DFO Logo

**Fisheries and Oceans Canada**

**National Standard for the Development of Vessel Monitoring System (VMS) Hardware**

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# Introduction

The purpose of this Government of Canada Standard (hereinafter referred to as “The Standard”) is to describe the specifications required for a Vessel Monitoring System (VMS) hardware to be qualified for use in Canada, as well as the qualification process. This Standard ensures that all applicants are given an equal opportunity to enter into the program and that Fisheries and Oceans Canada (DFO) shall remain impartial.

In Canada, the use of VMS hardware is a condition of license for many fisheries. While primarily an enforcement tool, VMS data is also used for other purposes, such as resource management, science, marine domain awareness and search and rescue, which are consistent with the sustainable management of fisheries. The VMS program is a National Government of Canada program that is managed out of the Conservation and Protection Directorate.

Only VMS hardware meeting the requirements contained within this document and accordingly qualified by DFO may be utilized on fishing vessels. A list of DFO qualified hardware can be found at <http://www.dfo-mpo.gc.ca/fisheries-peches/sdc-cps/vessel-monitoring-surveillance-navire/approved-approuvee-eng.html>. Details on specific VMS requirements can be found in the Integrated Fisheries Management Plans and/or the License Conditions for specific fisheries.

In order for a VMS unit to qualify for use in the VMS program, it must have successfully completed the Qualification Program and received a Seal of Qualification. The Qualification Program is the process through which DFO reviews candidate VMS hardware to assess its compliance with the requirements outlined in this document. Applicants interested in submitting their devices to be considered for qualification can refer to the instructions provided in the VMS Qualification Document which can be found at [insert link].

# Guiding Principles

The following guiding principles apply to this standard:

## 2.1 Integrity

The standard will ensure that data integrity is maintained at all times throughout the data capture, storage, processing and transmission processes.

The standard will ensure that all VMS hardware can record the data, and that the data transmitted to DFO represents the location of the fishing vessel. In some cases, data is automatically reformatted prior to being saved in the VMS database, this process shall not reduce the integrity of the data.

## 2.2 Security

The standard will ensure the security of the information transmitted through the VMS hardware. The information transmitted is sensitive; hence, it is critical that all effort be made to ensure that no prejudice is caused to any stakeholders due to data loss or inappropriate access to data.

## 2.3 Innovation

The standard will allow for innovation. Stakeholders should retain their innovative abilities when developing VMS hardware. The standard clearly identifies the needs of DFO and stakeholders, without excessively limiting ways of meeting those needs.

# Definitions/Acronyms

Applicant – the company/organization that is submitting a VMS hardware for qualification.

Client – fish harvesters utilizing VMS hardware on their vessels.

C&P – Conservation and Protection.

CSP – Communication Service Provider.

DFO – Department of Fisheries and Oceans.

GPS - Global Positioning System.

IP65 – Ingress Protection rated as **protected against multi-directional, low-pressure water jets.**

Qualification - A designation given to a VMS hardware when it successfully passes the Qualification Program and fully meets all requirements laid out in the Standard.

Qualification Program – the program through which developers can submit their VMS hardware to be considered for qualification under DFO.

Seal of Qualification - A logo that is provided to applicants for hardware that has successfully completed the Qualification Program and have been designated as qualified under the DFO Standard.

WGS-84- The World Geodetic System (WGS84) is the reference coordinate system used by the Global Positioning System.

VMS – Vessel Monitoring System.

# Confidentiality Statement

Information related to each VMS hardware application submitted for qualification to DFO will be kept confidential and will only be shared with individuals or groups directly involved with the VMS qualification process.

Information collected as part of the qualification process is subject to the *Access to Information Act* and the *Privacy Act* and will be treated accordingly. In the event of an Access to Information request, applicants will be consulted prior to any disclosure of information about them in order to ensure that the information is appropriately protected.

# Qualification Process

The Qualification Program refers to the process through which applicants can submit their VMS hardware to be considered for qualification under the DFO VMS Program. Hardware that is being submitted for consideration must be compliant with the requirements set out in this Standard.

For an overview of this process, please refer to the VMS Qualification Program Document provided at the following web address: [insert link].

## Expression of Interest

Applicants interested in submitting their hardware to be considered for qualification should send a letter of interest to the VMS Program. This letter must contain the following information:

* + Name of the Company
	+ Primary Contact (name, e-mail, phone): individual who will act as the point of contact in all dealings with DFO
	+ Mailing address
	+ Phone number
	+ Email address
	+ Signature block and signature of signing authority.

A sample Letter of Interest is available in Appendix A of this document. This letter can be emailed to the following address: DFO.VMSSupport-SSNSoutien.MPO@dfo-mpo.gc.ca

## Qualification Program Applications

When the VMS program receives an expression of interest, applicants will receive a confirmation of the receipt and a copy of the VMS Qualification Program document. This document, developed in accordance with this Standard, will provide applicants with instructions on how to compile and submit their application to the Program.

## Updates to VMS Hardware

Qualification is based on the original characteristics of the specific hardware that was submitted to DFO for qualification. The complete hardware, including all component parts, must remain exactly as described in the application form. If changes are to be made to any of the hardware’s components after it has been successfully qualified, details of the proposed change must be submitted in writing to the VMS Program. Applicants will be informed if the hardware requires resubmission into the Qualification Program. It is advised that if a developer is planning upgrades to VMS hardware or software, they initiate discussions with DFO as soon as possible to avoid potential issues. If DFO becomes aware of changes to any of the component hardware or software without written approval from the VMS Program Manager, it may result in that hardware’s removal from DFO’s list of qualified VMS hardware.

# 6. Technical Specifications

This section describes the mandatory technical specifications that all VMS hardware are required to meet in order to be qualified for use in the Canadian VMS program. Developers may include additional “value added” components in hardware at their discretion so long as these do not compromise the integrity of the system as qualified by DFO.

1.

## Technical Acceptance Certificate

Must be certified by Industry Canada and issued a valid Technical Acceptance Certificate (TAC).

Inquiries concerning the certification process should be directed to:

Certification and Engineering Bureau

Industry Canada

Spectrum Engineering Branch

3701 Carling Avenue, Building 94

Ottawa, Ontario

K2H 8S2

Telephone: (613) 990-4389

Fax: (613) 990-5009

e-mail: certification.bureau@ic.gc.ca

## Naming

VMS hardware names must be unique. Once a hardware is qualified, no new hardware with that exact name will be allowed into the program in the future. Hardware updates which require requalification will require the hardware name to be adjusted to differentiate from the original (e.g. A/B, I/II, etc.).

## Accuracy

All VMS hardware must be able to triangulate GPS positions utilizing a minimum of three (3) satellites. All latitude and longitude positions must be reported using decimal degrees, and must be accurate to a minimum of five (5) decimal places. GPS Positions shall be in WGS84 format.

## Antenna

The VMS hardware must have a minimum of one set of GPS and communication antennas. The antennas can be setup as two separate or one combined antenna. They must be suitable for a severe marine environment - antennas and any other hardware that could be exposed to the marine environments should conform to a minimum of IP65**.**

If either of the antennas are disconnected or blocked, the display (as described under 6.7 Hardware Operational Status) must change to reflect a “non-operational status”.

## Data Transmission

All hardware must be capable of sending position reports at a time interval specified by DFO, and capable of changing this interval remotely as required (e.g. changing reporting from 1-hour intervals down to 5-minute intervals without being directly connected to the device). Once configured, the hardware must be able to send a position report continuously at that interval until such time as it is changed. Interval change requests must be made without delay. More details on data transmission can be found in section 7.4.

## Configuration

VMS hardware configuration must be protected and only changeable by the CSP or its representative. The minimum acceptable protection will be a password to limit the potential of unauthorized hardware configuration. Changes to VMS hardware must be logged with the position logs so an audit of changes to configuration can be performed

Remote configuration functions must include changing the reporting interval, software updates, updating boundaries for geo-fencing purposes, retrieving position reports from the VMS hardware’s position log file for a specific time period, and polling for VMS hardware status report.

## Hardware Operational Status

All hardware must have a means to easily identify its operational status. The display can be a Graphic User Interface (GUI), LED lights or a combination of both. The display must be visible from various locations within the wheel-house and be physically integrated with the VMS hardware so that the operational status may be identified without connecting the hardware to a computer or other external device.

At a minimum, the VMS hardware must be able to display that the hardware has power, that it is acquiring positions (i.e. that the GPS antenna is functional) and that it is transmitting reports (i.e. the communication antenna is functional). The hardware must also be able to clearly display when it is not functional. If an LED display is utilized, this would result in a minimum of three (3) LEDs.

## Power Supply

The most common type of power on a vessel ranges from 10-40V DC. The VMS hardware must be able to connect to such power sources either directly or through another device that regulates the power supply for the VMS hardware. If there is extra equipment required for the hardware to work in such an environment, then the applicant must identify such requirements as part of the VMS hardware solution. The VMS hardware must be able to cope with power fluctuations likely to be experienced on board fishing vessels without any degradation to performance.

## Backup Power Source

VMS hardware must be able to connect to a secondary power source.

## Hardware Storage and Accessibility

VMS hardware must contain sufficient internal storage to maintain two (2) year’s worth of positions, with new positions over writing old ones. In the event of a seizure or transmission failure, the CSP must provide DFO a way to access this data in a readable format.

## Tamper Proofing

VMS hardware must be designed in such a way as to prevent physical tampering and digital hacking to the extent possible.

## Cellular Transmission

Users may transmit reports via the cellular network when a cellular signal is available. However, all hardware must be capable of automatically switching to satellite transmission when a cellular signal is not available. The use of cellular **MUST NOT** interrupt the transmission of reports at the specified reporting interval.

## Application Programming Interface

There must be an application interface available for the VMS hardware such that the functionality can be extended to support other types of reports from other hardware. These extra peripherals may or may not be directly connected to the VMS hardware, but rather to another computer-device on the vessel. The application on the connected computer-type device must be able to send reports received from the extra peripherals through the hardware as required by DFO or the client.

*NOTE: These reports must be clearly identified to be separate from the required positional reports sent directly by the VMS hardware, such that the reports from the hardware cannot be altered, replicated or reproduced.*

# Data Specifications

This section describes the mandatory data specifications that all VMS hardware are required to meet in order to be qualified for use in the Canadian VMS program. To ensure program integrity, it is essential that data be received by DFO in a secure, reliable and timely manner.

## Reliability

A fully operational hardware shall transmit a minimum of 95% of required reports to DFO at the specified time and shall not miss any more than two (2) consecutive reports.

DFO may conduct periodic analysis on VMS hardware after qualification. If an issue/problem arises impacting the qualified hardware such that it no longer meets this standard, it may be removed from the list of units qualified for use in Canada.

## Communication Service Provider (CSP)

Clients are responsible for acquiring service from a communication service provider (CSP) for their VMS hardware. The unique identifier assigned to the hardware (normally an IMEI number or a serial number) by the CSP must be included on the Registration Form submitted to DFO by the client.

## Reporting

The VMS hardware must be transmitted to DFO using the following format:

* A double slash (“//”) and the characters “SR” to indicate the start of a report;
* A double slash (“//”) and the field code to indicate the start of a data element;
* A single slash (“/”) to separate the field code and the data; and
* The characters “ER” and a double slash (“//”) at the end to indicate the end of a report.

\*\* *Please note that although this is based on the NAF format, it is not identical and some fields may have different meanings. The definitions of each field have been provided for each report to ensure clarity and consistency.\*\**

1. **Position Report**

This is the most frequent report, and is required to be sent at set intervals as defined by DFO. It should be transmitted to DFO in the format outlined above. The required contents for this type of report is outlined in the table below. The following is a sample report:

**//SR//ID/30023406253250//TR/POS//DA/20190118//TI/022521//LA/45.54393//LO/-63.35335//SP/10.3//HE/125//SQ/25945867//ER//**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field Code** | **Data Element**  | **Format** | **Definition** |
| SR | Start Report |  | Indicates the start of the report. |
| ID | Unique VMS Hardware Identifier | Numerical and/or characters | Serial Number, IMEI, etc. This number must exactly match the number on the DFO VMS registration form for that hardware. Vessel names will not be accepted. |
| TR | Type of Report | Characters | Report types “POS”, “ENT”, “EXI”, “ON” or “OFF”. POS = regular positional report as per required polling rate.ENT = report sent immediately upon entry into a geofence.EXI = report sent immediately upon exit from a geofence.ON = report sent immediately after the hardware is powered up.OFF = report sent as the hardware is powered down. |
| DA | Date | YYYYMMDD | Date of when the position was acquired by the hardware, recorded in the format  |
| TI | Time | HHMMSS | Time of when the position was acquired by the hardware, recorded in UTC. |
| LA | Latitude | +/- DD.ddddd | Latitude, recorded in decimal degrees to a minimum accuracy of five (5) decimal places  |
| LO | Longitude | +/- DDD.ddddd | Longitude, recorded in decimal degrees to a minimum accuracy of five (5) decimal places  |
| SP | Speed | Numerical to one decimal place. | Speed, recorded in nautical miles per hour (NM/hr) with a minimum accuracy to one decimal place. This measurement is captured from the GPS module. |
| HE | Heading | 0-359 | Heading, recorded as an angle from true north. This measurement is captured from the GPS module. |
| SQ | Sequence Number | Numerical | This is a unique, chronological number assigned to each report that allows DFO to pull reports in order from the CSPs data repository. Each CSP will have it own unique sequence.  |
| ER | End Report |  | Indicates the end of the report. |

1. **Hardware No-GPS Report**

In the event that a GPS position cannot be acquired at the time of a required position report, a NO-GPS fix report must be sent stating that a position could not be acquired and the number of GPS satellites detected at the time of the report. It should be transmitted to DFO in the format described at the beginning of this section and contain the required information as outlined below. All NO-GPS fix reports shall consist of the predetermined default location of Latitude: 51, Longitude -114. The following is a sample report:

**//SR//ID/300234062533250//TR/NFX //DA/20190118//TI/022521//LA/51//LO/-114//SC/0//SQ/25945867//ER//**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field Code** | **Data Element**  | **Format** | **Definition** |
| SR | Start Report | Numerical and/or characters | Indicates the start of the report. |
| ID | Unique VMS Hardware Identifier | Numerical and/or characters | Serial Number, IMEI, etc. This number must exactly match the number on the DFO VMS registration form for that hardware. Vessel names will not be accepted. |
| TR | Type of Report | Characters | NFX = a NO-GPS fix report. |
| DA | Date | YYYYMMDD | Date of when the position was acquired by the hardware, recorded in the format  |
| TI | Time | HHMMSS | Time of when the position was acquired by the hardware, recorded in UTC. |
| LA | Latitude | +/- DD.ddddd | Latitude, recorded as the default coordinate 51. |
| LO | Longitude | +/- DDD.ddddd | Longitude, recorded as the default coordinate -114. |
| SC | Satellite Count | Numerical | The number of GPS satellites detected at the time of the report. |
| SQ | Sequence Number | Numerical | This is a unique, chronological number assigned to each report that allows DFO to pull reports in order from the CSPs data repository. Each CSP will have it own unique sequence. |
| ER | End Report |  | Indicates the end of the report. |

After the NO-GPS report is sent, the VMS hardware must attempt to acquire a new position and send a position report as soon as it is acquired. If the next position interval is reached before acquiring a position another NO-GPS fix report must be sent and the process repeated.

1. **Backlogged Data**

In instances where there is a disruption in data transmission and data is backlogged on VMS hardware or on the CSP server, DFO should be notified as soon as possible. Once the transmission issues have been resolved, data should be made available to DFO in chronological order (i.e. the oldest report first) using the date and time that the positions were acquired by the hardware.

## Data Transmission

All data must be sent to DFO in the format as described in section 7.3. Data will be acquired by DFO utilizing an IP-IP protocol and encryption using certificates.

CSPs must have a secure location to store VMS data, for example a server, a web service, etc. CSPs must provide DFO with a username and password using HTTP authentication headers to access this encrypted data connection. Where possible, all data must be stored in chronological order of when positions were acquired by the hardware. At regular intervals, DFO will pull data from this repository into the National VMS Database, using the sequence number (SQ) as a guide. The SQ is specific to each CSP, each CSP can determine how to create this SQ so long as it is able to identify the last (or most recent) record for that CSP. The SQ should always reference the same position record for that CSP.

All data must be made available for transmission to DFO without delay after it is received from the hardware. This allows DFO to maintain near-real-time positional data with minimal latency. If, for any reason, data is not immediately available, CSP’s must notify DFO as soon as practical.

## Geofencing

The VMS software must be able to create geofences based on coordinates of specified areas (international, Marine Protected Areas (MPA’s), closed zones, etc) provided by DFO. It must also be able to send entry and exit reports, which may be based on predefined conditions (such as speed, for example), related to these geofences. The VMS hardware must be able to receive and update these coordinates either remotely or via a physical update by the CSP. These reports are in additional to the regular positional reports.

## Data Protection/Privacy

Data from VMS hardware is collected by CSPs for the purpose of transmitting to DFO on behalf of their clients. Note that applicable data protection laws require CSPs to appropriately safeguard any identifiable data such as personal information that it collects from all VMS hardware.

Identifiable data may only be used for the purpose for which it was collected; CSPs must obtain consent from their clients if they intend to use or disclose identifiable data for other purposes. Clients have a right to access their information and correct inaccurate information held by a CSP.

# Previously Approved Hardware

VMS hardware that have been previously approved under the *Fisheries and Oceans Hardware Type Approval Process (version 1.3.0 September 06, 2015)*, including those hardware that were grandfathered in,must now be qualified under the DFO VMS Qualification Program (Section 5). Service providers will be given six (6) months from the effective date of this standard to have their existing hardware qualified. Those that meet the new standard will be qualified for use by DFO. Those that do not meet the new standard will not be qualified for use in Canada. Hardware that has not been submitted for qualification within the six (6) month period will be removed from the list of units qualified for use in Canada. Developers with new hardware may submit it at any time following the effective date of this standard.

If a fish harvester has hardware that does not meet this new standard, they will be given one (1) year from the end of the initial 6 month qualification period (i.e. 18 months from the effective date) to replace it with a qualified hardware.

DFO will make all reasonable attempts to notify users of previously approved hardware that have not met these new standards to inform them of their options.

**Note: It is the responsibility of users to know what VMS hardware they are using and if it is qualified by DFO.**

# Official Languages

If requested, developers should be willing and able to provide necessary user documentation in both official languages of Canada.

# Legal and Technical Support

Due to the use of VMS in law enforcement, all technical aspects of a service provider submission are subject to being admitted as evidence in a court of law, as required. The reliability of all technologies utilized in the hardware may be analyzed in court for, inter alia, testing procedures, error rates, peer review, and general industry acceptance. Furthermore, the service provider may be asked to provide technical and expert support regarding VMS capabilities to establish DFO’s case against suspected violations.

The data chain of custody shall be tamper proof. For court cases, the copyright holder of the VMS hardware shall be able to explain how it works, especially concerning the management of the data. This would include any applicable data converter.

# Effective Date

This standard and the procedures contained within will come into effect on DATE, thereby replacing the *Fisheries and Oceans Hardware Type Approval Process (version 1.3.0 September 06, 2015).*

The procedures shall be applied to **all** candidate hardware for qualification into the VMS program. Any hardware previously approved for use will also be subject to this standard (see section 8 for details).

# Amendments

DFO may revise this standard at any time. Updates shall be posted on the DFO VMS website (<http://www.dfo-mpo.gc.ca/fisheries-peches/sdc-cps/vessel-monitoring-surveillance-navire/index-eng.html>).

# Signature

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Sylvie Lapointe Date

Assistant Deputy Minister,

Fisheries and Harbour Management

# APPENDIX A

EXPRESSION OF INTEREST



*The following is a sample letter of interest that can be used by applicants as per Section 5.1 of the above Standard document*

E-mail Guidelines

Subject Line: VMS Qualification Program – Letter of Interest – [Company Name] – [Model Name]

To:  DFO.VMSSupport-SSNSoutien.MPO@DFO-MPO.gc.ca

Sample Letter

To the VMS Program,

On behalf of the [Insert Company Name here], I would like to convey our interest in enrolling in the DFO VMS Qualification Program.

We request that you send us the necessary materials and instructions for our application, via the e-mail identified below.

Sincerely,

X
\_\_\_\_\_\_\_\_\_\_\_\_\_insert signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| Name of the Company  |   |
| Company Mailing Address  |    |
| Primary Contact and Role/Relationship to Company  |   |
| E-mail for Primary Contact  |   |
| Phone for Primary Contact  |   |