

# BLUEMASSMED PILOT PROJECT

## POSSIBLE IMPLEMENTATION PLAN AND COST EVALUATION OF AN EUROPEAN CISE BASED ON THE RESULTS OF THE BMM EXPERIMENTAL DEMONSTRATION

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## 1 Possible CISE Implementation Plan

The BMM pilot project has demonstrated a viable technological solution for the CISE implementation, whose major strengths are the high cost/benefit ratio and the flexibility of the approach, which can be easily adapted to the various operational and legal constraints at MS, Sectorial and EU level.

Based on the technological results of the project and on the level of cooperation achieved among Partners Agencies during the experimentation, the BMM project has reached substantial consensus over the basic concepts that characterize its proposed technological baseline for the C.I.S.E.

However, given the budget and time constraints of the Pilot Project, BMM has focused on the true innovation points, i.e. those aspect of the future technological solution that showed the highest level of risk in terms of meeting expectations and reaching consensus among the administrations, leaving a full scale engineering effort to the subsequent follow-up phases.

Technological results arising out of the BMM project could be fruitfully exploited in the framework of the C.I.S.E. deployment along three major routes:

- at National level by the different Administrations
- at regional / sub-regional level by involved sectorial and cross-sectorial administrations
- at EU level (Pre-Operational Validation of CISE)

### 1.1 BMM Exploitation at National Level

At each MS level, the following actions are expected / required as a follow-up of the BMM project:

- a) keep in operation and maintain the current BMM Primary Nodes prototypes (permanent CISE test-bed)
- b) finalize the integration of back-end systems and services (end-to-end)
- c) definition and implementation of National level rules, restrictions and limitations on BMM/CISE certificates issuing and user credentials policies
- d) definition and implementation of National level constraints on the cross-sectorial data distribution (sensitivity levels)

Such follow-up activities shall start immediately after the end of the project (September 2012) and for an initially expected period of 12-15 months (until December 2013), when the Pre-Operational Validation Phase shall start.

### 1.2 BMM Exploitation at Regional/Sub-regional Level

Beyond the full deployment of the basic front-end components, the CISE implementation will require a step-by-step bottom-up process, taking the actual maritime surveillance stakeholders on the way to exploiting cross-sectorial / cross-border information sharing to enhance their capabilities and support their operations.

Such process shall take place in parallel to the National exploitation route, involving groups of Users dealing with a same maritime region or sub-region but entailing a diversity of sectors and member states.

In this framework, the BMM prototype architecture as developed until now would be further developed and consolidated on the ground of actual, operational services provision in areas where a metric for added value validation can be easily found and applied, and end to end service chains entailing future CISE connections shall be devised, implemented and operationally validated.

These Regional contexts will be moreover the main occasions for selective upgrades of current BMM Primary Nodes with respect to the services and functionalities designed (please refer to the System View)

but not yet implemented in the current prototypes, as well as for the development of additional (functional) Primary Nodes in the frame of the evolution of the User's maritime surveillance systems towards the C.I.S.E..

These projects will have to address and solve to a fully engineered scale, technical areas not sufficiently covered by the BMM pilot project, such as:

- a) full automatic User & Service federation mechanism
- b) implementation of information protection methods and dual-use architectures
- c) definition of an appropriate application-based data segregation / indexing function
- d) full implementation of the SBCMP procedure, including appropriate track quality, confidence and ranking indicators harmonized at operational level
- e) adoption of algorithms for maritime picture optimization in areas of overlapping

Moreover it is expected that these bottom-up application-cases shall provide the adequate operational and legal background to sustain the technical choices in terms of information exchange.

Such follow-up activities shall start immediately after the end of the project (September 2012) and for an initially expected period of 12-15 months (until December 2013), when the Pre-Operational Validation Phase shall start.

### **1.3 EU level Pre-Operational Validation**

Based on the outcomes of the National and Regional/Sub-regional level exploitation routes, substantial indications will be gathered on operational, technical and legal aspects in practical field situations.

On such ground, a systematic Pre-Operational Validation activity could be run at EU level, putting together a sufficiently representative number of Nodes in order to experiment on an adequate scale the "user independent" added value capabilities with particular reference to:

- a) The further development of core and common services as defined in the BMM system view document
- b) The implementation of more sophisticated information protection services, entailing SAML/XACML protocols for credentials management as well as full WS-S technology exploitation for additional security enforcing at service level
- c) the definition of an appropriate application-based data segregation / indexing function
- d) the adoption of more sophisticated algorithms for maritime picture optimization in areas of overlapping
- e) the Implementation of an advanced mechanism for added value services publication, discovery and ranking (quality of service feedback)
- f) the Development of a sustainable Technical Standards baseline and the associated life cycle support policy (and "protection" from the commercial products)

Such Pre-operational validation activity shall involve the implementation of a growing number of Nodes (up to 40-50 Nodes could be envisaged) covering the widest possible domain in terms of sectors and geographic areas, and shall entail a refining and tuning period of at least 6 months + an experimental validation period of at least 1 year and a wrap-up and conclusion drawing phase of 6 months.

Consequently the EU level Preoperational Validation can be assumed of 2 years duration and shall start as soon as the bottom-up project activities have come to a sound conclusions (i.e. 2014-2015).

### **1.4 Operational Implementation**

Based on the result of such pre-operational validation project the full-scale final procurement and development guidelines of CISE could be derived, along with the related final guidelines for the CISE operational procedures and life cycle support.

## 2 Operational Implementation Phase - Cost Evaluation

The BMM project and notably the Experimentation Phase has put in evidence significant aspects that will have an influence on the global cost model of CISE operational full-scale implementation. In order to proceed to a cost evaluation of the “full scale” CISE implementation, we shall make the preliminary assumption that the **residual engineering and validation activities required to take up to a full-scale engineering stage all the components devised under the BMM EMSN design according to the System View document, shall be performed and financially covered under the initiatives planned in §3.1, 3.2 and 3.3.**

Under this condition, and as a major distinctive feature of the BMM proposed approach, we can make the basic assumption that the CISE bulk implementation cost is given by the **cost of implementing a “full-scale” BMM front-end at all connected nodes**. Therefore a first approximation model could be:

***COST OF CISE = COST OF FRONT-END IMPLEMENTATION x NUMBER OF NODES***

However, a basic driver of the front-end implementation cost at each future C.I.S.E. Node is the *number of “back-end systems” feeding the Front-End*. As a matter of fact, depending on National and sectorial policies, C.I.S.E. Nodes could have a large variety of systems in their back-ends, ranging from single surveillance systems to multiple systems or sources of tracks and information, as it is the case for Interministerial Nodes. The corresponding cost model shall consequently separate the cost components that are substantially independent on the number of systems connected to the Front-End and the cost components that are proportional to such number. The resulting refined model of the bulk cost of C.I.S.E. implementation would be:

***COST OF CISE = ( Cost of Front-End HW & SW COTS licenses + Cost of Front-End Basic Infrastructure ) x Number of Nodes + (Cost of Front-End Adaptation & Integration + Cost of Back-End Components Development & Integration + Cost of Data Access & Distribution Plan implementation) x Number of Systems***

A further refinement of the cost model can be achieved considering also the **nature of back-end systems**. Based on the BMM project experience, we could group the “back-end systems” in two “limit” broad categories:

1. systems featuring full maritime surveillance and monitoring capabilities, that will be able to fully implement and publish most of the added value services according to the defined BMM interfaces, like for example Navies, Coast Guards, Fishing Authorities systems and others; for the sake of the cost modeling we will indicate systems belonging to this category as “Active Systems”;
2. systems featuring little or no maritime surveillance and monitoring capacity but still interested in managing and exchanging information, events, alerts, etc. related to maritime awareness. These systems would be primarily interested in subscribing C.I.S.E. information exchange services while publishing a very limited subset of own information services (typically only data augmentation services). This is the case for example of most Customs Agencies, Police Dept., Environment Ministries, etc.; for the sake of the cost modeling we will indicate systems belonging to this category as “Passive Systems”.

Assuming that the average cost of front-end adaptation & integration and back-end components development & integration could be reduced by 40% for a “passive” system with respect to an “active” system, the model for the bulk cost of C.I.S.E. implementation could be consequently refined as:

$$\text{COST OF CISE} = (\text{Cost of Front-End HW \& SW COTS licenses} + \text{Cost of Front-End Basic Infrastructure}) \times \text{Number of Nodes} + (\text{Cost of Front-End Adaptation \& Integration} + \text{Cost of Back-End Components Development \& Integration} + \text{Cost of DA\&DP Implementation}) \times (\text{Number of Active Systems} + 0,6 \times \text{Number of Passive Systems})$$

A preliminary assessment of the cost elements, based on the BMM project experience and experimentation work, is presented in the table below, together with the basic assumptions for their validity.

**Overall, the cost elements estimations are R.O.M. and intended only as guidelines for budgeting and benchmarking w.r.t. other approaches to the C.I.S.E..**

COST ELEMENT	BMM Experience	Reuse	Cost of full-scale element	Price Base	Assumptions and Limitations
<b>a) Hardware, Networking and COTS License</b>	40.000	-	40.000	<i>Euro / Node</i>	- open source licenses - platform sizing for a Node with backend including up to 5 “active” systems
<b>b) Front-End Components (basic infrastructure)</b>  b.1) Protocol Stack b.2) Core Services and associated functionalities b.3) Common Services (TD&IE, DAS, WAM) and associated functionalities b.4) SBCMP procedure and associated functionalities	200.000	80%	40.000	<i>Euro / Node</i>	- The Front-End components are intended as the basic services implemented in the frame of the pilot project, including the WSDL, XSD and basic functionalities according to the SV, independent of the specific node and systems - The SBCMP procedure basic infrastructures includes only the implementation of the rules established by the SV and not the specific algorithms for track synchronization, association and correlation
<b>c) Front-End Components Adaptation &amp; Integration</b>  c.1) Protocol Stack c.2) Core Services and associated functionalities c.3) Common Services (TD&IE, DAS, WAM) and associated functionalities c.4) SBCMP procedure and associated functionalities	100.000	50%	50.000	<i>Euro / Active System</i>	- Integration of Front-End components with the C.I.S.E. Network (service brokering, service integration, user federation, information protection mechanism, etc.)  - does not include specific DDP implementation (see point e))  - does not include specific business logic for back-end integration

<b>d) Back-End Components Development &amp; Integration</b> d.1) Back-end data integration d.2) Back-end services integration d.3) SBCMP processing implementation	100.000	20%	80.000	<i>Euro / Active System</i>	- does not include implementation of specific services in the back-end systems  - does not include back-end data reprocessing or indexing for DDP implementation purposes (see point e))
<b>e) Data Distribution &amp; Data Access Plan Implementation</b> e.1) Data Distribution Plan Implementation e.2) Back-end Data Indexing and segregation	-	-	T.B.D.	<i>Euro / Active System</i>	- cost to be assessed on the base of the complexity of the data access and distribution plan that will be established at Operational & Legal level
<b>TOTAL COST ELEMENTS x NODE</b>			<b>80.000</b>	<b><i>Euro / Node</i></b>	
<b>TOTAL COST ELEMENTS x (ACTIVE) SYSTEM</b>			130.000	<b><i>Euro / System</i></b>	<b>Excluding the Costs of DD&amp;DAP implementation (letter e))</b>

**Table 3 – R.O.M. assessment of Cost Elements for Operational Implementation of C.I.S.E. based on BMM experience**

Based on such figures, and on the overall findings on the BMM project, an overall tentative budget estimation for the CISE operational implementation can be attempted, as in the table below.

PRICE BASE	UNITS	UNIT COST OF ELEMENTS	OVERALL COST	
NODES ON C.I.S.E.	100	80.000	8.000.000	Euro
“ACTIVE” SYSTEMS ON C.I.S.E.	200	130.000	26.000.000	Euro
“PASSIVE” SYSTEMS ON C.I.S.E.	200	78.000	15.600.000	Euro
<b>TOTAL COST OF CISE OPERATIONAL IMPLEMENTATION (excluding DD&amp;DAP implementation)</b>			<b>49.600.000</b>	<b>Euro</b>
Budgetary overhead to take into account the DD&DAP implementation (15%)			7.440.000	Euro
Other overheads (engineering, supervision, quality assurance, management, handling and industrial margin fees) – 30%			17.112.000	Euro

<b>GROSS BUDGET ESTIMATION (before VAT and any other applicable Taxes)</b>	<b>74.152.000</b>	<b>Euro</b>
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**Table 4 – Tentative Budget for C.I.S.E. operational implementation based on BMM experience**

Considering a preliminary impact of up to 15% for the DD&DAP implementation (Euro 7.440.000), as well as a general mark-up of 30% to take into account engineering, supervision, quality assurance, management, handling and industrial margin fees, a gross budget of around 75.000.000 can be estimated for the C.I.S.E. operational implementation cost under the performed assumptions.

Based on the implementation cost estimation, a R.O.M. estimation of the annual operational cost of C.I.S.E. can also be drawn, as shown in the above table and based on the BMM lessons learned.

As it can be seen in the table the operational costs, excluding explicitly the maintenance and operations of the back-end systems that are subjects to own administration policies and operational practices, reduce to the sum of HW maintenance (preventive, corrective and evolutional) and of technical assistance for the keep-in-operation, configuration, control, debugging and operation support of the front-end and back-end components at each Node.

<b>C.I.S.E. ANNUAL OPERATIONAL COST</b>	<b>Units</b>	<b>Full Scale</b>
a) Hardware, Networking and COTS License	<i>33% of Value</i>	13.200
b) Front-End Components Maintenance / Configuration b.1) Protocol Stack & Web Portal b.2) Core Services and associated functionalities b.3) Common Services (TD&IE, DAS, WAM) and associated functionalities b.4) SBCMP procedure & Regional Correlation	500 hours	25.000
c) Front-End Components Operations Support c.1) Web Portal Integration c.2) Web Services Integration c.3) Data Distribution Plan Implementation c.4) SBCMP procedure integration	500 hours	25.000
d) Back-End Integration Evolution Support d.1) Back-end Data Indexing and segregation d.2) Back-end data integration d.3) Back-end services integration	1000 hours	50.000

d.4) Back-end HCI integration		
<b>TOTAL ANNUAL OPERATIONAL COST (CONNECTED TO NOT MORE THAN 5 ACTIVE SYSTEMS)</b>	<b>Euro / Node</b>	<b>113.200</b>
<b>Number of Nodes on C.I.S.E.</b>		<b>100</b>
<b>TOTAL ANNUAL OPERATIONAL COST FOR C.I.S.E.</b>	<b>Euro / Year</b>	<b>11.320.000</b>

**Table 5 – Tentative Budget for C.I.S.E. annual operational cost**

Assuming the above mentioned number of 100 Nodes interconnected with C.I.S.E., and assuming that on average such Nodes are connected to not more than 5 “active” systems in their back-ends, the total annual operational cost of C.I.S.E. can be therefore budgeted at 11.320.000 Euro per year.

### **3 Conclusions**

In this document, the major outcomes from the BMM project experimental demonstration have been presented, in terms of

- (i) *the proposition of the still remaining engineering, prototyping and validation activities to be carried out in synergy at National, Regional and EU level in order to bring all the necessary capabilities to a full-scale engineering stage, ready to the operational implementation*
- (ii) *the derivation of a first-order preliminary model for the evaluation of the bulk cost of operational C.I.S.E. implementation as well as for the associated annual operations and maintenance costs.*

The results, indications and propositions made in this documents are to be intended as working information, subject to further detailing and refinement as the further pre-operational development and validation activities of C.I.S.E. will progress along the established roadmap for C.I.S.E. implementation in Europe. However the BMM project has given the unique opportunity to address all the major enabling issues of the C.I.S.E. implementation on a consensus basis in a wide and representative base of future potential stakeholders.