BlueMassMed

Thematic Report n.2

A technical framework for information exchange

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TABLE OF CONTENTS

ACRONYMS LIST

AIS	Automatic Identification System
BMM	Blue Maritime Surveillance System for the Mediterranean sea(BlueMaSSMed)
CCTP	Cahier des Clauses Techniques Particulières
COP	Common Operational Picture
DG MARE	Directorate-General for Maritime Affairs and Fisheries
EC	European Commission
EMSN	European Maritime Surveillance Network
EU	European Union
GIS	Geographic Information System
LRIT	Long-Range Identification and Tracking
MSS	Maritime Surveillance Systems
NAF	NATO Architecture Framework
PN	Primary Node
QoS	Quality of Service
SBCMP	Shared Basic Common Maritime Picture
SN	Secondary Node
SOA	Service Oriented Architecture
SOP	Standard Operating Procedures
TCP/IP	Transmission Control Protocol/Internet Protocol
VMS	Vessel Maritime System
WAN	Wide Area Network
XMSN	eXperimental Maritime Surveillance Network

1 INTRODUCTION

The European Union is strongly committed to implementing an Integrated Maritime Policy which supports improved efficiency of the Maritime Situational Awareness by the competent authorities, through the integration of networking and maritime surveillance systems in Europe (ref. COM (2009) 538 and COM (2010) 584 relating to the implementation of a Common Information Sharing Environment (CISE)).

The implementation of regional pilot projects, such as BMM, in parallel with the work of the Working Groups set up by the relevant EU DGs, aims to create the requested operational and technical conditions for the implementation of a common maritime surveillance network through the direct involvement of the competent authorities, the integration of national legacy surveillance systems and the analysis of technological operational and legal constraints in order to identify solutions to be proposed for the implementation of the CISE Roadmap.

Accordingly, in over two years of work the BMM Technical Group has defined and developed an open, flexible, secure and decentralized architecture able to make interoperable systems and networks operated by the 37 participating governmental agencies, and thus to make them accessible a Shared Based Common Maritime Picture (SBCMP) harmonized across civil and military sectors and enriched by newly and extremely value added information services.

Looking at the overall development plan of the future C.I.S.E., BlueMassMed can be thought of as having covered most of the so-called “feasibility phase”. The major results of such phase are the High Level System Requirements (*Project CCTP*), the Technical Specifications (*System Views*), the *demonstrative network implementation & integration,* the related *experimental demonstration*, as well as the identification of *lessons learned* and *cost* and *time planning* for the subsequent project phases.

Moreover, the major outstanding issues, deserving further dedicated efforts before a full scale engineering solution can be achieved, have been identified and described:

- the adoption of architectural solution for dual use systems’ interconnection on C.I.S.E. (enabling exploitation of classified and security sensitive information)
- the detailed design of the information protection mechanism, enabling user / service authentication and data access and distribution policy enforcement by the Competent Authorities
- the definition of the operational governance at program management, network management and configuration management level
- the cooperative development of technological solutions and standards in order to ensure a full life cycle management of the future C.I.S.E. infrastructure

2 THE OPERATIONAL REQUIREMENTS

The primary operational requirements that such architecture is able to answer are to:

i. allow the sharing of maritime situations of the different sectorial administrations, while respecting their own roles and data access privileges setting suitable criteria for the distribution of data between member states and communities, facing the future requirements of CISE
ii. facilitate the exchange of value-added information, not limited to sharing of positional data, already available through multiple networks of maritime reporting (AIS, LRIT, etc..)
iii. support the civil-military cooperation through the sharing of resources and information in compliance with the policy of treatment of classified data (dual-use)
iv. permit the sharing and the optimization of large scale monitoring assets such as satellites (eg Cosmo-SkyMed, Pleiades, Galileo, satellite AIS, etc..) and patrolling units (aircrafts, helicopters, vessels).

These requirements have been addressed through innovative technological choices, based on the adoption of the WSS SOA (Web Service Security Service Oriented Architecture) paradigm, which allowed to securely connect disparate systems and networks, which were developed and managed by government in respect to various sectorial maritime policies, through the adoption of a common semantics and the implementation of a harmonized set of information services.
BMM, thus, faced with a paradigm shift: from the centralization of information, with consequent limitations in the availability of the same and the need for use of centralized computer systems, to the distribution of open and flexible services, made in distributed computing systems.

The benefits of this process are already being experienced in many fields of Information Technology, and can be summarized in an extensive user involvement, an increase of information exchange and a consequent sharp reduction in development costs, acquisition and maintenance of technological infrastructures.

In the BlueMassMed architecture, a shared cross-sector maritime situation (SBCMP) is built through the capability of each node of the network to make available to the others the services of common interest (exchange of surveillance information, intelligence and traffic monitoring, correlation of tracks at regional level, discovery of suspect / not cooperating vessels, identification of pollution into areas of interest), sharing data and information provided by surveillance and monitoring resources held by individual national authorities, within the limits dictated by the policy of access and distribution of data.

The ability to join a simple, flexible and secure network of services will naturally lead governments to optimize their resources and their investments in monitoring systems, preferring the possible synergies arising from a harmonized cross sectorial and trans-national harmonization and sharing of maritime situation data and information.

This requirement is, also, strongly supported by EU in the development of the Common Information Sharing Environment (CISE), facing the issue that currently a large number of systems/sensors provide their information through networks and systems, often in overlap between them without offering an effective decision support capacity to the competent authorities.

3 THE NAF METHODOLOGY AND THE HIGH LEVEL (CCTP) REQUIREMENTS

To apply this innovative paradigm in a multinational and multi-sectorial project like BlueMassMed, the Technical Working Group proposed since the start of the program a large usage of the international design methodology "*NATO Architectural Framework*", defining the future " European Maritime Surveillance System " not through the traditional approach based on the derivation of technical requirements to allow unique identification of each elementary component of the system hardware and software, but rather through the definition of a series of "Standard Views" to specify the operational perspective (Operational Views), the services definition (Service Oriented Views), the reference standards (Technical Views) and requested functionalities (System Views).

The output of such an extensive architectural definition work, the so-called "**BlueMassMed Cahier de Clauses Techniques Particuliéres - CCTP**" is reported as Annex 1, and was used to launch an industrial tender for the turnkey design and experimental demonstration of the BMM architecture.

4 THE BMM SYSTEM VIEWS AND STEP-BY-STEP IMPLEMENTATION OF THE BMM EXPERIMENTAL NETWORK

Later on, following the evaluation of the industrial proposals, the SG adopted the decision to follow a step-by-step implementation methodology, keeping on the institutional level the design authority. The Technical Working Group has been therefore requested to develop and approve in a complete autonomy and independence from the Industry, the baseline system design of the future European Maritime Surveillance System, identifying technical reference standards, operational and functional requirements, common semantics and protocol architecture.

The result of this activity is reported in the BMM System Views document, which is attached as Annex 2 in the last updated version, reflecting the lessons learned from the experimentation results, and representing the reference technical output of the BMM project, that sets the systems level requirements, interfaces and service specifications for the future follow-up BMM Nodes, Network and Users interfaces.

Based on the developed baseline design, starting from June 2011, five partners (IT ASI, FR DGA, SP Armada and Guardia Civil, PT Marinha) have independently commissioned to different (groups of) private companies the implementation of prototype nodes integrated into a BMM demonstration network (XMSN – Experimental Maritime Surveillance Network) that has been tested and validate in the latter part of the BMM project.

So, as a result, a BMM demonstration network has been set-up, composed of 5 Primary Nodes (Italy, Spanish Navy, Spanish Guardia Civil, France, Portugal) connected to over 30 national maritime surveillance systems managed by different authorities, linking over 100 agencies and competent authorities able to access information and to share resources through BMM web services provided to each partner by Primary Nodes accordingly to his credentials and privileges.

The basic connectivity, provided by the XMSN demonstrator through secure public Internet https connections, will be increasingly made safer in the future through the use of Virtual Private Network grid connections (VPN mesh), and will be extended through the adoption of appropriate encryption techniques and physical separation of networks ensuring the interoperability of civil and military networks (dual-use).

The implemented protocol architecture and infrastructure core services ensure the possibility of any user to access the network from any node (Access Federation), and to contribute to the same maritime situation invoking / publishing the added value services on the basis of its profile whatever access point is used to be connected to the network (Service Federation).

The BMM TWG has also addressed the definition of rules for the association and identification of tracks, and the specification of a harmonized methodology for compiling the multi-sectorial shared based common maritime picture of the Mediterranean, which is a first concrete step towards the goal of equipping all maritime administrations of a common maritime multilevel situation, supporting the definition of common methodologies and StandardOperatingProcedures (SOP) for all the Member States of the European Union (EU), the baseline framework for the realization of the European Maritime Surveillance Network (EMSN).

5 THE BMM EXPERIMENTAL NETWORK (XMSN) INTEGRATION AND VALIDATION

The integration and validation of the BMM XMSN demonstrator started under the supervision of the Technical Working Group in October 2011 and was focussed on the demonstration of connectivity between nodes, validation tests of infrastructure services, integration tests for the added value services and the process of completing the SBCMP.

As obvious, the integration and validation activities have led to a number of feedback on the System Views requirement, as well as to guidelines and indications for an optimised implementation of the key system requirements with respect to interoperability and harmonisation issues (reported in Annex 3).

The full set of integration and testing procedures related to the BMM Nodes integration on the XMSN network are reported instead in Annex 4.

In parallel, the BMM experimentation phase started in the month of April 2012 under the supervision of the Operations Working Group (UWG, leadership of the Com Eugenio Diaz Del

Rio), aimed at the direct involvement of administrations on the use of the developed XMSN network and the collection of feedback from operational users to validate the conceptual approach of BlueMassMed to the EU institutional cooperation in the maritime sector.

For a detailed report of the experimentation please refer to the Thematic Report n. 4.

6 CONCLUSIONS AND RECOMMENDATIONS

The BlueMassMed Experimental Demonstration activities were concluded on June 7, 2012 with the execution of the a live demonstration held in Brussels and attended by the leading European Authorities in the Integrated Maritime Policy framework.

The live demonstration showed how, in a typical scenario of smuggling of illegal immigrants at sea, the cooperation between competent authorities is considerably more profitable and efficient through the real-time availability of a shared maritime situation, ensuring the exchange of services obtained from different and independent technology platforms designed and developed in respect to different European and national policy requirements. The demonstration highlighted the high-level technological capabilities offered by EU Member States and European industries, and the unique ability to design a collaborative, advanced and open architecture, ensuring the requested interoperability to allow a real, effective and decentralized European cooperation at sea.

The project has shown a willingness to join forces between Member States and the European reference Institutions on a sensitive issue like the maritime surveillance data interchange; accordingly, the project results will be useful to outline a new framework for cooperation in the maritime sector in Europe.

In conclusion, the proposed technical approach, being based on a transparent and non-hierarchical architectural design, makes BMM as an optimal candidate for the implementation of the integrated maritime policy at European level, thanks to the ability to:

- realize the harmonized cross-sectorial maritime situation;
- assure the Member States / Nations to directly control the management of shared information through a national BMM node;
- allow better use of European resources through direct financing of government that can most appropriately exploit the project results in terms of definition and harmonization of requirements and standardization and reuse of solutions;
- ensure the optimization of available information avoiding, at the same time, the waste of resources due to duplication of existing systems in use and the capability to provide cooperating neighbouring countries with an open platform to share data, information and services.

The detailed technical conclusions and lessons learned from the technical and technological perspective from BMM can be found in Annex 5.

As described in the annex, the main technical result from the BMM project can be thought of as a **basic harmonised Front-End capable to adapt any given legacy system (or group of legacy systems) to the C.I.S.E. network thanks to the adopted SOA open approach**.

Starting from such result, the main recommendation from the technical perspective at the end of the BMM project is **to proceed with the project definition phase, based on the achieved technical results, and keeping at government/institutional level the design authority**, in order to:

- *develop and validate a full scale engineering prototype*, implementing all the components, services and capabilities defined in the technical specifications (System View) up to a **pre-operational level** compatible with the need to proof the operational added value in a sufficiently wide cross sectorial and cross border scenario

- *develop the fully engineered technical and operational specifications* for the **operational implementation** of C.I.S.E. (final design, procurement, integration and acceptance of the C.I.S.E. components)

However in order to ensure full continuity of the BMM technical approach and of cooperation model established within the BMM project towards an integrated maritime surveillance capability in Europe, the following major recommendations can be drawn:

- in the short term (next 3-6 months), it is recommended that **the BMM Partner Nations set a joint agreement for the continued operation and validation of the prototype experimental network** established by the Project

- in the mid-term (6-12 months), it is recommended that the BMM Partners promote further cooperation initiative, open to a larger number of participants, for the **adoption of the BMM approach for the pre-operational validation of the C.I.S.E. on an European scale**, as foreseen by the current DG Mare roadmap for C.I.S.E. implementation. It is worth noting that in this context the exploitation of the results of the BMM project (the harmonised C.I.S.E. front-end) can be extended to those systems that were not included in the BMM project perimeters, and first of all to those covered by the twin pilot project for the Baltic MARSUNO.

Finally, it is recommended that:

- **further harmonisation of maritime picture information fusion techniques and standardisation of the related operational procedures is pursued at national (interministerial) level by each PN and then at EU level** in order to consolidate the Shared Basic Common Maritime Picture (SBCMP) concept as the key feature enabling cross-sectorial cross-border decision support capabilities on the C.I.S.E..

- corresponding governance schemes at national and EU level are proposed, in compliance with the applicable operational and legal constraints.

ANNEX 1
BLUEMASSMED HIGH LEVEL REQUIREMENTS
(CCTP DOCUMENT)

ANNEX 2
BLUEMASSMED SYSTEM REQUIREMENTS
(SYSTEM VIEW DOCUMENT)

ANNEX 3
BLUEMASSMED SYSTEM REQUIREMENTS IMPLEMENTATION GUIDELINES

ANNEX 4
BLUEMASSMED INTEGRATION & TEST PROCEDURES

ANNEX 5
BLUEMASSMED LESSONS LEARNED TOWARDS A TECHNOLOGICAL SOLUTION FOR THE C.I.S.E.