



IALA GUIDELINE

G1111-5 PRODUCING REQUIREMENTS FOR ENVIRONMENT MONITORING SENSORS

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1. 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.

1.1. 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 and Equipment
- 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
- 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

2. OPERATIONAL OVERVIEW

This Guideline is a part of the overall *G1111* series of guidelines 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 also 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 providers have collected environmental data simply to support their VTS activities. However, many VTS providers have their VTS areas in, or alongside, marine protected areas or maritime reserves where it is important to avoid any damage to the environment. 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 purposes of environmental monitoring:

- navigation data collection; and
- environment protection.

Navigation data collection includes the traditional environment monitoring sensors but, to begin to implement the “Just in Time” arrival concept, VTS providers should also consider integrating forecast information so that weather conditions related to the expected time of arrival can be assessed and 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 that 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 minimize 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.

3. PRODUCING FUNCTIONAL AND PERFORMANCE REQUIREMENTS

3.1. INFORMATION PRESENTATION

Real time environment monitoring data should be available to the VTS operator (VTSO) on the main traffic display and presentable using a variety of styles and techniques. This could be a simple numeric display of the data parameters, as received, or could involve a time-based representation of the environmental data so that the VTSO can easily visualize how weather or hydrographic conditions are changing over time.

Appropriate symbology should be used when presenting environmental information so that third parties can easily understand it. The VTSO should be able to select or deselect the display of environmental information.

3.2. PARAMETERS AND ACCURACY

Where a VTS provider determines a need to establish their own real time monitoring stations, it should be noted that the VTS provider, in conjunction with environmental experts, should determine the accuracy, resolution and

granularity of the data to be collected. These should be in accordance with the requirements defined during the operational risk assessment. The range of the information to be collected should also consider the different environmental conditions for all months of the year.

The following parameters are measured to assist VTS operations:

- Wind Speed m/s
- Wind Direction degrees
- Air Temperature degrees Celsius
- Humidity %
- Pressure hector Pascals
- Rainfall mm/hr
- Visibility m
- Tide Height m
- Current Speed m/s
- Current Direction degrees
- Wave height m
- Wave Direction degrees
- Sea Surface Temperature degrees Celsius
- Salinity
- Ice coverage
- Ice thickness
- Oil Spill Area
- CO2 emissions [6]
- NOx emissions [7]

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.

3.3. FUNCTIONAL REQUIREMENTS

This section describes the essential functions of the environmental monitoring 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 to a VTS centre for analysis, system wide processing and subsequent display to the VTSO in user-selectable format. The measured data can be presented both numerically and graphically.

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

The VTS centre may also have access to other external sources of environmental information relevant to the VTS area(s). In addition, the VTS system could , share the available environmental data with other VTS users (shipping etc.) and external allied services.

3.4. INSTALLATION AND MAINTENANCE CONSIDERATIONS

The environmental monitoring systems should 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

3.4.1. SUITABILITY TO MEET RANGE, ACCURACY AND UPDATE RATE REQUIREMENTS

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

3.4.2. 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.).

3.4.3. 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.

3.4.4. INTERFERENCE

These sensors should comply with applicable international standards and regulations. IEC requirements (*IEC 60945*) [5] refer.

3.4.5. POWER SUPPLY REQUIREMENTS / OPTIONS

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

3.4.6. INSTALLATION

Requirements concerning the installation of sensors, wiring and the arrangement of the equipment providing environmental 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)[3]
 - IEC 721-3-6 Classification of environmental conditions, Part 3: Classification of groups of environmental parameters and their severities; Ship environment [4]
 - IEC 60945 Maritime navigation and radio communication equipment and systems - General requirements, methods of testing and required test results [5]
- Local national wiring standards/regulations

The environmental requirements for operation and survivability of environmental sensors and associated equipment should be determined by the VTS provider.

3.4.7. MAINTENANCE

Possible requirements, concerning maintenance, should be determined. Location considerations for sensors should include maintenance, repair, and accessibility requirements.

3.4.8. 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.

3.4.9. SAFETY PRECAUTIONS

Depending on the individual type of the equipment, requirements should be determined based on local occupational health and safety requirements and regulations (Refer to *G1111* Section 3.4.6).

4. DEFINITIONS

The definitions of terms used in this Guideline can be found in the *International Dictionary of Marine Aids to Navigation* (IALA 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.

5. ABBREVIATIONS

Please refer to IALA G1111 Establishing Functional and Performance Requirements for VTS systems for an extensive list of abbreviations and acronyms covering the entire G1111 series.

6. REFERENCES

- [1] WMO. Guide to Meteorological Instruments and methods of Observation.
- [2] WMO. International Meteorological Vocabulary.
- [3] IEC. 529 - Degrees of protection provided by enclosures (Ingress Protection (IP) Code).
- [4] IEC. 721-3-6 - Classification of environmental conditions.



- [5] IEC. 60945 - Maritime Navigation and Radiocommunication Equipment and Systems.
- [6] IMO. Greenhouse Gas Strategy.
- [7] IMO. MARPOL Convention Annex VI Prevention of Air Pollution from Ships.