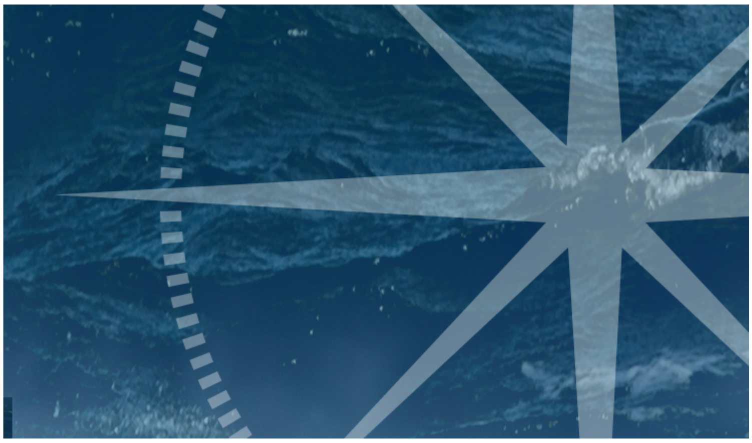

MONALISA 2.0 – Activity 4

Report on the procedures to integrate the different information systems technologies

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Table of contents

1 Document objective

This document focuses on several key areas related to different procedures to integrate the different information systems and its interoperability involved in maritime safety and how the integration will optimize the process of decision support in many fields related to maritime environment, such as route calculation and route selection algorithms, critical decisions related to emergencies onboard or in ports. Integration also may lead to a reduction of unsafe operation, incidents and accidents and a best and optimum response to any emergency that may occur. Another related consequence should be the reduction of the emissions. This document, developed during MONALISA 2.0 project, includes information of previous deliverables of this activity, D4.5.1, D4.5.2 and D4.5.3, to explain how the integration process has been done.

Finally, the integration of different systems that are detailed in this document has been done under the specific systems that are related to this activity of MONALISA 2.0 project and will need to be updated or modified if is needed to be used with different information systems.

2 Introduction

In the maritime environment information systems are one of the most important tools since due to the quantity of different elements that are involved in it is hardly impossible to control them without any information system. This leads to a huge quantity of different information systems; ports, for instance, may have more than two different information systems. Each actor in maritime community has their own information systems and most of them do not share neither information systems nor the data.

Maritime Information Systems are still un-connected and some risks cannot be detected previously due to the lack of information exchange. Costs are also high since each system stores the its information and usually this information is redundant with the information that stores any other system.

Safety Information systems sub activity in MONALISA 2.0 project try to solve those problems by creating an integrated Safety Information System which will include not only information about safety but also all the information available relative to the maritime domain such as meteorological information or routes of ships, routes provided by the Sea Traffic management.

3 Systems for Safety management in ports

The safety of port facilities, operations and workers reduce risks to vessels using the port. Physical security of buildings and access points to the port allows threats from persons and materials to be detected and neutralized before reaching sensitive areas. The burden on ship safety and security personnel is reduced with a strong threat detection system in the port area. Having the information of port safety in real time improves the reaction to an incident in a port to prevent having more risks and improving the response time and its quality.

Since there is not an standard system for all ports even in the same country we will develop our integrated information system with information of Valencia Port, that is also a member of this sub activity.

Valencia Port Authority has its system explained in more detail in the Deliverable D4.5.1. An overview of their systems follows:

Safety and Security (Safe Port) information system in order to guaranty safety in ports of Valencia, Sagunto and Gandía is a main objective of the Port Authority of Valencia in close collaboration with administrations responsible for police protection, civil protection, fire prevention, rescue operations and the fight against pollution.

Port operations, services, maintenance and upkeep are all centralised to ensure improved coordination which enables the Port Authority of Valencia to reduce accident rates as much as possible. The Emergency Control Centre (CCE) is the tool through which the Port Authority of Valencia undertakes this coordination. The CCE monitors port activities 24/7. Decisions that need to be made about safety issues and emergencies can be taken thanks to the information the Centre has at its disposal. In thise sense, the main information systems used to prevent and to act against risk are the Estrabon and Socaire systems which are detailed in the next chapters.

Estrabon is a computer software in GIS format that presents on real-time information that the Emergency Control Center may require concerning the port status: vessels at port, dangerous goods on board and in terminals, and other active events that may change safety conditions. It draws on the databases APV to provide full information on means of contact, vessel characteristics, dangerous goods, emergency schedules IMO guides, first aid, etc.

SOCAIRE's spirit is the attack of accidents or incidents before they happen. Manages safety from a holistic perspective hybridizing the concepts of industrial, environmental, occupational safety and port security.

3.1 Port Safety Information Systems integration

Since Valencia Port Authority did not give access to their information and not even its data architecture. To cope with this and to be able to complete the sub activity CIMNE detailed one of the possibilities to integrate all the information provided by Port Safety Information Systems to the Monalisa 2.0 Safety Information System is by using Domain Specific Open Reference Systems Architecture for Sea Traffic Management as an enabling technology for integrated safety information systems for port and sea operations.

Reference Architecture (RA) refers to a special type of Software Architecture (SA) that contains knowledge about a specific domain, providing guidance for the development, standardization, and evolution of system architectures of a specific domain.

Reference Architecture provides an architectural template (a "blueprint") for a set of products and sub-domains based on the generalization of a set of successful previous solutions, coupled with a set of new requirements.

Whilst software architecture plays a huge role in the success of any software-intensive system, Reference Architecture is at a higher level of abstraction; it can be seen as a generic architecture for a class of software systems, such as Sea Traffic Management and/or e-Navigation solutions. Reference Architecture encapsulates a particular segment of a domain, capturing all the domain knowledge and providing abstract blueprint architecture for the given domain.

The Reference Architecture can be looked upon as the "parent" class in an architecture hierarchy and all instances of the architecture are "children" of this "parent" architecture.

With Reference Architecture in hand the software architect is subsequently able to create an instance of the Reference Architecture for a particular product or family of products / systems. The Reference Architecture is important for various stakeholders within the domain of interest and, whilst some stakeholders have a considerable good understanding of technology and the domain, others may have much less such knowledge.

The domain specific Reference Architecture draws from all the best features and attributes of architectures and technologies present in adjacent domains (e.g. avionics and automotive), using this foundation so as to create a state-of-the-art Reference Architecture specifically targeted for the maritime industry and Sea Traffic Management in particular.

Reference Architecture encapsulates the technical aspects of the domain in question, as well as the end user's needs. It helps stakeholders in different segments of the industry to come together and formulate an architecture based on a shared understanding. Reference Architecture is based on the lessons learnt and experiences of past architectures. Reference Architecture is a complex artifact and, in order to aid with reuse and separation of concerns, it is viable and desirable to adopt a building block approach as has been done in the avionics industry. This allows suppliers and other stakeholders to build the "right" building blocks and the integrators to integrate the whole system. Such an approach is only made possible and feasible with Reference Architecture in hand, which is a combination of software architectural concepts and building block interfaces.

The maritime industry is highly fragmented, comprising of a few key players and thousands of Small and Medium Enterprises (SMEs) with most maritime electronic systems operating on proprietary networks allowing only integration between devices operating on the same network. The maritime industry needs a solution, which will help the industry move away from ad-hoc proprietary platform engineering to open architectures and open standards. The lack of an open standard permitting interoperability between electronic devices and systems from a variety of manufacturers is hampering maritime operations and limiting innovation in the field. In order to undertake this challenge, the maritime industry needs a common platform, which will allow the seamless integration of most (if not all) onboard and onshore systems based on a well-engineered domain specific maritime Reference Architecture. The end users, e.g. seafarers, VTS personnel, etc., should be given the flexibility to select the devices best suiting their usage scenarios, directly referring to an open (source) platform, based on open standards.

In other industries domain-specific Open Reference Architectures already exist and have been widely adopted. Examples are AUTOSAR for the automotive industry and SAVI for the avionics industry.

Maritime systems software architecture should encapsulate domain specific services offered onboard and onshore, also providing a framework, which will allow current proprietary networks to be linked to the Maritime Open Reference System Architecture. This will enable a gradual shift towards services as software components and, when considering that a ship's lifetime can be in excess of 20 years, a platform that is future-proof. Maritime open reference systems architecture can serve as a base for the development of standards and, at the same time, support the integration and interoperability of software-dependent devices and systems. The Maritime Open Reference System Architecture should be made available for free to the vendors and/or innovators. Vendors and manufacturers will then be able to derive differentiating, highly innovative, instances and implementations of the Reference Architecture, leading to reduced development and acquisition costs, contributing to higher levels of software components reuse, thus leading to higher quality of maritime electronic systems amongst other benefits.

With Reference Architecture in hand various stakeholders are able to increase the levels of reuse and reduce validation, verification and testing activities. Reference Architectures are used to avoid re-work, re-validation and re-verification of architectures.

The purpose and main reason for having Reference Architecture in place is to guide the development of architectures for new systems as well as product families. Reference Architecture captures a lot of domain knowledge by analyzing past architectures and initiatives and, based on the knowledge gathered, formulates a reference skeleton architecture from which all future architectures in the domain can be derived.

Open system software Reference Architecture for the maritime industry should serve as a blueprint for the design and implementation of all software systems and their integration onboard ships and related onshore maritime operations. The blueprint will tackle the non-functional properties by providing a platform, upon which innovation and integration can take place. Open Reference Architecture approach ensures that end users and other stakeholders are not locked into a proprietary technology or a single-vendor system, making it a future-proof solution. Open Reference Architecture fosters collaboration on low value-add between maritime electronic systems vendors and other stakeholders. Such an approach provides a collaboration platform on a shared domain-specific middleware. Open Reference Architecture allows suppliers, regulators and other stakeholders to create and operate their own instances of Reference Architecture without giving away their real value-add differentiating portion. It creates an environment where open and proprietary software system solutions and co-exist in symphony.

Based on publicly available data solutions based on Open Reference Architectures deliver up to 80% cost savings as compared to proprietary solutions. In case of Maritime Open Reference System Architecture similar cost savings can be envisaged for owners and operators in terms of Total Cost of Ownership, for equipment manufacturers in development and maintenance costs, and for ship builders, land-based maritime traffic control centers in acquisition, integration and commissioning of maritime digital systems.

One of the purposes of Reference Architecture is to steer and control the instantiation of solution architectures. Reference Architecture is a domain and organizational asset as it:

- Provides a common language which can be understood by all involved stake-holders;
- Provides consistency with regard to the implementation technology used to solve challenges;
- Enables the verification and validation of solutions against the reference architecture;
- Encourages the adherence to common standards, patterns and specifications.

Benefits of Reference Architectures:

- Reference Architecture allows encapsulating an entire domain in a technology independent manner. Industry members can use the Reference Architecture in order to generate custom architectures for a family of products, with the Reference Architecture used as the template; all specific architectures will be based on the same common core, enabling seamless integration and a positive progress forward.
- Reference Architecture improves effectiveness as it;
    - Aids in reducing duplicate work;
    - Provides guidance when designing new products;
    - Acts as a mechanism through which the software architect is able to validate and verify the architecture.
- The particular technology specific instance of the Reference Architecture can be compared against the Reference Architecture for validity;
- It enables higher reuse levels;
- Greatly reduces costs to design & commercialize a software product;

- Reduces time-to-market for the system, as the technology specific architecture for the system can be derived quickly.

Open Reference Architecture allows interaction with COTS (off-the-shelf components) contributing to cost reduction, higher quality and interoperability of systems.

Maritime Open Reference System Architecture should provide a set of best practices in domain-specific software engineering for the maritime industry. It should be technology-independent, allowing for both front-end as well as back-end independence, and therefore it should be a candidate to be considered as a European and potentially global standard. One possible implementation on-board is a maritime cloud, a hybrid cloud computing implementation with a private cloud on-board a vessel and a secure connection to the public / community cloud, based on a publish–subscribe model.

Such a platform-as-a-standard (PaaS) cloud implementation could provide a common standard platform for Sea Traffic Management and/or e-navigation service applications as it does not dictate any specific solutions for each layer of PaaS. Due to the open source approach, it is a future-proof open standard that can benefit from community improvements on a continuous basis. Open solutions for PaaS layers make it also cost effective.

Envisaged benefits of the maritime cloud implementation include:

- Increased software system quality,
- Full interoperability,
- High reliability, redundancy, robustness and scalability,
- Flexibility and support for continuous technology refresh and rapid insertion.

As a hardware and technology independent domain specific shared middleware, the maritime open system reference architecture approach lends itself nicely as an architectural base-layer for implementation of Sea Traffic Management and e-navigation solutions. It provides the platform on which services can be deployed, with applications running on top of it, be they proprietary, open or a mix thereof.

Based on the maritime open system reference architecture, each manufacturer of maritime electronic systems can develop their own proprietary or open source "family" system architecture containing a shared set of assets, and then design and engineer their own specific product or "family" of products to be installed on-board and on-shore, containing a mix of proprietary and open source components. Further in the development cycle real life "field" feedback from product end-users shall be fed back in order to improve the system by defining constraints and opportunities as well as extracting essentials to further improve the reference architecture itself. The middleware based on the open maritime reference architecture can be deployed on each and any computing platform with high reuse of components that can be easily removed and updated (future-proofness).

The main features of the maritime open system reference architecture should include:

- Defined standard data types and interfaces
- Common language
- Verification and Validation
- Abstraction from technologies
- Code generation
- UML profile
- View-based model to cater for various stakeholders needs
- Model-driven development
- Component-based
- Modularity
- Robustness.

The Maritime Open Reference System Architecture software should comprise data types and interfaces ("Footprints") used by the architecture's layers above and applications deployed on the architecture's backend and Services (dependency on Footprints) including the actual software code to interact with the hardware.

A typical example would be the MONALISA 2.0 route exchange format that could be used by all vendors free of charge and thus ensuring continuous improvement of the format as well as full interoperability between various vendor systems.

> In order to effectively implement the System Wide Information Management (SWIM) concepts for Sea Traffic Management, it is essential to build upon the experiences from the air traffic management programmes. According to the SESAR and Next Generation initiatives in aviation, by providing flexible and secure information management architecture based on the commercial off-the-shelf hardware and software, cost effective and efficient solutions can be achieved. Therefore, the Maritime Open Reference System Architecture should encapsulate these properties providing a Service-Oriented Architecture (SOA) that should ideally be implemented in the Maritime Cloud.

To solve the lack of information from Valencia Port Authority systems and also to have a port-independent solution we have implemented a solution using a web form to ask safety officer to fill it up in case of an emergency so the Safety Information System could know about the emergency. This web form could be customized to meet each port requierements or particularities and each port will only have acces to their own web form. It will be integrated in the Monalisa 2.0

Safety Information System. We have named it as Monalisa 2.0 Port Emergency System (PES).

3.2 Monalisa 2.0 Port Emergency System (PES)

When the Safety Officer of port wants to report in an emergency to the PES he has to log in with his credentials to verify that it's him. After that there will be a dynamic form where the officer will notify if there is any emergency or not. Somtimes the same officer controls more than one port, like in Valencia case where there are also Sagunt and Gandia so in this case the officer could choise the port where the emergency is.

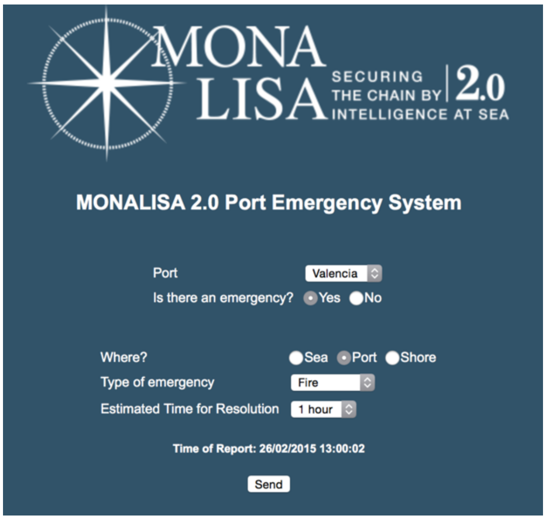

Figure 1 Port Emergency System view

If there is an emergency the Safety officer will be able to select where the emergency is, what type of the emergency is and the estimated time of resolution to know when would not be the emergency anymore. The Safety officer well be able to remove an emergency when it is done. As it will be part of the Monalisa 2.0 Safety Information System(SIS) the Port Emergency System will be improved with the SIS.

4 Systems to support SAR operations

Spanish Maritime Safety and Rescue Agency (SASEMAR) is responsible in Spain for the maritime search and rescue services, prevention and fight against marine pollution and maritime traffic control.

SASEMAR has several information systems where large amounts of information are collected we will integrate to Monalisa 2.0 Safety Information System the data from SIGO and SARMAP.In addition, SASEMAR is in charge of the coastal AIS network (Automatic Identification System for Ships) distributed throughout the Spanish coast line and the islands, and is responsible of receiving and storing the positions and movements received from the vessels sailing the Spanish waters. So we will use SASEMAR AIS data.

4.1 Information System for Operations Management SIGO

The SIGO, Information System for the Operations Management, is the main tool from where SASEMAR, manages all the information concerning the activity of all maritime and air units as well as attending to emergencies, control of maritime traffic and pollution at sea. This system is used in SASEMAR for operations management of maritime emergencies. It includes information concerning the maritime traffic, the aerial and maritime units and the response operations. It also provides the data from the results of the response activities such as recovery of people.

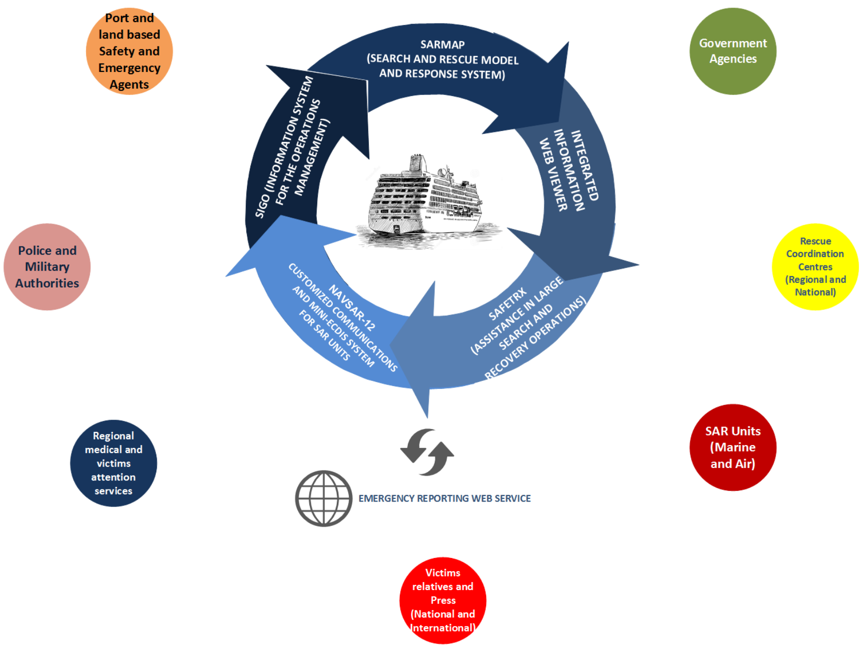

Figure 2. SASEMAR's Information systems to support and optimize SAR and MRO operations

4.2 Search & Recue Model and Response System SARMAP

SARMAP: is a Search and Rescue Model from ASA employed in SASEMAR which provides rapid predictions of the movement of drifting objects and missing persons at sea. SARMAP includes the ability to deploy search & rescue units (SRUs) with search patterns and calculate probability of containment (POC), probability of detection (POD), and probability of success (POS).

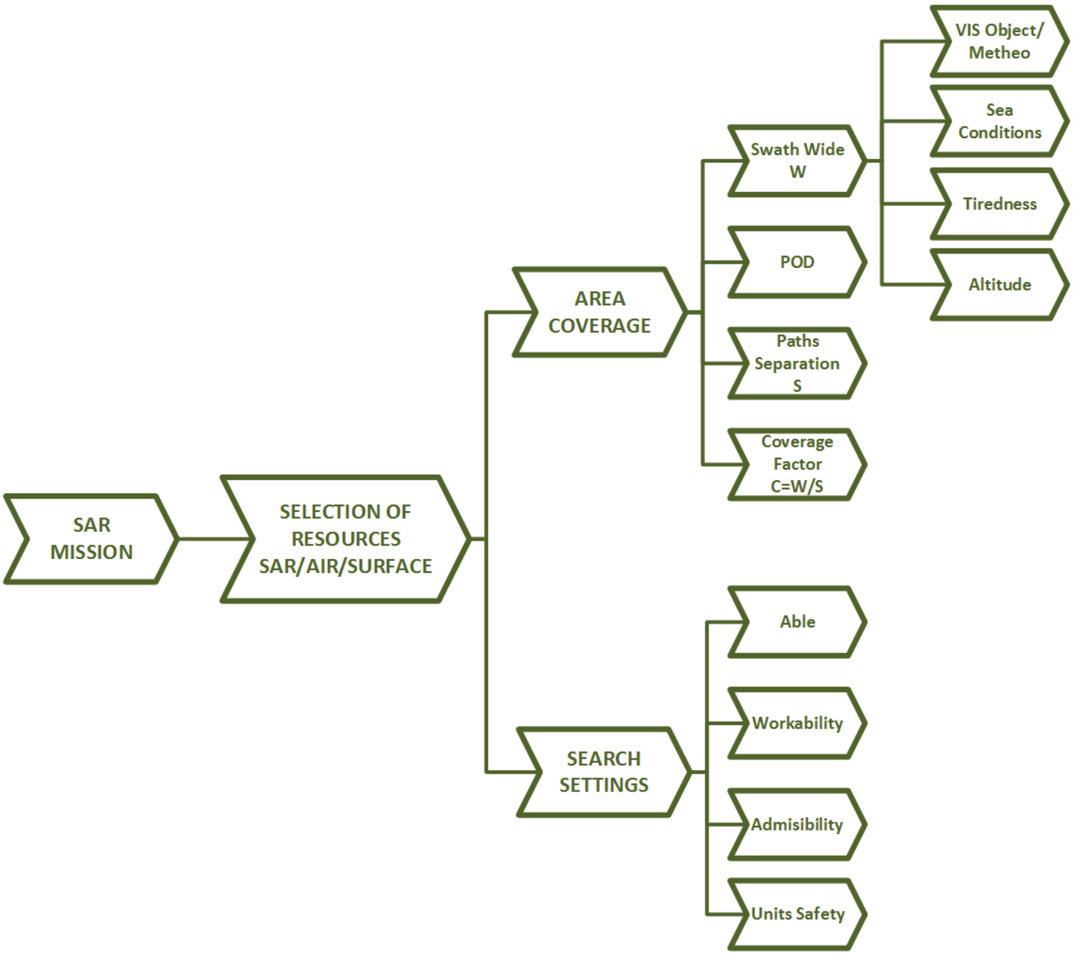

Figure 3. SARMAP Functions

4.3 Automatic Identification System (AIS)

The Automatic Identification System (AIS) is an automatic tracking system used on ships and by vessel traffic services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships, AIS base stations, and satellites. When satellites are used to detect AIS signatures then the term Satellite-AIS (S-AIS) is used. AIS information supplements marine radar, which continues to be the primary method of collision avoidance for water transport.

Information provided by AIS equipment, such as unique identification, position, course, and speed, can be displayed on a screen or an ECDIS. AIS is intended to assist a vessel's watchstanding officers and allow maritime authorities to track and monitor vessel movements. AIS integrates a standardized VHF transceiver with a positioning system such as a GPS or LORAN-C receiver, with other electronic navigation sensors, such as a gyrocompass or rate of turn indicator. Vessels fitted with AIS transceivers can be tracked by AIS base stations located along coast lines or, when out of range of terrestrial networks, through a growing number of satellites that are fitted with special AIS receivers which are capable of deconflicting a large number of signatures.

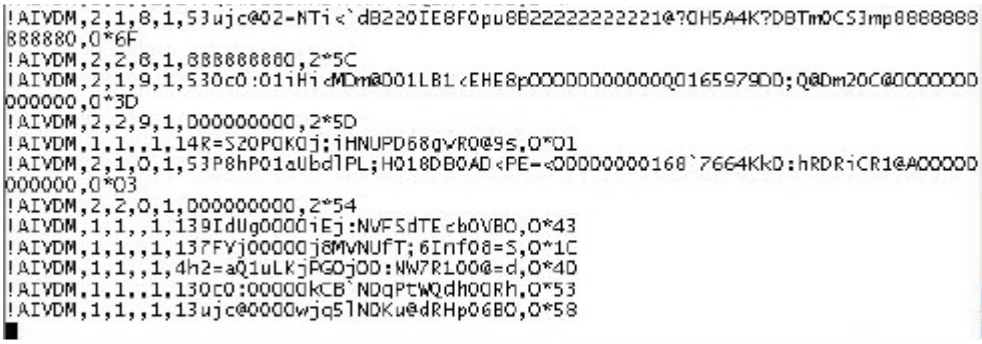

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Figure 4 AIS Messages

5 MAR/HYDRO/METEO Information Systems

5.1 Pilot Handbook data

Pilot books summarize information related to currents, tidal streams, natural phenomena, signals, buoys, lighthouses, underwater cables, measured distances, places where fuel can be taken on, legislation, cautions, pilotage, radio stations, local magnetic anomalies, standard and summer times, consular offices, climate/weather, and so on. They include detailed descriptions of the coastline with 2D drawings of specific features of relevance.

The information contained in pilot books is constantly changing due to the latest tendencies, changes in resources and in navigational tools technology not only on board ships but in ports, buoys, radio stations, lighthouses, delivery of weather information and so on.

6 Procedures to integrate different Information Systems

As every system has its data types and are different within other systems, as we discussed before, we arranged an information exchange protocol with every actor of this Monalisa 2.0 SubActivity.

6.1 Data Access

One important factor is data rights since each actor has their own data and each organization wants to keep their own data which, most of times, cost some money to gather. To resolve this issue and to be able to integrate the information in one information system we have defined a sort of web services using SOAP protocol to access the data when is needed and we agreed to not to store it in a database. Using this protocol, we will need to define at least one web service for each type of information system that needs to be accessed.

6.1.1 Web Services

A Web service is a method of communication between two electronic devices over a network. It is a software function provided at a network address over the Web with the service always on as in the concept of utility computing. The W3C defines a Web service generally as: a software system designed to support interoperable machine-to-machine interaction over a network. Other systems interact with the Web service in a manner prescribed by its description using SOAP (Simple Object Access Protocol) messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.

We can identify two major classes of Web services:

- REST-compliant Web services, in which the primary purpose of the service is to manipulate representations of Web resources using a uniform set of stateless operations.

- Arbitrary Web services, in which the service may expose an arbitrary set of operations.

6.1.2 Simple Object Access Protocol (SOAP)

SOAP, originally an acronym for Simple Object Access Protocol, is a protocol specification for exchanging structured information in the implementation of web services in computer networks. It uses XML Information Set for its message format, and relies on other application layer protocols, most notably Hypertext Transfer Protocol (HTTP) or Simple Mail Transfer Protocol (SMTP), for message negotiation and transmission.

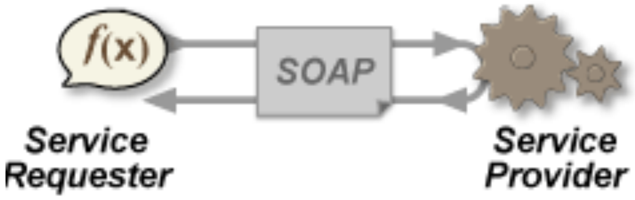

Figure 1 Web Service diagram

6.2 Graphical Information System (GIS)

A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data. The acronym GIS is sometimes used for geographic information science (GIScience) to refer to the academic discipline that studies geographic information systems and is a large domain within the broader academic discipline of Geoinformatics. What goes beyond a GIS is a spatial data infrastructure, a concept that has no such restrictive boundaries.

During Monalisa 2.0 project we have been improving and enhancing our GIS web viewer. To do this, we have been developing new versions of our tool and in the final version users can select one of several ways to view mapping system base. Providers of mapping services are based on WMS services hosted in the cloud. In addition, this display does not require any plugin to run in a browser and is independent of the web browser used.

Below are listed the main features of the map viewer:

- JavaScript-based client, therefore is supported by the almost all Internet browsers.
- Transparent layers superimposed on the map to display different information on each layer. Possibility to enable or disable layers.
- Advanced Graphical Interface.
- Scale dependent mapping.
- Possibility to zoom,pan and view information associated to different layers without tools or enable and disable menus.
- Scroll to zoom and change the scale.

- Generation of thematic maps and visualization dependent objects of different styles (assigning icons to geographic features as layer attribute).
- Viewing layers through mosaic of images that are automatically loaded into the browser as they are needed.
- Use of TileCache layers to load layers more efficiently.
- Grouping markers for cleaner and efficient visualization.
- Using Geo JSON to communicate Map Viewer with server database.

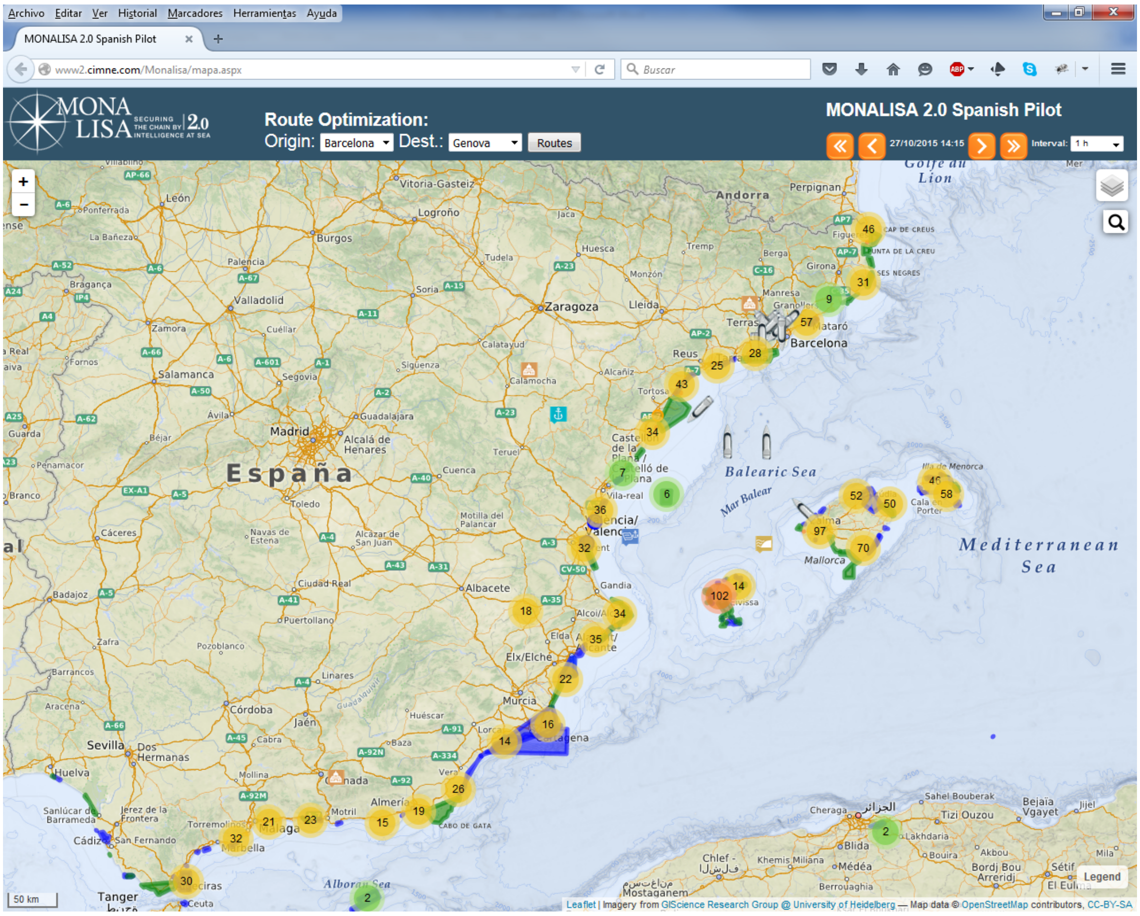

Figure 2 GIS

One of the most important features is the map viewer geographic linking map objects with dynamic information of the elements in order to manage large volumes of data associated with different map layers, and above all, keep updated in real time the information coming from different services, such as AIS or SIGO information.

Also, using a scroll bar, you can see every day, the information obtained from storage facilities and location of ships by AIS antennas. These daily data is obtained through a web service that handle query and plot the real-time information from these services on the map.

The display on the map takes place in two complementary ways in the exact position where the boat and by a layer of themed boat position and direction indicating the exact heeling of each boat.

Finally, the GIS include a display of web services for optimizing shipping routes between two specific points. This service graphic on the map at least three alternative routes you can take a boat between an origin point and a destination point and highlights the optimal route to follow the ship taking into account various factors that are explained elsewhere in the document.

6.3 GeoJSON

GeoJSON is an open standard format designed for representing simple geographical features, along with their non-spatial attributes, based on JavaScript Object Notation.

The features include points (therefore addresses and locations), line strings (therefore streets, highways and boundaries), polygons (countries, provinces, tracts of land), and multi-part collections of these types. GeoJSON features need not represent entities of the physical world only; mobile routing and navigation apps, for example, might describe their service coverage using GeoJSON.


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Figure 3 Exemple of GeoJSON of AIS data

6.4 Port Information

Since the Monalisa 2.0 PES and this system runs on CIMNE WebServers the Data is accessible directly from the Safety Information System and there is no need to create any web service to access to it. This data is stored on CIMNE database.

6.5 AIS Integration

To integrate to the Safety Information System AIS data we will use the following approach in order to not store any data to our DB. We will get the data from Sasemar through a web service and then we will dynamically generate a GeoJSON to plot it in our GIS web viewer.

When the web service method is called, either using a GET or a POST HTTP request, the web service will return information about all the vessels detected around Spain through Sasemar AIS system. Those data will be in a JSON object and we will only use the following information: *NAME, MMSI, IMO, Destination, ETA, Location, Size, Draft, Callsign*.


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```


Figure 4 AIS JSON data

Then, once the Safety Information System have the JSON, the information contained is parsed to be able to dynamically generate a GeoJSON to feed the GIS web viewer. The following code is used to generate a GeoJSON with AIS information

```
        Dim txt As String

        Dim req As HttpWebRequest = WebRequest.Create(urlWS)

        Using response As HttpWebResponse = req.GetResponse()
            Using responseStream As Stream = response.GetResponseStream()
                Using reader As StreamReader = New StreamReader(responseStream)
                    txt = reader.ReadToEnd()
                End Using
            End Using
        End Using

        Dim json As JObject = JObject.Parse(txt)
        Dim idBarco As Integer = 0

        For Each barco As JProperty In json.Item("ships").Children
            Dim datos As JArray = barco.Value
            idBarco += 1
                    if datos.Item(3).ToString <> "0.0" then
            Puntos += ", {""type"": ""Feature"", ""properties"": {""PointID"": " + idBarco.ToString + ",
 ""Name"": """ + barco.Name + """}, ""Rumbo"":" +
Decimal.ToInt32(Convert.ToDecimal(datos.Item(3).ToString)/10.0).ToString + ", ""geometry"": { ""type"":
 ""Point"", ""coordinates"": [ " + datos.Item(1).ToString + ", " + datos.Item(0).ToString + " ] } }" + vbCrLf
                    end if
        Next
        If Not String.IsNullOrEmpty(Puntos) Then Puntos = Puntos.Substring(1)
    End Sub
```

Figure 5 GeoJSON generation code

Once the GeoJSON is generated, almost instant, the AIS data shows up in GIS web viewer using a vessel icon and if you click it an information bubble appears with the information of that vessel.

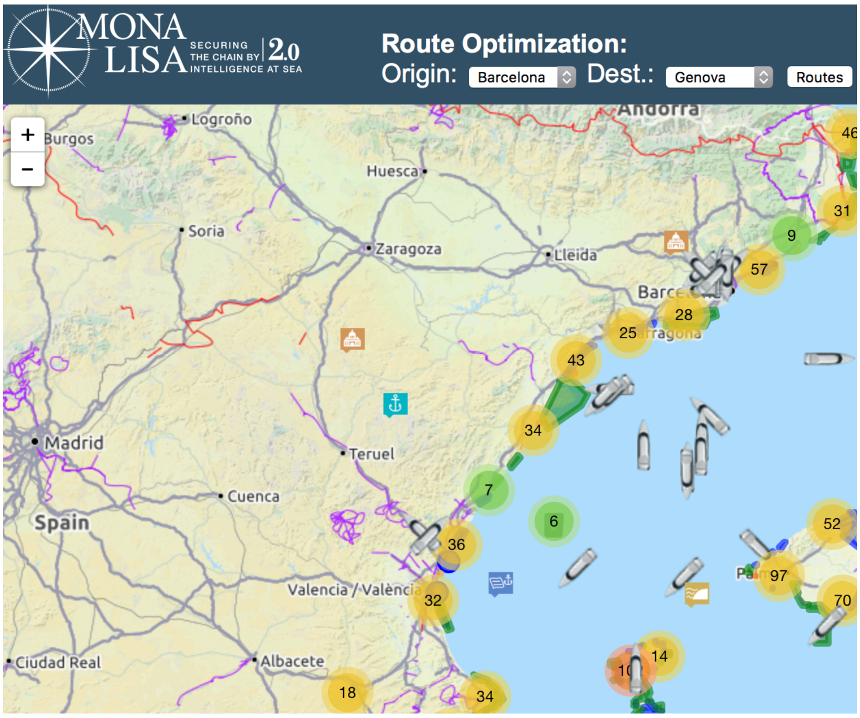


Figure 6 AIS data in Safety Information System

6.6 SIGO Information Integration

As explained before the SIGO is the system to mange the SAR operations. From there we will get all data related to marine emergencies and SAR operations. To get this data we have designed a web service where when a user access the web platform web server consults the web service to get the information about SAR operations in this moment.

The webservice returns a JSON object with the information of all operations performed last hour and its state using the following fields:

Center, ER Code, Name, Last status, Execution date, Execution hour, End date, End hour, Base Type, Latitude, Longitude, Type, SubType, Contacted through.

Centro	Código ER	Nombre	Ultimo Estad	Fecha Ejecució	Hora Ejecució	Fecha Finalizac	H
CNCS Madrid	766/14	RB NUEVO PERLA	FINALIZADA	22/4/14	22:25	24/4/14	
CNCS Madrid	806/14	RB BOLINA UNO	FINALIZADA	22/4/14	6:09	23/4/14	
[illegible]	[illegible]	I-061-14 Pateras	[illegible]	[illegible]	[illegible]	[illegible]	

Figure 7 Example of SIGO data

From all those fields we only need, to draw into the Graphical Information System (GIS): *ER Code, Name, Satus, End date, End hour, Latitude, Longitude, Type and SubType*. So, per each row, we get the data from those fields and we generate dynamically a GeoJON to provide that information to the GIS.

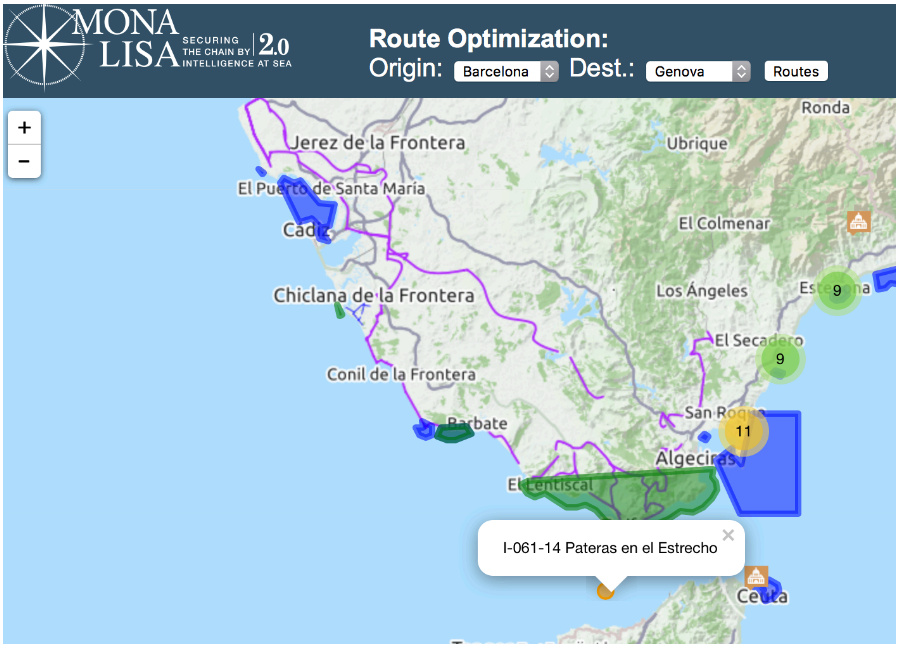


Figure 8 Safety Information System with SIGO data

6.7 SARMAP Information Integration

For SARMAP integration have been considered the search pattern the Probability Of Success (POS) and the Probability of Containment (POC). Once generated those data from SARMAP servers a dynamic GeoJSON is generated and then displayed at Safety Information System.

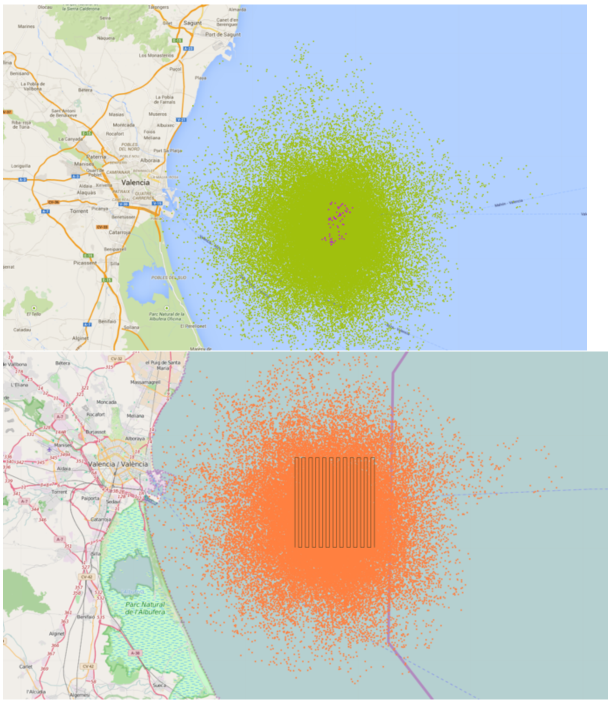


Figure 9 SARMAP data from Valencia rescue

6.8 MAR/HYDRO/MET Information Integration

Among the most important data required by seafarers is that related to the weather and hydrography; for one side, meteorological observations from ships has been a major pillar supporting this modern science; by the other, hydrography supports the safe navigation in coastal waters and in harbour approaches. In the sea side, the automation on board merchant ships suffered during some decades, a kind of blocking that has changed only in the first 2,000 decade towards a progressive assimilation of the technical advances offered in the market.

Electronic chart systems like ECDIS have improved the integration of hydrographical and navigation information in one screen combining fixed data with dynamic data coming from the AIS, information from the own ship is not also display but also of the neighbouring vessels as well, improving safety and reducing collision risks in combination with RADAR.

Tools for automatic Route and Voyage planning from Port A to B via C can be integrated as a part of the ECDIS systems in the market.

Optimizing the schedule taking into consideration the latest weather forecast (weather routing) and using integrated environmental databases for tides and currents will allow the vessel to proceed along the route at the safest economical speed and arrive at its final destination on time.

Nevertheless, in SAR operations, the limitations of the units deployed require precise information about the conditions at sea. Weather, and navigation combined with hydrography data require real time access and reduced space to install a standard ECDIS equipment. In D.4.5.2, the customized solution MiniECDIS provided by SAINSEL has been developed to be adopted by the Spanish Maritime Safety Agency (SASEMAR) and installed in the small units.

This report is referred to the results in providing an alternative information systems served by internet to the small vessels when they are sailing/operating in coastal waters. Some previous results in combining hydrographical/navigation/meteorological information have been applied to offer a complementary solution when sophisticated or advanced ECDIS is not be able on-board, making possible to access the information by means of portable devices like tablets, mobile phones or laptops.

The weather and meteorological information layer must be enabled by the user as it requires. The latest weather forecast is displayed as it is provided by the information service linked. A geo-referenced picture is overlapped on the screen maintaining the original chart view and the other elements are able to be called in case a combined query is required.

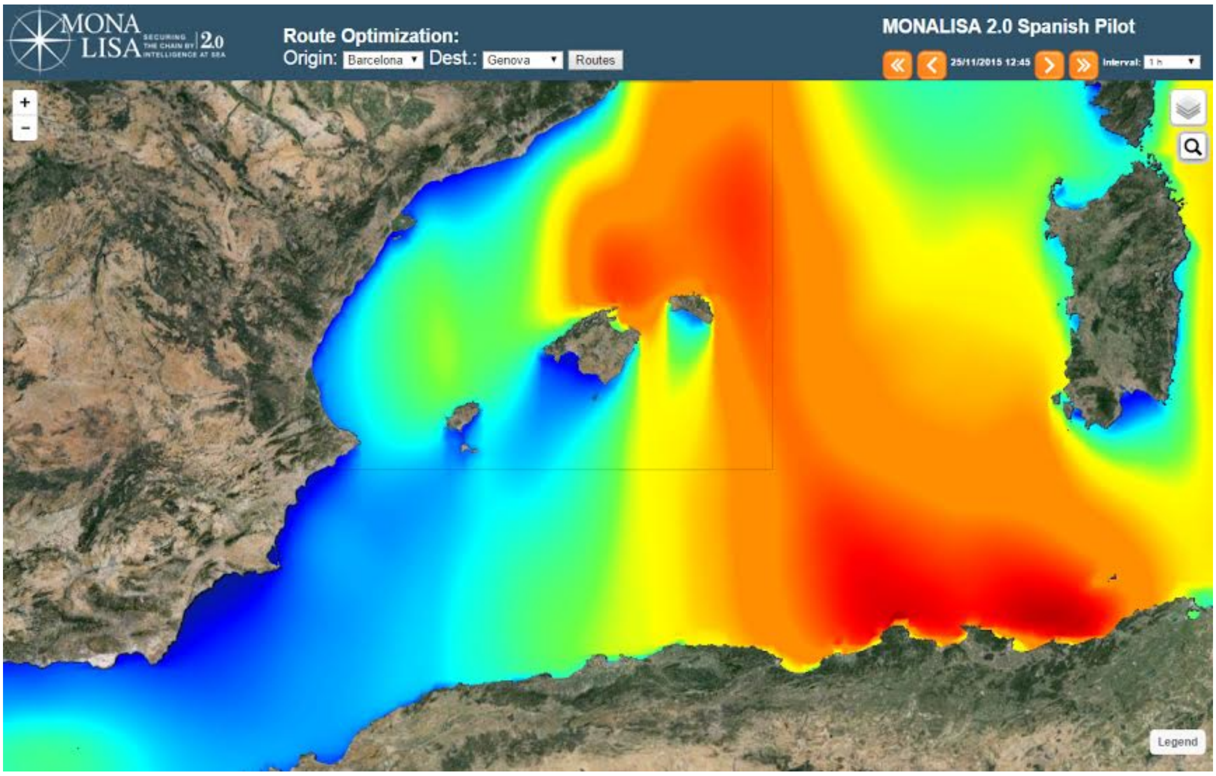


Figure 10 MAR/HYDRO/METEO tool meteorological view over terrain map

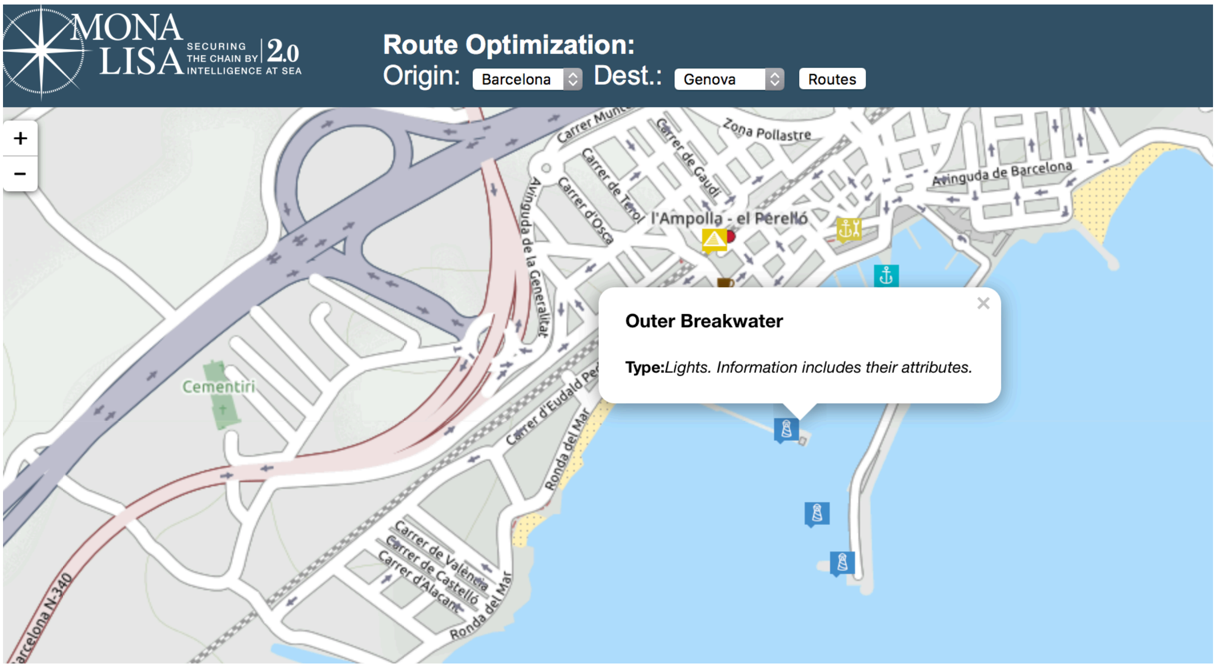
6.9 Pilot Books Information Integration

From Pilot books we have transformed that information into a tables that can also be accessed from the Monalisa 2.0 Safety Information System. A part of those tables we have also transformed that information into GeoJSON to show it in the GIS web viewer.

ID	Title	Description	Type	Lat	Lon
127	Archipiélago de Cabrera National Park	Isla de Cabrera Archipelago (39°10'N 2°58'E) consists of a group of several named islands and islets extending 5 miles SW from the S side of Freu de Cabrera, with navigable passages between them. Marine reserve. The entire group lies within the National Park: The Isla Cabrera Archipelago lies within a Marine-Terrestial National Park the limits of which are marked by light buoys (special) and are shown on the chart. Navigation, fishing, diving and the collection of flora and fauna is prohibited unless authorised by the Director of the National Park in Palma. A marine reserve also encompasses Punta de Sas Barbinas and Islote El Toro. Restrictions apply. Speed limit. There is a speed limit of 5 kn in the entire National Park area. Currents, induced by the strength and direction of wind, are experienced in the waters of the archipelago.	1600	39,166666	2,96667
167	Bahia de Palma	Bahía de Palma is entered between Cabo Blanco (39°22'N 2°47'E) and Punta de Cala Figuera (39°28'N 2°31'E), 13·1/2 miles WNW; the city and port of Palma lie at the head of the bay. Topography The coast on the E side of the bay is high with white cliffs and on the W side it is high with rocky cliffs indented by a number of small bays and coves. The city of Palma, with its airport a few miles E, dominates the head of the bay. Fish havens Large numbers of fish havens line the shores on each side of the bay, as shown on the charts. Marine and Integral Reserves. A Marine Reserve has been established on much of the E side of the bay, the limits of which are shown on UKHO chart 2832. An Integral Reserve has also been established within the Marine Reserve, as shown on the chart. For information on Marine and Integral Reserves. Restricted area Most of the W side of the bay lies within a prohibited anchoring and trawling area, the limits of which are shown on the charts. Area to be avoided To avoid the risk of pollution and damage to the environment an area has been established approximately 1 to 2·1/2 miles offshore, from Punta de Cala Figuera to Palma, as charted.	1700	39,4869	2,6422

Figure 11 Table with information from Pilot Books

Information of NATURE 2000 protected and restricted areas is also displayed in the Safety Information System (Figure 8).



7 Conclusions

Nowadays each actor has, at least, one safety information system so in case of an emergency the information is split between several information systems. This could lead to an inefficiencies and possible errors during an emergency, even if it is taken into account that each actor has different safety systems not connected and in case of maritime ports and cost guards have their own systems. Having an integrated safety information system would reduce this possible problems and errors.

Sea Traffic management (STM) would be better if it has information of possible safety issues within ports or vessels and could really improve sea navigation reducing costs an emissions adapting each route to new conditions in real-time. Having Monalisa 2.0 Safety Information System installed a board of vessels should allow them to know in real time the state of their routes and the possible accidents near them.

In case of an accident information is critical to reduce possible side effects or just to calm down relatives of possible victims so the safety information system should also be used to inform media about the accident.

Monalisa 2.0 Safety Information Platform integrates information from ports, Valencia Port, cost guards, SASEMAR, data from MAR/METEO/HYDRO conditions and information of routes planned with algorithms to support the decision from Monalisa 2.0 Activity 1. This system is good as a proof of concept but needs to be improved by including information of other costs guards and ports, at least. It should define also an standard protocol to communicate with all the different systems that every actor on maritime environment has. By the way, it also needs some regulations to force the actors to share their data because sometimes they do not want to share the information with other organizations. This would be a good point to take into account in future projects.

8 References

D4.5.1. Report on the information systems for safety management in ports.

D4.5.2. Report on the Information Systems to Support SAR Operations

D4.5.3. Report on the implementation of MAR/HYDRO/METEO information systems

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