

IALA GUIDELINE

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GUIDELINE ON SHIP REPORTING FROM A SHORE-BASED PERSPECTIVE

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1. OVERALL GUIDELINE GOAL

The overall goal of the Guideline on Ship Reporting from a Shore-based Perspective is to assist shore-based stakeholders with automating processes and procedures associated with VTS Reporting and ship reporting in general, while complying with national and regional reporting requirements and with FAL Resolutions on ship reporting.

Automating these processes and procedures is expected to:

- Make them less labour intensive and error prone.
- Ensure compliance with all applicable national and regional port and area entry rules and regulations.
- Result in faster identification of abnormal (exception) reports that shore-based stakeholders will need to address through (enforcement) action, thereby reducing the time it takes to clear a ship for port entry.
- Improve compliance with reporting requirements by conveying details of the latest report submission requirements to ships well ahead of their submission deadlines.

1.1. STREAMLINING SHIP REPORTING

1.1.1. INTERMEDIARY SHIP REPORTING SYSTEM

To comply with [FAL resolution 12\(40\)](#) Standard 1.3bis, Shore-based Stakeholders face pressure to provide solutions that facilitate the electronic exchange of information related to arrivals and departures of ships, persons and cargo. The ideal and most comprehensive solutions currently realized are known as National Single Window (NSW) or Maritime Single Window (MSW) systems. Unfortunately, these systems can be difficult to establish for a variety of reasons and may be impossible for many Shore-based Stakeholders to establish for several years. For this reason, this Guideline proposes that Shore-based Stakeholders, who are currently unable to realize an NSW/MSW, initially migrate to an “Intermediary” Ship Reporting System. The purpose of the Intermediary Ship Reporting System is to:

- Improve compliance with reporting requirements.
- Identify and catalogue currently required ship reports as a step towards streamlining and automating national processes and procedures.
- Enable shipboard and shore-based reporting systems to automate generation and submission of reports to Shore-based Stakeholders as a means of standardised and automated reporting (S2 Prioritised e-Navigation Solution, e-Navigation Strategy Implementation Plan, [MSC.1/Circ.1595](#))

The Intermediary System allows Shore-based Stakeholders to continue to use their current national and regional ship reporting processes and procedures but requires them to:

- Replace the definition of the data elements of their reports with the definition of data elements published in the [IMO Compendium](#).
- Publish the reporting requirements in a ship reporting Central Repository that shipboard and shore-based reporting systems can use to automate generation and submission of reports (see Section 3.2.2 [Submit Local Reporting Requirements to Central Repository](#))
 - What reports are required?
 - When are they required?
 - Who do they need to be addressed to?
 - How should they be submitted?

Figure 1 depicts the establishment and maintenance of the Central Repository and Figure 2 depicts the functionality of ICT ship reporting tools at high levels:

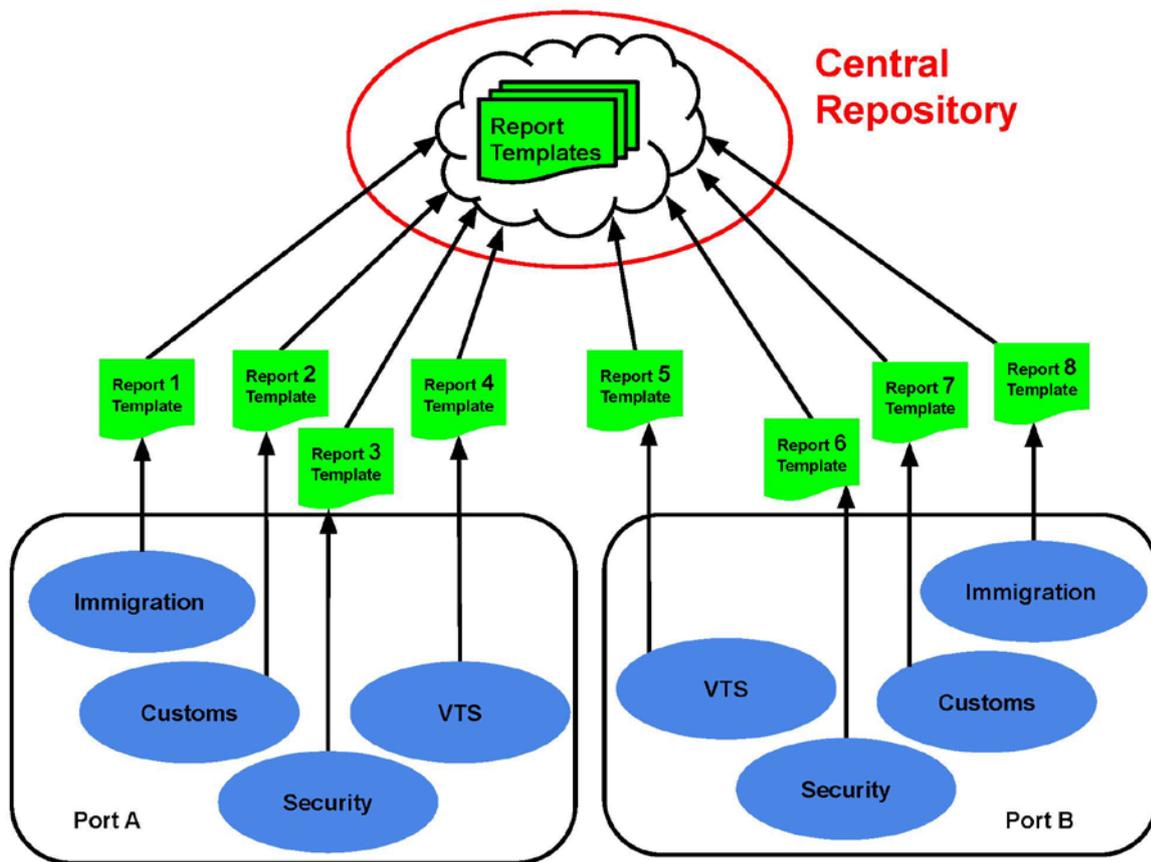


Figure 1 Central repository of report templates

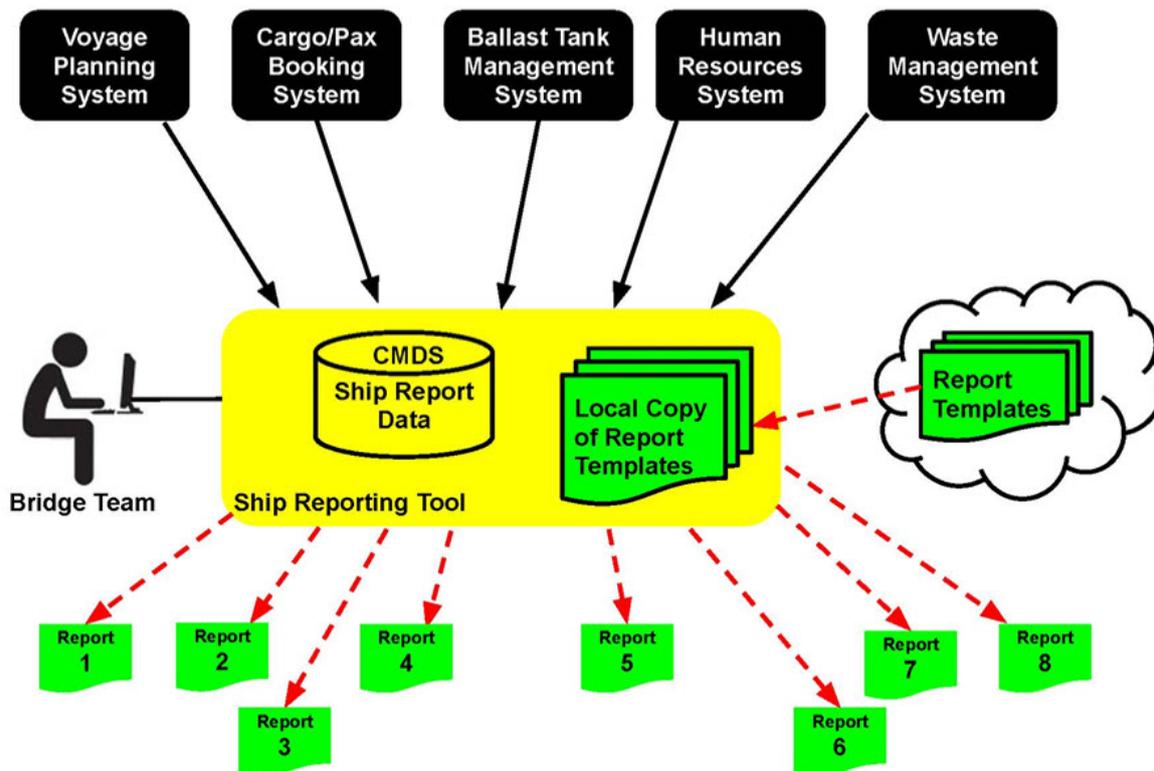


Figure 2 ICT Ship Reporting Tool

1.1.2. FULLY DIGITAL HARMONISED SHIP REPORTING SYSTEM

To enable realisation of all Guideline goals, this Guideline proposes that Shore-based Stakeholders implement a fully digital information exchange with ships using web services, possibly taking advantage of the infrastructure of existing NSW/MSW systems. The message exchanges between a ship and the NSW web service should be harmonised to make it possible for on-board ship reporting [ICT](#) tools to automatically exchange messages with all NSW's.

This involves establishing a National Authority that hosts a web service that shipboard reporting systems will use to request port entry, to receive updates on the latest reporting requirements and to submit ship reports to the National Authority along with their updates.

If it involves Mandatory Ship Reporting then the National Authority hosts a web service that shipboard reporting systems can use to request area entry, to receive updates on the latest reporting requirements and to submit Mandatory Ship Reports to the National Authority.

A pre-requisite for implementing a harmonized fully digital ship reporting system is streamlining and automating national and regional processes and procedures. This includes implementing a system that the National Authority can use to automatically distribute the ship reports it receives to individual government agencies and other stakeholders, possibly including shore-based stakeholders in other countries that are on the ship's voyage plan.

The latter could involve updating a Port Community System (PCS) that governmental and industry stakeholders, in turn, can use to populate their individual information systems.

2. BACKGROUND

2.1. DESCRIPTION OF LEGACY SHIP REPORTING SYSTEMS

2.1.1. IMO MANDATORY SHIP REPORTING SYSTEM

IMO adopted the Ship Reporting System with Resolution [MSC.31\(63\)](#) as an amendment to SOLAS 74 on 23 May 1994. At that time, the Ship Reporting System did not become mandatory, but MSC.31(63) states:

“The Organisation shall ensure that adopted ship reporting systems are reviewed under the guidelines and criteria developed by the Organisation.”

In Resolution [MSC.43\(64\)](#), adopted on 9 December 1994, IMO invited Governments to apply for the establishment of Mandatory Ship Reporting Areas. It provides guidelines and criteria for Ship Reporting Systems in Annex 11.

Mandatory Ship Reporting did not start until 1996. At that time, VHF radiotelephony was envisioned but digital reporting was endorsed whenever it became available. MSC.43(64) states:

“Shore-based authority should have the ability to relay information relating to distress, maritime safety or threats to marine environment without delay to the appropriate national or international maritime authorities, with a view to the initiation of response action.”

The first two mandatory ship reporting systems were adopted in Resolution [MSC.52\(66\)](#) on 30 May 1996. One for the Torres Strait / Inner route of the Great Barrier Reef and the other for “Off Ushant, France”. The format and content of reports and the reporting time and geographical position for submitting report, authority to whom reports should be sent and available services are described in MSC.52(66).

Since then more than 20 other Mandatory Ship Reporting Systems have been adopted in IMO/MSC Resolutions. Mandatory Ship Reporting systems come into effect six months after adoption by IMO.

2.1.2. Ship reporting other than IMO Mandatory Ship Systems

All countries/ports require ship reports. The required reports differ from port to port even if they are in the same country. While some countries have established a National Single Window (NSW), ports within the country often still require additional reports. Many countries/ports still require reports to be sent directly to individual shore-side stakeholders on their unique forms.

Many ports have adopted FAL Forms 1-7 for some of these reports but still require ships to submit them in hard copy to shore-based stakeholders.

Below is an example of the reporting requirements for Guangzhou, China as of 14 November 2016 according to [IHS Markit](#).

Pre Arrival Information

ETA: The Master should advise the vessel's ETA to the state agent or through the local agent to the state agency, 72, 48 and 24 hours prior to the vessel's arrival at the pilot station. The ETA message should include the time and date of the vessel's arrival and sea/fresh water draughts.

If there is any dangerous cargo onboard, the Master should also report details of that cargo including description, packaging, IMO code and gross/net weight.

Should the vessel's ETA or other circumstances change, prior to arrival, the Master should send further messages.

Documentation required:

Document	Distribution (copies)						Total
	LA	IM	CH	QI	AP	HM	
1. General Declaration	-	1	1	1	1	1	5
2. Cargo Declaration	-	-	1	1	1	1	4
3. Ship's Stores Declaration	-	-	1	1	1	-	3
4. Crew's Effects Declaration	-	1	1	-	-	-	2
5. Crew List	1	2	1	1	1	1	7
6. Passenger List	-	2	1	1	1	1	6
7. Maritime Declaration of Health	-	-	-	1	-	-	1
8. Last Port Clearance	-	-	-	-	-	1	1
9. Ship's particulars	1	-	-	-	-	1	2
10. Crew's passports	-	All	-	-	-	-	All
11. Chinese Tonnage Dues Certificate	-	1	-	-	-	-	1
12. Cargo Manifest	1	-	2	-	-	-	3
13. Bills of Lading	1	-	-	-	-	-	1
14. Stowage Plan	1	-	-	-	-	-	1

Note: In the above table LA = local agent, IM = Immigration office, CH = Customs House, QI = Quarantine Inspection office, AP = Animal and Plant Inspection office, HM = Harbour Master.

Figure 3 Example ship reporting requirements

There are 19 different report types:

- 1 Arrival Declaration / General Declaration
- 2 Ballast Water Log
- 3 Cargo Declaration
- 4 Certificate of Disembarkation
- 5 Certificates
- 6 Crew Effect Declaration / Article
- 7 Crew Vaccination Record List
- 8 Crew List Report
- 9 Foreign Currency List
- 10 General List / NIL List
- 11 Health
- 12 Passenger List
- 13 Port of Call List / Voyage Memo
- 14 Security Report
- 15 Ship's Particulars

- 16 Ship's Repair
- 17 Ship's Stores Declaration
- 18 Tank Condition
- 19 Waste Notification

A country/port typically requires a subset of these reports on their unique forms.

The [IMO Compendium](#) contains definitions for data elements for many of the above report types but definitions of the data elements for other types of reports ("Data Structures") will still need to be added to enable countries/ports to migrate to the Intermediary Ship Reporting System (see [section 3.2.1.1](#)).

2.2. EVOLUTION OF SHIP REPORTING SYSTEMS

2.2.1. COMPLY WITH FAL RESOLUTIONS

The FAL Convention annexes contain several standards and recommended practices that Contracted Governments will need to comply with. These are managed and updated by the FAL Committee, via FAL Resolutions.

2.2.1.1. Accept FAL Forms

The FAL Convention as amended, includes a list of documents in its Standard 2.1 which public authorities can demand of a ship and recommends the maximum information and number of copies that should be required.

IMO developed Standardized Forms for seven of these documents (updated FAL Forms are effective since 1 January 2018):

- [IMO General Declaration](#) (FAL form 1)
- [Cargo Declaration](#) (FAL form 2)
- [Ship's Stores Declaration](#) (FAL form 3)
- [Crew's Effects Declaration](#) (FAL form 4)
- [Crew List](#) (FAL form 5)
- [Passenger List](#) (FAL form 6)
- [Dangerous Goods](#) (FAL form 7)

Three additional declarations entered into force on 1 January 2018:

- Security-related information as required under SOLAS regulation XI-2/9.2.2.
- Advance electronic cargo information for customs risk assessment purposes.
- Advanced Notification Form for Waste Delivery to Port Reception Facilities.

Two other documents may also be required under the Universal Postal Convention and the International Health Regulations.

2.2.1.2. Establish National/Maritime Single Window (NSW/MSW)

Ref. FAL resolution 12(40) from 2016 Contracting, Governments should encourage public authorities to introduce arrangements to enable the submission of all the information required by public authorities in connection with the arrival, stay and departure of ships, persons and cargo (avoiding duplication) to a "Single Window".

Consideration should also be given to such a Single Window serving as the mechanism through which the public authorities communicate decisions and other information covered by the FAL Convention.

In April 2019, the FAL Committee issued Revised guidelines for setting up a Maritime Single Window (MSW). See [FAL.5/Circ.42](#). It serves as a source of information, advice and guidance for those IMO Member States looking to

create an MSW and provides examples of the experience and knowledge gained by some Member States in approaching the implementation of MSW.

Shipping companies engaged in international trade regularly must submit large volumes of information and documents to ports and governmental authorities, to comply with regulatory requirements. The information often must be submitted through several different agencies, each with its own specific system and paper forms. These requirements, together with the associated compliance costs, constitute a burden both to Governments and to the business community and can be a major barrier to the development of international trade, particularly in developing countries.

Establishing a Single Window facility is one means of addressing this problem. It can enhance the availability and handling of information and can simplify and expedite information flows between trade and government. It can also bring about greater harmonization and better sharing of the relevant data across governmental systems, bringing meaningful gains to all parties involved in cross-border trade.

2.2.1.3. Accept Electronic Ship Reports

The mandatory requirement for national governments to introduce electronic information exchange between ships and ports came into effect from 8 April 2019, under the FAL Convention.

According to the FAL resolution 12(40) Standard 1.3bis, Public Authorities had to establish systems for the electronic exchange of information by 8 April 2019. A period of no less than 12 months for transition to the mandatory use of the systems would be provided from the date of the introduction of such systems.

Standard 1.6bis states that when introducing systems for the electronic exchange of information required by public authorities for the arrival, stay and departure of the ship, persons and cargo to facilitate clearance processes, Contracting Governments shall encourage public authorities and other parties concerned (ship-owners, handling companies, seaports, and/or cargo agents, etc.) to exchange data in conformity with the relevant UN Standards. Such standards include UN Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT) Standards, or other internationally agreed Standards, such as the XML Standard.

2.2.2. AUTOMATE INTERNAL WORKFLOW AND PROCESSING OF SHIP REPORTS

Recommended practice stated under section C in [FAL resolution 12\(40\)](#) is:

Contracting Governments should encourage public authorities and other parties concerned to cooperate or participate directly in the development of electronic systems using internationally agreed standards with a view to enhancing the exchange of information relating to the arrival, stay and departure of ships, persons and cargo and assuring inter-operability between the systems of public authorities and other parties concerned."

3. IMPLEMENTATION STEPS

While the goal is to establish a world-wide harmonised fully digital ship reporting system, it is unlikely that all shore-based stakeholders will be able to migrate to such a system at the same speed. For this reason, this Guideline proposes that shore-based stakeholders, who are not ready to establish an NSW/MSW, initially implement an Intermediary Ship Reporting System. Stakeholders should be able to migrate to the Intermediary System in about 18 months because it does not require them to change their existing ship reporting processes and procedures. Rather it requires that:

- The definition of the data elements in existing forms be harmonised with the IMO Compendium
- Templates of existing ship report forms and their submission requirements are published on a Central Repository

3.1. INTERMEDIARY SHIP REPORTING SYSTEM

3.1.1. PURPOSE OF INTERMEDIARY SYSTEM

A harmonized ship reporting system will help to facilitate more efficient and effective communication between maritime stakeholders for reporting purposes.

3.1.2. CONCEPT

The concept of the intermediary system revolves around a Central Repository, where shore-based stakeholders publish instances of their report templates. Ships and shore-based representatives of ships (i.e. Port Agents) will retrieve report templates and submit the reports, when completed, directly to Shore-based Stakeholders.

Each report template, that is published in the repository, comprises a set of data fields selected from a standardized pre-defined list known as the [IMO Compendium](#). Shore-based Stakeholders can create customised templates by retrieving the relevant data elements from the Compendium. The Compendium harmonises the names of data elements and avoids confusion arising from different names used for the same data element. It ensures data interoperability across compliant systems.

3.1.2.1. Central Repository

Shore-based stakeholders must define information about their country, port or area in the Central Repository. This includes the reporting area, URL of the destination port's webservice (if available) as well as relevant information that the ship needs to know. The reporting area can be used by the system to determine the Estimated Time of Arrival (ETA) of the ship at the destination port, and to advise the ship on the submission requirements of updates and/or additional reports where necessary.

The information required to define a port should include:

- Port Name
- Country
- Email
- Telephone
- Reporting area
- Web page or web service URL (if available).
- Means of submitting report (Email / Web form / Fax / REST/SOAP API).
- Format of submission (XML / JSON / PDF / Spreadsheet / Word Document/plain text).

The Central Repository provides a web interface as well as REST/SOAP API's that will enable shore-based stakeholders to publish and maintain report templates and their submission requirements.

3.1.2.2. Ship Report Templates

For reports to be submitted by inbound ships, shore-based stakeholders create report templates by selecting data elements from a global set in the IMO Compendium, as shown below.

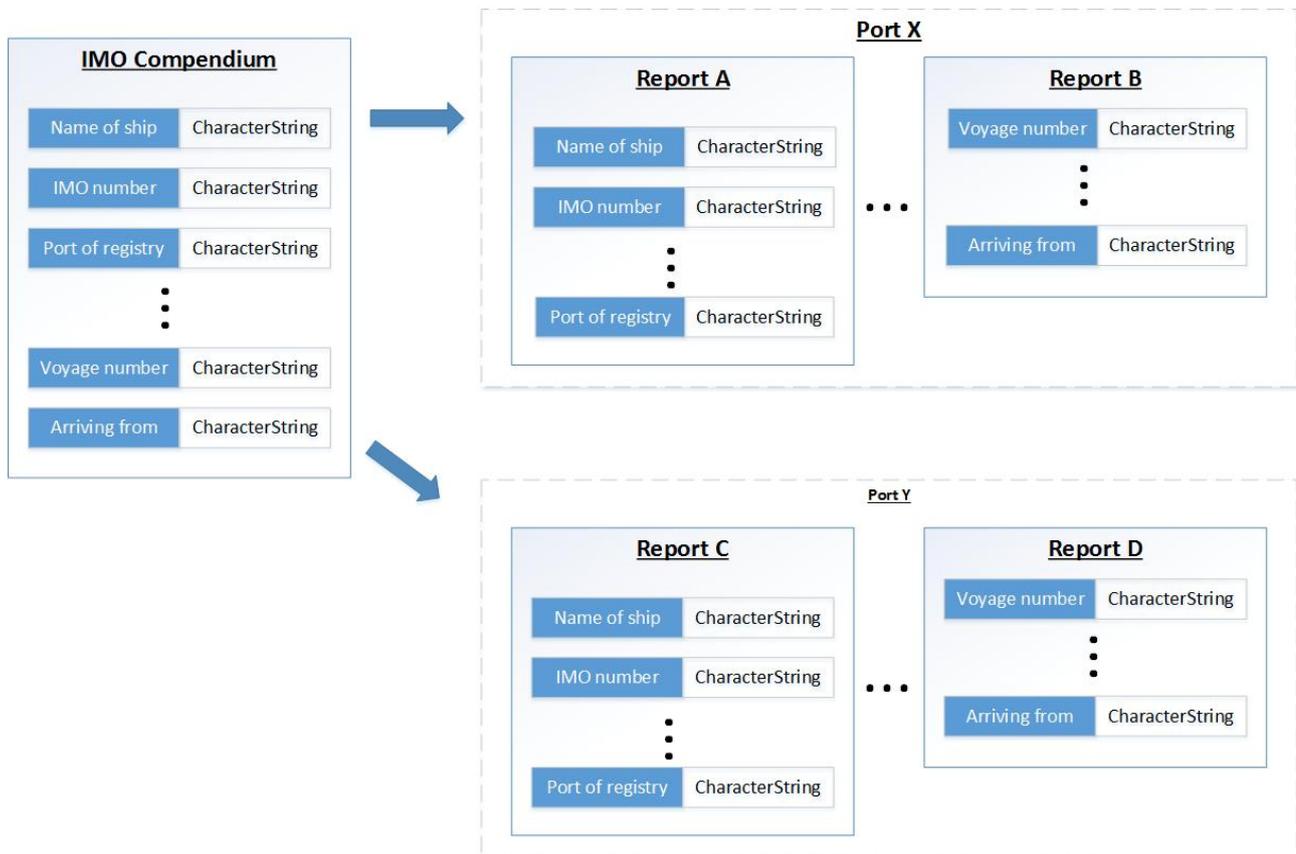


Figure 4 Ship Report Templates

The data elements in IMO Compendium can be found at <https://svn.gefeg.com/svn/IMO-Compendium/Current/index.htm>.

In addition to defining the data elements to be used in each report template, rules can also be included, i.e. to define the submission timeline for the reports, and types of vessels for which the reports are applicable. For example, Pre-Arrival Notification (PAN) would be attached with the rule that defines the number of hours prior to arrival for a PAN to be submitted, and the types of vessels that need to submit a PAN.

Rules that can be applied:

- Submission Trigger
 - Time – X hours before ETA.
 - Location – Distance from port.
 - Location – Area defined by the Shore-based stakeholder – ship will submit the report if its location is within the area.
- Applicability
 - Last Port
 - Ship Type
 - Ship Size (DWT)
 - Cargo Type
 - Etc.

3.2. MIGRATION STEPS TO THE INTERMEDIARY SHIP REPORTING SYSTEM

3.2.1. HARMONISE DEFINITION OF DATA ELEMENTS IN EXISTING FORMS

To allow ports to define their report templates and communicate them to ships without ambiguity, a standardized set of data elements must be used. The IMO Compendium includes harmonised definitions of data elements.

3.2.1.1. Using IMO Compendium

The IMO Compendium on Facilitation and Electronic Business is a tool for software developers that design the systems (i.e. ICT Ship Reporting Tools) needed to support transmission, receipt, and response via electronic data exchange of information required for the arrival, stay, and departure of the ship, persons, and cargo to a port. With regard to reporting obligations to public authorities, the IMO compendium consists of a data set, a reference model, and mapping to three main standards:

- World Customs Organization (WCO)
- United Nations Economic Commission for Europe (UNECE)
- International Standards Organization (ISO)

The IMO reference model is growing since FAL 43 approved the compendium to go beyond the scope of the FAL convention and will be the base model for many of the maritime services provided in MSC circulars [1595](#) and [1610](#).

The IMO Compendium will also be mapped to [S-XXX Product Specifications](#).

One of the core principals when the compendium was designed was that this was not intended to be a “new” standard rather the tool to harmonize existing standards and from the beginning all participants agreed to that principal. The goal was to produce a guidance for all interested parties to be able to automatically map the data set coming out of the FAL convention to any of the leading standards and make it easier for companies involved in maritime trade or transport to create software that could communicate no matter of the standard they were based on. This means that any organisation responsible for a standard or a data model in the scope of a ship approaching a port is welcome to add and map data in the FAL compendium.

For detailed information about the compendium see:

<https://svn.gefeg.com/svn/IMO-Compendium/Current/index.htm>

3.2.1.2. Adding Data Elements to IMO Compendium

The IMO compendium is maintained by the Expert Group of Data Harmonization (EGDH) which is a group of experts that meet between the regular FAL committee meetings and prepare updates to the compendium that the FAL committee approves. [Annex 2](#) describes an example of ship report harmonization that is a pre-requisite for adding data elements to the compendium. During the FAL committee the work produced by EGDH will be examined by the electronic business working group.

To add data to the compendium shore-based stakeholders need to submit input papers in accordance with IMO procedures and preferably in a defined format. As a submitter, a Shore-based stakeholder can either submit input to the EGDH which runs on a fixed priority list by the FAL committee and EGDH can recommend a priority to be approved by the next FAL committee, or the submission can be made directly to the FAL committee which will assign the priority for the next EGDH.

The current format to submit new data elements to the data set is in the following format:

Description of the sequence of data exchanges. (The submitter is required to send in a brief description of the flow of the data between the submitter and the receiver)

1. Description of data elements as follows:

Change indicator	Data ID	Data element	Definitions	Format	Code lists	Business rules
------------------	---------	--------------	-------------	--------	------------	----------------

The elements mandatory for submission are:

- Data element
- Definitions
- Format

The other fields are not mandatory, but it is advised to specify Change indicator and Data ID for fields that are requested to be updated. Code lists and business rules are to be provided if known or if the submitter has a suggestion.

3.2.2. SUBMIT LOCAL REPORTING REQUIREMENTS TO CENTRAL REPOSITORY

To facilitate ports in maintaining their report templates, the intermediary system will provide a web portal with a user interface for Shore-based Stakeholders to publish and maintain their report templates. The web portal allows users to create report templates that are to be submitted by ships, and to select the data elements required in the report templates. This process is illustrated in Figure 5. Users can publish rules for each report template to indicate the submission criteria.

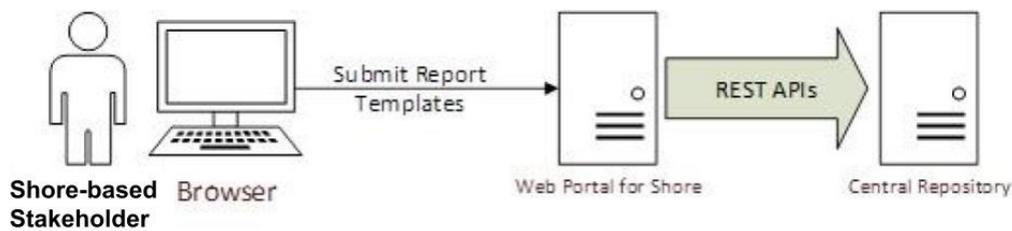


Figure 5 Submission of local reporting requirements to central repository

3.2.3. RETRIEVE REPORTING REQUIREMENTS

An ICT Ship Reporting tool can help to automate reporting tasks, such as automatically populating reports from other systems (i.e. Voyage Planning System, Stores Management System, etc.) and sending completed reports based on reporting requirements (i.e. PDF, Text, Spreadsheet, XML, JSON, etc.).

An ICT Ship Reporting tool can also be used to retrieve the most up-to-date report templates from the Central Repository as illustrated in Figure 6.

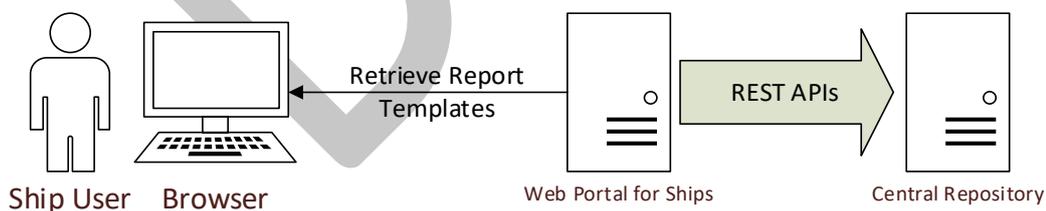


Figure 6 Retrieval reporting requirements

Through this web service, ICT ship reporting tools can declare the ports and mandatory ship reporting areas that are on the voyage plan and retrieve templates of the reports that are to be submitted.

3.3. HARMONIZED SHIP REPORTING SYSTEM

A harmonised ship reporting system reflects the idea that the ship can submit its obligatory reporting requirements in standardized way, without having to worry about which country or port the ship is arriving at.

This idea is one of the most important solutions to reduce the amount of mariners' time spent on preparing and submitting reports to Shore-based Stakeholders.

The use of standards plays an important role in a harmonised ship reporting system and the emerging digitization in the maritime world, both on the ship and on shore, is a key enabler to achieve the ambition set out in the IMO e-navigation Strategy Implementation Plan Solution 2 – Means for standardized and automated reporting (see MSC.1/Circ.1595).

A harmonised ship reporting system using the IMO e-navigation ambition is achieved through the concept of “Reporting as a Service”.

3.3.1. CONCEPT

The introduced maritime “Reporting as a Service” comprises reporting services that supports reporting to two recognized reporting systems.

The first system, Vessel Shore Reporting (VSR) is normally implemented for (pre-) arrival, stay and departure reporting. This service should cover information and guidelines related to reporting formalities and instructions (when, what and how) for reporting to a specific country or port. In addition, this service should also facilitate the exchange of information required in a single window ship reporting system. The VSR regime should be based upon internationally recognized data formats and exchange standards.

The second system is normally linked to a transit in an area where a Mandatory Ship Reporting System (MRS) is established. Ship reporting systems and reporting requirements are used to provide, gather, or exchange information in short reports between the ship and shore. The information is used to provide data for many purposes including search and rescue, vessel traffic services, weather forecasting and prevention of marine pollution.

Resolution [MSC.433\(98\)](#) on Guidelines and criteria for ship reporting systems, recalls that communication between a shore-based authority and a participating ship should be limited to information essential to achieve the objectives of the Ship Reporting System. Details regarding recommended reports and data elements for Ship reporting systems and reporting requirements are found in the [IMO resolution A.851](#).

Reporting requirements from the two mentioned systems are addressed by the FAL Committee and the NCSR Committee. The unique data elements in the requirements are considered by the EGDH group in their efforts to maintain the [IMO Compendium](#)¹ on Facilitation and Electronic Business and ensure the further development of data elements beyond the FAL Convention. Eventually, the data elements are included in the IMO Data Reference Model if agreed and mapped into the WCO, ISO, UNECE and eventually into S-XXX data models (“Product Specifications”).

From a generic point of view the maritime “Reporting as a Service” does not in principle differentiate between the two reporting regimes briefly mention above. The service²(s) exposes two services to the ships:

- Information on the reporting requirements (when, what and how)
- An interface for reporting data values of structured data elements

Both services ensure a fully harmonized and digitized information exchange between ship and shore.

¹ <http://www.imo.org/en/OurWork/Facilitation/Pages/IMOCompendium.aspx>

² the service could be implemented as one or more services, or a service with one or more methods. However, always with a unique URL

3.3.2. REPORTING AS A SERVICE

Whilst acknowledging the user and operational aspects of automatic ship reporting, this section addresses the technical aspects of the Reporting as a Service. Based upon the introduction described in the concept, to be capable of generating information and transmitting it automatically, a realistic implementation of these services will require involvement of both Competent Authorities and shipowners.

The concept of an automatic reporting schema comprises in principal two technical systems or services:

- an on-board ICT Ship Reporting Tool; and
- an on-shore system(s) (SHORE side)

Figure 7 below visualizes the scope that of the reporting and shows how the two systems or services interacts at various stages of a ship voyage.

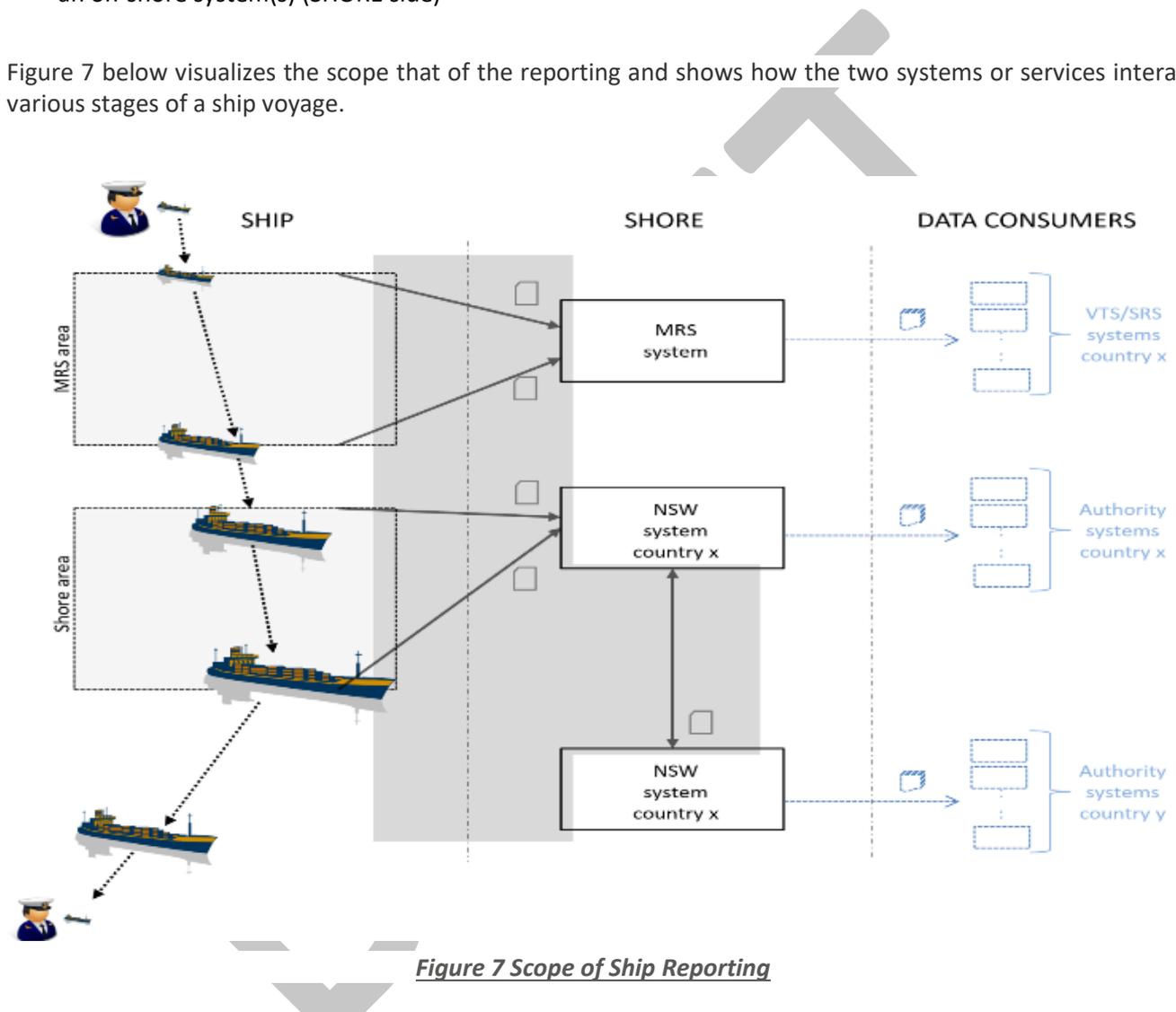


Figure 7 Scope of Ship Reporting

The reporting obligations usually lies with the Master on the ship, but the actual reporting might be done by a third party such as a ship agent. For simplicity, the third party is omitted from the figure. Using existing data communication systems, ship information will be transmitted to the authorities, ports, VTS's and shore centres during the ship voyage or ship arrival to port.

The "DATA CONSUMERS" (i.e. shore-based) e.g. VTS, Authorities or private stakeholders' side, illustrated in the figure on the right, is included to visualize the holistic picture of ship reporting. The stakeholders will receive relevant information from ships, using the existing connections and exchange mechanisms implemented in the relevant system, i.e. National Single Window(s).

The main area of interest is depicted in the grey area of the figure. This represents the area where the automatic ship reporting typically operates, and where the systems interact and communicate with, or affect, each other. The endpoints typically expose one or more services that enable submission, retrieval, and exchange of information.

The endpoints indicated in the figure comprise at least two principal set of services that are common in both - Vessel Shore Reporting (VSR) and Mandatory Ship Reporting System (MRS) reporting. The first enables the ship and shore to request and receive information, and the second service enables the transmission and reception of the reporting information.

3.3.2.1. Request and Response Services (RRS)

From the ship's perspective, the relevant reporting system provides an information service and is able to digitally respond to information requests from the ships. Both types of shore services should, as a minimum, respond by giving the requesting system the accurate current reporting obligation for that specific reporting system.

Additional functions of the service could provide responses to other requests as indicated in earlier in this document.

Currently the various reporting systems have different reporting obligations and procedures. The reporting obligations (data elements to be reported) should be in accordance with the IMO Data Reference Model. However, not all reporting systems require all the information that is specified in the reference model and the reporting procedures will vary based upon different parameters.

One of the central services that should be found in the Request and Response Service (RRS) is the ability for the ship's system to request the reporting obligations for a specific voyage geography or port call. Based on the ship particulars and voyage information, such as the type and size of the ship, port of departure, crew and passengers, the ship system should be able to request the shore-based reporting system for the ship's reporting obligations for that specific voyage. The shore-based system should, in return, respond to the requester in a structured message with the obligatory reporting information and reporting procedures that would be required for the ship and voyage.

Therefore, as seen from the ship's perspective, the reporting system provides an information service, and can digitally respond to information requests from the ships. Both types of shore services should, as a minimum, respond by giving the requesting system the accurate current reporting obligations and procedures for that specific reporting system, being Vessel Shore Reporting (VSR) or Mandatory Reporting System (MRS).

3.3.2.2. Transmit and Receive Services (TRS)

The TRS service is a more traditional service provided by the VSR and MRS systems. The services are exposed to ships and can receive and acknowledge the submitted reports (new or updates) from the ships.

3.3.3. MESSAGE EXCHANGE

In every reporting schema, and especially in a harmonised and automatic reporting schema, there needs to be well defined message exchange mechanisms in place. These exchange mechanisms should in principle be independent of the context in which the exchange is taking place.

The exchange is often described in the form of message exchange sequences (patterns) and corresponding information elements that are necessary to execute the exchange. Each pattern can represent several specific exchanges between different parties. However, with regard to ship reporting, the message sequences should be the same generic flow of information both for single window data exchanges or ship reporting to VTS or any other ship reporting system.

The sequence diagram(s) presented in Figure 6 consists of vertical lines representing an abstract time axis for client (ship) and server (shore) respectively and in some cases a proxy (catalogue).

Arrows between the parties represent the sequence of messages that need to be exchanged. A thick line from an arrow end to a new arrow start shows synchronous processing by the respective party.

The e-Navigation services message flow and representation are being discussed in the IMO Expert Group on Data Harmonisation (EGDH), and the figure Service Request (below) is a slightly modified version of the figure found in [annex 3 of the IMO document3 EGDH 1/9](#). The modification to the original generic drawing is done to visualize a specific sequence diagram for the pattern which describes a Service Request in relation to the concept of automatic reporting.

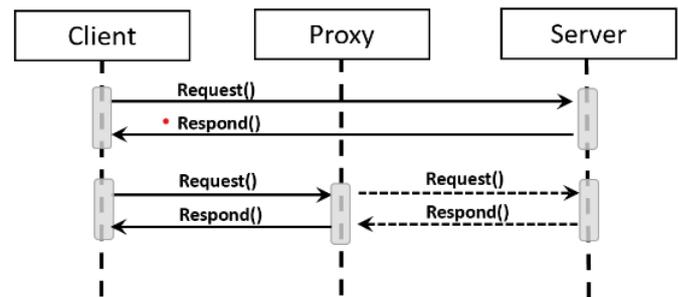


Figure 8 Sequence Diagram

In Figure 8 the ship requests the RRS from the shore centre, in this case the request is for the Reporting Obligations & Procedures for clearance to go to a port or entry into an MRS area. A receipt is sent to acknowledge that the request for service is received by the shore centre. The shore centre proceeds with some work to handle the request and responds to the requesting ship with the relevant reporting requirements and procedures for the specific ship and voyage. In the generic sequence diagram, there are also sequences for loops and options related to the message exchange. Loops and options might not be relevant in the example.

A Central Repository (proxy service) will expose the service on behalf of the shore centre.

In a sequence where the ship submits a report (TRS service), loops and options will be relevant. As an example, a single window system that has received a ship report would check that the data received is correct and in the correct format. The single window will then forward the relevant information to the appropriate authorities and other Shore-based Stakeholders.

Results of the work done by the shore centre is sent to the ship as a service response, for instance, for a Single Window, this can be a clearance to enter the port. The ship can both update and cancel the request in several iterations. For port clearance, this corresponds to sending a clearance message multiple times, when the ship has available more information to submit (i.e. updates). The ship can also cancel the service request, for example, to cancel the port clearance request.

³ ISO (2019), Input paper to IMO EGDH 1/9, Submitted by ISO: "IMO DATA SET RELATED TO ACKNOWLEDGEMENT RECEIPTS", 4 October 2019.

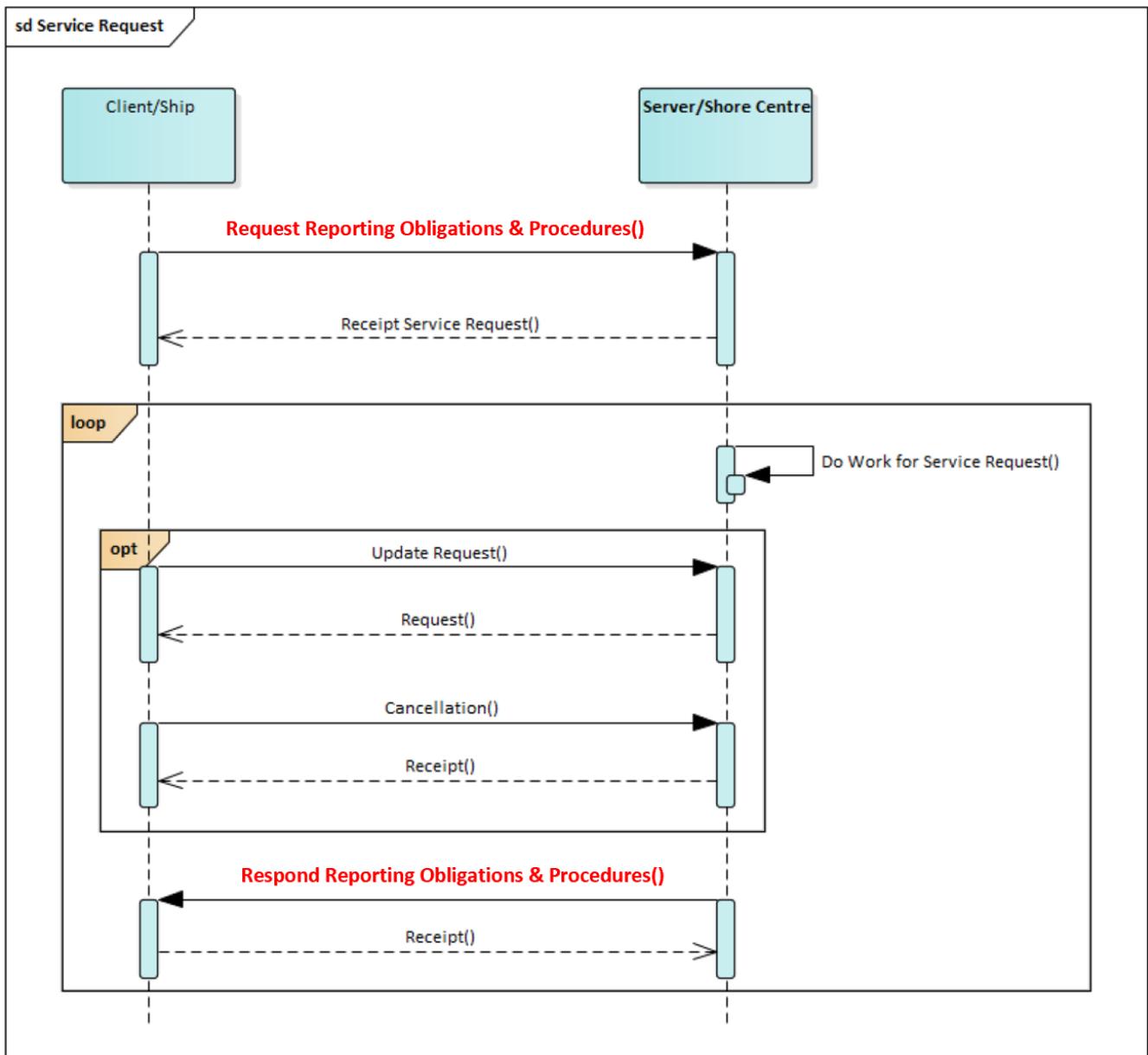


Figure 9 Message Exchange

To enable a sequence of data exchange similar to that described in Figure 9 above would require definitions of additional data elements (beyond conventions and regulations). The data elements would be within the computer and communication domain and would not require additional human interaction or be an administrative burden.

The pattern can also be used to describe a use case where the client (i.e. the ship) subscribes to updates from the shore centre server until it times-out or until cancellation.

Note that for simplicity and consistency, the sequence diagram in Figure 7 is foreseen to be an information exchange between the ship and shore. However, from a practically and real-world point of view, systems, and services “onboard” might be implemented elsewhere i.e. on shore or in a cloud-based implementation. Interpretation of the sequence diagrams should take other scenarios into account.

3.3.4. CYBER SECURITY REQUIREMENTS

The harmonized ship reporting system has specific cyber security requirements. These requirements will need to be fulfilled by a cyber security regime that is harmonised for all ships, their shore-based representatives and for shore-based stake holders. There is no consensus to date on what security regime the maritime industry will adopt;

several options are being considered. [Annex 1](#) of this Guideline contains a description of some of the cybersecurity regime candidates that are currently being considered. This Guideline assumes that a harmonised cyber security regime will be available.

3.3.4.1. Authentication

Shore-based stakeholders will need to be able to authenticate senders of entry requests and of ship reports and their updates.

ICT ship reporting tools used by ships and/or their shore-based representatives will need to be able to authenticate addressees of their entry requests and their ship reports (and their updates).

3.3.4.2. Repudiation

ICT ship reporting tools used by ships and/or their shore-based representatives will need to be able to prove that their entry requests, their ship reports, and their updates were received by shore-based stakeholders.

Shore-based stakeholders will need a way to prove that ICT ship reporting tools used by ships and/or their shore-based representatives did in fact receive their reporting requirements.

3.3.4.3. Encryption/Authorization

Ship Reports may contain sensitive personal information about crew and passengers as well as commercial data. Ship Owners/Operators (and by extension their representatives) own this information or are required to protect dissemination of this information on behalf of crew and passengers. Ship Owners/Operators must have control over access to certain ship reports and limit access to only those who have a need to know.

3.4. MIGRATION STEPS TO THE HARMONISED SHIP REPORTING SYSTEM

3.4.1. ESTABLISH A NATIONAL AUTHORITY

Establishing a National Authority that offers an MSW/NSW is a prerequisite for migration to a fully digital, harmonised ship reporting system. It, in turn, requires amending most if not all existing ship reporting processes and procedures. [FAL.5/Circ.42](#) is intended for:

“public authorities or Administrations responsible for developing or modifying environments for a Maritime Single Window (MSW)”

and provides detailed guidelines (see [Section 2.2.1.2](#)). Annex A of [FAL.5/Circ.42](#) provides examples of NSW implementations.

IALA Guideline [G1113](#) establishes relevant principles for the design and implementation of harmonised shore-based technical system architectures that are used by National Authorities

IALA Guideline [G1114](#) proposes a Common Shore-Based System Architecture for all systems that a National Authority uses. In terms of this architecture, a MSW/NSW will require a:

- “Data Collection and Data Transfer Service”
 - SOAP/REST Webservice
- “Value Added Data Processing Service”
 - Acknowledge Receipt of Entry Request.
 - Analyse Entry Requests and respond with Reporting Requirements.
 - Store and analyse Ship Reports.
 - Acknowledge receipt of Ship Reports and their updates.
- “User Interactive Service”
 - For Shore-Based Authority Users

- “Gateway Service” for “External Users”.
 - For other Stakeholders
 - ✓ Customs
 - ✓ Immigration
 - ✓ Health
 - ✓ Security
 - ✓ Port Community
 - ✓ Authorities in other Countries
 - ✓ Etc.

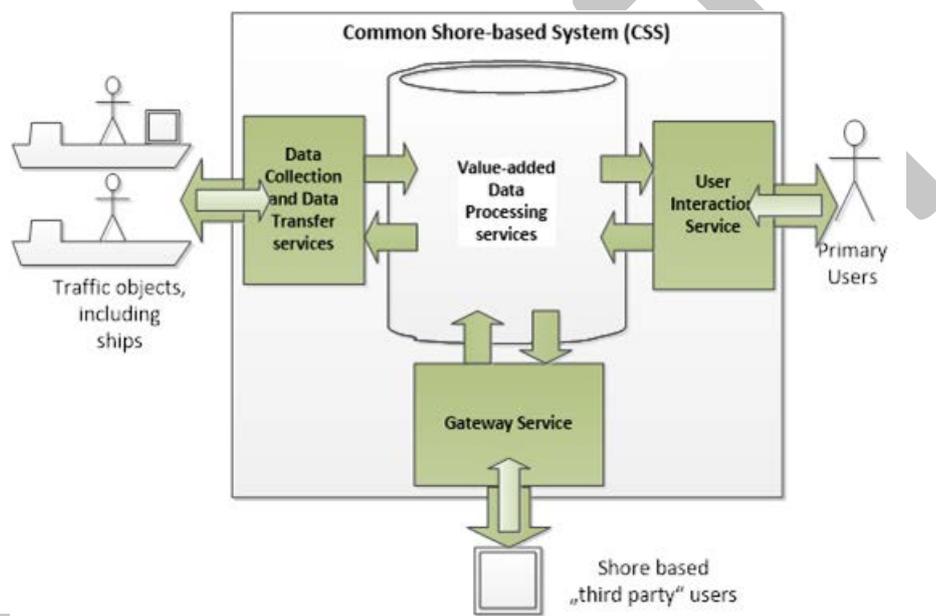


Figure 10 Common shore based system

3.4.1.1. Establish a Ship Reporting web service

Establish a [SOAP/REST](#) webservice that is designed to securely exchange information with approaching ships (and with their shore-based representatives).

This webservice will need to comply with the requirements specified in Section [3.3 Harmonised Ship Reporting System](#) where it concerns information exchange with ships and/or their shore-based representatives.

Any service specification developed for ship reporting should follow the IALA guideline for the specification of e-navigation technical services (G1128).

3.4.1.2. Publish the URL of the web service in the Central Repository

ICT Ship Reporting Tools will use the [Central Repository](#) to identify the (URL of the) ship reporting web services associated with ports of call that are in the voyage plan and web services that are associated with Mandatory Reporting System areas that the ship will enter during its voyage. The ICT Ship Reporting Tools will initiate ship reporting sessions with the relevant webservices to request area and/or port entry.

3.4.1.3. Receive Port/Area Entry Requests

The service will need to allow [ICT](#) ship reporting tools that are used by bridge teams and the ship's shore-based representatives to initiate a secure webservice session and use [JSON/XML](#) to transmit a port/area entry request, possibly a [S-421](#) message.

3.4.1.4. Convey Reporting Requirements

Based on the values of the data elements transmitted with the port/area entry request, the webservice will need to have logic rules to determine what reports the ship will need to submit and when.

Specifically, in response to receiving a port/area entry request from a ship or from a shore-based representative of the ship, the webservice will need to acknowledge receipt of the request and then transmit the names of the report data structures as defined in the IMO Compendium along with their submission deadlines using JSON/XML. If the IMO Compendium data structures do not include the required report then the procedures detailed in section 3.2.1.2 of the Guideline should be followed.

The report deadlines may be expressed in a specific UTC date/time or a date/time relative to the planned time of arrival (i.e. 96 hours before ETA). The submittal of ship reports may also be triggered by entering a certain geofenced area.

3.4.1.5. Receive Ship Reports

The webservice should also allow ICT ship reporting tools to initiate a secure webservice session and use JSON/XML to transmit the values of the data elements that are part of required reports (a.k.a. data structures) along with updates of these values.

3.4.1.6. Distribute Ship Report Information to other stakeholders

The national authority is required to distribute selected parts of the information it receives from ICT Ship Reporting Tools via its webservice to other Shore-based Stakeholders.

This will involve selecting the data structures or even individual data elements that they require, confirming that they are authorized to receive them and forwarding them using an appropriate cybersecurity regime.

3.4.2. ESTABLISH A CYBER SECURITY ENVIRONMENT

There is no consensus yet on what security regime the maritime industry will settle on. Several options are being considered. In [Annex 1](#) of this Guideline contains a description of some of the cybersecurity regime candidates that are currently being considered. This guideline assumes that a single harmonised cyber security regime will be adopted.

4. DEFINITIONS

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.

5. ACRONYMS

API	Application Programming Interface
CMDS	Common Maritime Data Structure
DWT	Deadweight Tons
EDIFACT	Electronic Data Interchange for Administration, Commerce and Transport
EGDH	Expert Group on Data Harmonization

ETA	Estimated Time of Arrival
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICT	Information and Communication Technology
IEC	International Electrotechnical Committee
FAL	International Maritime Organization, Trade Facilitation Committee
ISO	International Standards Organization
JSON	JavaScript Object Notification
MCP	Maritime Connectivity Platform
MRN	Maritime Resource Name
MRS	Mandatory Reporting System
MSC	Maritime Safety Committee
MSW	Maritime Single Window system
NCSR	IMO Sub-Committee on Navigation, Communications and Search and Rescue
NIL	No animals, no passengers, no stowaways, no arms
NMEA	National Marine Electronics Association
NSW	National Single Window system
PCS	Port Community System
PDF	Portable Document Format
REST	Representational State Transfer
RFC	Request for Comments +from the Internet Society
RRS	Request and Response Services
SECOM	Secure exchange and service communication of S-100 based products
SOAP	Simple Object Access Protocol
SOLAS	International Convention for the Safety of Life at Sea, 1974
TLS	Transport Layer Security
TRS	Transmit and Receive Services
VHF	Very High Frequency Radio
VSR	Vessel Shore Reporting
VTS	Vessel Traffic Services
WCO	World Customs Organization
UN	United Nations
UNECE	United Nations Economic Commission for Europe
URL	Uniform Resource Locator
USB	Universal Serial Bus
UTC	Coordinated Universal Time
XML	Extensible Mark-up Language

A.1. BACKGROUND OF CYBER SECURITY

In [MSC-FAL.1/Circ.3](#) Annex, maritime cyber risk refers to a measure of the extent to which a technology asset is threatened by a potential circumstance or event, which may result in shipping-related operational, safety or security failures as a consequence of information or systems being corrupted, lost or compromised.

Resolution [MSC.428\(98\)](#) Maritime Cyber Risk Management in Safety Management Systems which was adopted on 16 June, 2017:

“recognizes the urgent need to raise awareness on cyber risk threats and vulnerabilities to support safe and secure shipping, which is operationally resilient to cyber risk and that Administrations, classification societies, ship owners and ship operators, ship agents, equipment manufacturers, service providers, port and port facilities, and all other maritime industry stakeholders should expedite work towards safeguarding shipping from current and emerging cyber threats and vulnerabilities. “

Importance of Cyber Security

Ship reports contain proprietary information about ship operations, such as voyage, oil consumption, the nature of the cargo and its source and destination as well as personal information about seamen and passengers.

If the cyber security of the ship reporting system is compromised, then proprietary information and the information systems associated with shipping operations, port and terminal operations and the operations of the whole of supply chain in maritime logistics are at risk as is the access to personal information about seamen and passengers.

1. Threat of Cyber Security on board and ashore

There are many ways to threaten cyber security on board and onshore. For example:

- Spread malicious code by laptop infected with malicious execution code.
- Plugging in a USB stick that is infected with malicious code.
- System attack by eavesdropping or hacking into equipment and/or software.
- Accidentally deleting system files.
- Professional hackers who watch for vulnerabilities and invade a network to steal and/or change information and data.

2. Cyber Security guideline for the Maritime Industry

In general, the cyber security guideline presents the functional elements that support effective cyber risk management which purpose is to support safe and secure shipping. A risk management framework includes the following:

- **Identify:** Define personnel roles and responsibilities for cyber risk management and identify the systems, assets, data and capabilities that, when disrupted, pose risks to ship operations.
- **Protect:** Implement risk control processes and measures, and contingency planning to protect against a cyber-event and ensure continuity of shipping operations.
- **Detect:** Develop and implement activities necessary to detect a cyber-event in a timely manner.
- **Respond:** Develop and implement activities and plans to provide resilience and to restore systems necessary for shipping operations or services impaired due to a cyber-event.
- **Recover:** Identify measures to back-up and restore cyber systems necessary for shipping operations impacted by a cyber-event.

A Cyber Security Guideline on IT infrastructure needs to deal with task dependent situations. Different situations need to be treated with different methods. Cyber vulnerabilities occur variously and unexpectedly and therefore every occurrence should be treated as a new occurrence with a new procedure to respond to it. Figure A1 depicts the continual improvement process of ITIL v3. The Guideline should include how to improve management processes with reference to Figure 1.

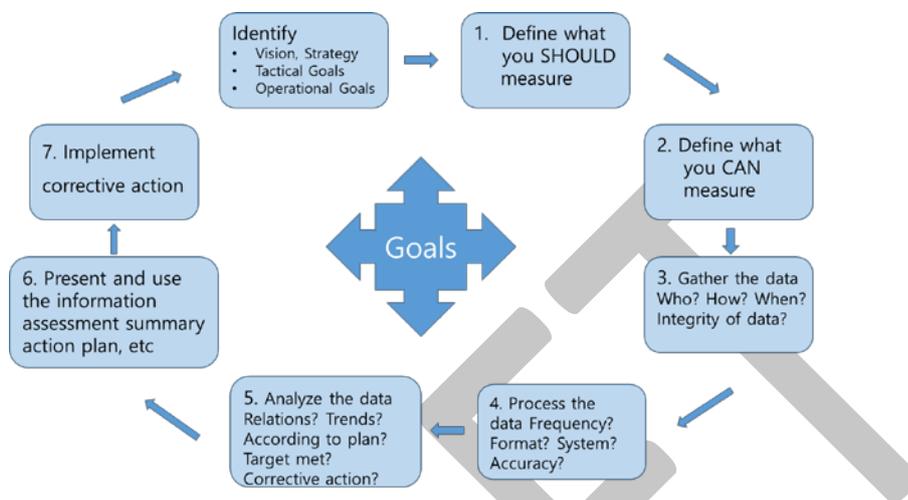


Figure A1 Continual improvement process of IT infrastructure

There are many best practice guidelines on cyber maritime security by BIMCO, CLIA, ICS, INTERCARGO, INTERTANKO, OCIMF and IUMI.

[ISO 27001](#) provides Information technology - Security techniques - Information security management systems – Requirements.

Also, NIST which is United States National Institute of Standard and Technology published a NIST [Framework for improving Critical Infrastructure Cybersecurity](#).

A.2. CYBER SECURITY REGIME

Implementation of the Harmonized Ship Reporting System will most likely require that a single Cyber Security Regime be used by all ships and shore-based stakeholders.

Several Cyber Security Regimes are being considered by the maritime industry for adoption. They include (amongst others):

1 SECOM

IEC TC80 WG17 is working on standard IEC 63173-1 Part 1: S-421 Route Plan based on S-100 which specifies the content, structure, and metadata needed for creating fully S-100 compliant route plan information and its portrayal within an S-100 based application.

WG17 is also working on standard [IEC 63173-2](#) Part 2: Secure exchange and service communication of S-100 based products (SECOM). The service interface includes the public side exposed on the internet and how the service is discoverable by a consumer. SECOM is applicable for IP based session-less interactive web services for information exchange. Technically SECOM uses a [TLS](#) which is described in [RFCS](#).

2 Maritime Connectivity Platform ([MCP](#))

MCP was created initially to address the goals of the e-navigation initiative of IMO. The MCP also has the potential to support digitalization across a much wider maritime domain because it is an open-source solution that relies on the internet concept of Web Service for identity management and service management and as such, can support much more than just the IMO's Maritime Services in the context of e-navigation.

The core components of the MCP are:

- The Identity Registry – for secure and reliable exchange of information, it supports safe login and usage to all services, using identity information provided by trust stakeholders. It facilitates confidentiality, integrity, and authenticity in information exchange between users and between machines. It uses existing standards such as [MRN](#), [OpenID Connect](#) and [X.509 certificates](#).
- The Service Registry - for registering, discovering, and using all relevant e-Navigation and e-Maritime services, commercial and non-commercial, authorised, and non-authorised, for free and against payment. It is a sophisticated “Yellow Pages” phone book. The registry can be searched using several different criteria including the coverage area.
- The Maritime Messaging Service – for allowing authorized maritime stakeholders to send and receive messages in an efficient, reliable, and seamless manner within the MCP to solve problems of the current maritime wireless data communication system.

All core components of the MCP are open-source.

3 OneNet

The National Marine Electronics Association of U.S.A ([NMEA](#)) has developed a ship network standard based on [IPv6](#) named “[OneNet](#)” which can operate a network in a secure mode or an open mode. To operate in a secure mode, authentication, information integrity and data confidentiality are necessary. To authenticate users, Human Interfaced Devices (HID) verify whether devices are certified. HID generates a master key and transfers it only to certified devices. OneNet Standard uses TLS and [DTLS 1.2](#) as described in RFC's to ensure information integrity and confidentiality. OneNet can be used to exchange all kinds of information such as navigational, engine data, cargo data, information for navigational environment, from [IoT](#), etc.



中华人民共和国出入境检验检疫
 ENTRY-EXIT INSPECTION AND QUARANTINE OF THE PEOPLE'S REPUBLIC OF CHINA
 压舱水申报单
 BALLAST WATER REPORTING FORM

船名 Name of ship 国籍 Nationality 到达港口 Arrival Port 到达日期 Arrival Date
 船舶所有人 Manager 船舶代理人 Agent 压舱水总量 (吨) Total Ballast on Board (m3) 压舱水池总数 Total Number of Tanks
 是否需在中国某一港口排放压舱水? Do you intend discharging any ballast water in a Chinese port? 是 Yes 否 No

压舱水箱/舱 Tanks/ Holds	压舱水来源 BW Source			压舱水更换 (最近三次) BW Exchange (Last Three Exchanges) 使用方法 Method Used: 清空 Empty/ 灌注 Refill <input type="checkbox"/> 灌流 Flow Through <input type="checkbox"/>						预计在中国港口排放压舱水情况 Best Estimate of BW Discharge in Chinese Ports			
	装载日期 Date of Uptake	装载地点 Location of Uptake	装载量 (吨) Vol. Taken Up (m3)	更换日期 Date of Exchange	起始点 Start Point		终止点 End Point		更换量 (吨) Vol. Exchange (m3)	更换百分比 (%) Exch.	排放港口 Ports	排放日期 Date	排放量 Vol. (m3)
					经度 LAT	纬度 LONG	经度 LAT	纬度 LONG					

船长签名 Signature of master 日期 Date [1-4-1(2001.7.1)]

Figure B2 Chinese government Ballast Water Log

here are differences in the data structure and data elements of Australia's Ballast Water Log and China's Ballast Water Reporting Form as illustrated in Figure B3:



Figure B3 Summary of differences between Australian and Chinese governments

An eventual inclusion of water ballast related data structures and elements as a new data set in the IMO compendium, will require a harmonization of water ballast reports from ports/countries that utilise these. This should be promulgated via submission by IMO member states or affiliated organisations of input papers to the FAL Committee subordinate 'Expert Group on Data Harmonisation' (EGDH), responsible for maintenance (expansion) of the Compendium.