.

An Environment Protection system could include implementing additional capability that provides early detection of any polluting incidents that may be caused by visiting vessels. This early detection of pollution could be achieved through the software processing of the VTS radar signals or by specialist sensors that are designed to detect oil, or other pollutants, in the water. In addition, the monitoring of the emissions from ships should be considered in order to minimise the impact on the local population. This may involve strategically located sensors or the use of drones to overfly the ship to detect specific pollutants.

# Producing Functional and Performance requirements

## Information Presentation

The results of the environmental monitoring measurements should, wherever possible, be transmitted in WMO standard units and displayed in user-selectable format.

## Malfunctions and Indicators

As a minimum requirement, malfunctions, warnings, alarms and indicators should respond to the requirements of IMO Resolution A.686(17) [3]. Additional requirements may be required, depending on the individual type or purpose of the sensor.

In particular, where measurements from a number of sensors overlap or provide coverage for adjacent areas, the identification of potentially anomalous readings should be included within the functionality of the data processing to reduce the possibility of incorrect decisions and to highlight the need for maintenance or inspection of the sensors.

## Parameters and Accuracy

Where a VTS Authority determines a need to establish their own monitoring stations, it should be noted that the individual VTS Authorities, in conjunction with hydrographical and meteorological experts, should determine the accuracy and availability requirements for each VTS Centre, as these will be based on individual circumstances. Table 1 gives an indication of typical measuring range and minimum accuracy requirements for various common environmental parameters.

**Note**: The availability requirement should be as prescribed by IMO A.915(22) [9].

| **Parameter** | **Measuring Range** | **Minimum Accuracy** | **Remarks** |
| --- | --- | --- | --- |
| **Height of Tide** | 0 to 20 m (or greater) | ≤ 0.01 m |  |
| **Rate of Tidal Stream/ Current** | 0 to 10 m/s | ≤ 1% | Maximum value to reflect local conditions |
| **Direction of Tidal Stream / Current** | 0° to 360° | ≤ 5° |  |
| **Wave Height** | 0 to 20 m | ≤ 0.1 m, for ≤ 5 m  ≤ 10%, for > 5 m |  |
| **Wave Direction** | 0° to 360° | ≤ 20° |  |
| **Wind Speed** | 0 to 75 m/s | ± 0.5 m/s, for ≤ 10 m/s  ± 5%, for > 10 m/s |  |
| **Wind Direction** | 0° to 360° | ≤ 3° |  |
| **Visibility** | 10 to 20,000 m | ≤ 50 m, for ≤ 600 m  ≤ 10%, for 600 m – 1500 m  ≤ 20%, for > 1500 m |  |
| **Air Temperature** | -10° to +50° C | ≤ 0.3° C | The measuring range should be aligned to the applicable hot/cold climate category area |
| **Air Humidity** | 0 to 100% RH | ≤ 2% RH |  |
| **Air Pressure** | 920 to 1080 hPa | ≤ 0.3 hPa |  |
| **Sea Surface Temperature** | -2° to + 40° C | ≤ 0.5° C | The measuring range should be aligned to the applicable hot/cold climate category area |
| **Ice Coverage** | - | - | Typically, measured by satellite remote sensing |
| **Ice Thickness** | - | - | Typically, measured by satellite remote sensing |
| **Oil Spill** | - | - | Typically measured by satellite or radar remote sensing |
| **Salinity** | 0 to 70 PSS | ≤ 1% |  |
| **Sulphur Emissions** |  |  | 0.5% sulphur limit  0.1% sulphur limit in ECAs |

**Note**: For air temperature, air humidity, air pressure and salinity accuracy. The accuracy values may be sufficient for shipping activities but if the information is to be used for scientific purposes (e.g., oil spills, environmental responses etc.) these values may need to be more stringent.

The VTS system requirements should also specify the time periods over which the various data parameters should be updated and may be averaged, if required, as these factors will depend upon the local circumstances pertaining to the VTS system.

## FUNCTIONAL Requirements

This section describes the essential functions of the hydro/meteo system for inclusion and integration within the overall VTS system.

Environmental measurements are made by dedicated and/or multipurpose sensors positioned throughout the VTS area (and its approaches) such that an overall environmental picture can be determined, taking account of the possibility of anticipated variations arising from the particular geography of the VTS location.

Measurements are transmitted by the communication system to a VTS centre for analysis, system wide processing and subsequent display to the VTSO in user-selectable format. The measured data is to be presented both numerically and graphically (in chronological order).

The VTS Authority may also require such data to be stored for a predefined period (e.g., up to one year).

It is essential that a VTS Centre also has access to external local hydro/meteo information relevant to the VTS area(s). In addition, the VTS system can, if required by the VTS Authority, disseminate the available environmental data to the VTS users (shipping etc.) and to external allied services.

## Installation and Maintenance Considerations

The environmental monitoring systems should be specified taking the considerations in Section 1 into account. This should also consider maintenance access, lightning protection and wind load on antennas. The build-up of ice in some climates should also be a consideration.

Key aspects, related to design and installation, include:

• suitability to meet range, accuracy and update rate requirements;

• location within the VTS area and its approaches;

• durability and resistance to environmental conditions;

• interference;

• power supply requirements / options;

• installation;

• maintenance;

• interfacing;

• back-up arrangements;

• safety precautions.

### SUITABILITY TO MEET RANGE, ACCURACY AND UPDATE RATE REQUIREMENTS

Individual sensors (multipurpose where appropriate) should be selected to provide the specified range, accuracy and update rate requirements.

### LOCATION WITHIN THE VTS AREA AND ITS APPROACHES

The network of environmental sensors should be part of a coherent sensor network designed to achieve the VTS system needs (coverage, appropriate accuracy in areas of different assessed risk, redundancy etc.).

### DURABILITY AND RESISTANCE TO ENVIRONMENTAL CONDITIONS

Electronics installed externally should be in a suitable environmental enclosure. IEC requirements for environmental conditions should be applied as practicable.

### INTERFERENCE

These sensors should comply with applicable international standards and regulations. IEC requirements (IEC 60945) (ref. [7]) refer.

### POWER SUPPLY REQUIREMENTS / OPTIONS

Relevant IEC requirements should be applied. In remote locations, due to the low power consumption of hydro/meteo sensors, authorities should consider use of alternative power (e.g., solar panels or wind vanes), in lieu of generators, when commercial power is not available.

### INSTALLATION

Requirements concerning the installation of sensors, wiring and the arrangement of the equipment providing hydro/meteo information to the VTS centre should be determined in accordance with national and international standards where applicable. Operational requirements will determine where sensors are to be located and how many are required. Sites for sensors should be selected based upon optimising data relevant to the VTS. Other considerations include:

• availability of power;

• protection against vandalism;

• housing and co-location with existing VTS, AtoN, or other suitable infrastructure.

Relevant IEC requirements should be applied. For example:

• IEC 529 ‘Degrees of protection provided by enclosures (IP Code)’[5];

• IEC 721-3-6 ‘Classification of environmental conditions, Part 3: Classification of groups of environmental parameters and their severities; Ship environment’ [6];

• IEC 60945 ‘Maritime navigation and radio communication equipment and systems - General requirements, methods of testing and required test results’ [7];

• local national wiring standards / regulations.

The environmental requirements for operation and survivability of environmental sensors and associated equipment should be determined by the VTS Authority and referred to Section 1.5.3 - General design, configuration installation and maintenance consideration.

### MAINTENANCE

Possible requirements, in addition to IMO Assembly Resolution A.694(17) [4] concerning maintenance, should be determined. Location considerations for sensors should include maintenance, repair, and accessibility requirements.

### INTERFACING

The typical information to be interfaced for the hydro/meteo service are described under the Operational Requirements, see Section 4.4.

For the interfacing of hydro/meteo services to VTS equipment, several different standards are in use. Among those standards, IEC 61162, Digital Interfaces for Navigation Equipment within a Ship (part 1 and part 3) [8], has been applied for these applications. In addition, the WMO has developed an interface standard for hydro/meteo applications [1].

For the interface between a VTS and its users, hydro/meteo data should follow standardised data exchange formats, e.g., XML. (In addition, a time stamp and source should be provided.)

### BACKUP ARRANGEMENTS

Depending on the individual type of the equipment, requirements concerning back-up and fall-back arrangements should be determined based on VTS requirements, availability and risk assessment.

### SAFETY PRECAUTIONS

Depending on the individual type of the equipment, requirements in addition to IMO Resolution A.694(17) [4] should be determined based on local occupational health and safety requirements and regulations.