



**BLUE MED PROJECT DEFINITION PHASE**

**WP2 - FAB Technical Implementation**

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## **D2.3 – Technical Platform Description**

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#### Abstract

Scope of this document is to provide the specification of a Technical Platform able to validate within an ad-hoc exercise/trial part of the Virtual Centre IOP mechanism. The set up of the platform will be performed in order to match the validation objectives and will include all the software developments required in order to achieve the expected validation results.

#### Keywords

BLUE MED, FAB, IOP, OLDI

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# 1 INTRODUCTION

## 1.1 Background

The BLUE MED project is pursuing the implementation of a Functional Airspace Block (FAB) in the South – East Mediterranean Area, in accordance with the requirements of the Single European Sky, to be put in operation within 2012 and with 2015 as target date for full FAB operations.

The BLUE MED FAB study was initiated in 2006 by the Italian Republic with the participation of a Consortium of ANSPs (the Italian ENAV SpA, representing the Italian Republic in the role of project coordinator, the Cypriot DCAC, the Greek HCAA and the Ministry for Infrastructure, Transport and Communications of Malta. The Tunisian OACA and the Egyptian NANSO also participated to the study to evaluate the impact on the interfaces and also their possible future participation to the FAB). Later in the Project, the Republic of Albania joined the Project as Associated Partner and the Hashemite Kingdom of Jordan as Observer.

The BLUE MED FAB project is open to the participation of any other interested regional state for which operational benefits exists; also, close integration with other neighbouring FAB initiatives has been actively pursued and will be fostered in the following phases of the project.

To this respect, it is important to notice that the BLUE MED Definition Phase is focused not only on the strict ACC borders of the participating states, but targeted capturing the operational requirements on a regional basis, under the assumption that FABs shall be independent from national border and adapt to operational needs; to this purposes, all operational studies were performed on the BLUE MED FAB interaction area.

The document complies with the applicable SES regulatory requirements.

## 1.2 Scope of this document

Scope of this document is to describe the technical platform for the WP2 technical exercise foreseen within the BLUE MED Project Definition Phase. This platform will be able to test one of the main concepts at the basis of the “Virtual Centre” as it is described below, and will be able to show capabilities of an advanced IOP feature candidate for overall BLUE MED implementation.

In order to ensure the success of the interoperability deployment for the FAB, these improvements shall be achievable and based on the national development plans of the involved ANSPs integrated in a regional implementation plan agreed by all. At the same time, the system improvements identified are considered sufficient to satisfy the requirements produced by the Operational Analysis of WP1 aiming at achieving FAB-wide seamless operations by implementing the FAB Virtual Centre.

In order to provide a clear and readable description of the technical platform to deploy the Virtual Centre of the FAB, the document has been structured in the following parts:

- Chapter 1** Providing a synopsis of the overall document;
- Chapter 2** Describing the context on which this document rely its fundamental concepts;
- Chapter 3** Describing the level of interoperability reachable in 2012 in the BLUE MED FAB;
- Chapter 4** Describing the technical platform on which the Virtual Centre of the FAB 2012 will be deployed;
- Annex 1** Describing the specifications of the technical platform on which the verification exercise is executed.



## 1.3 Acronyms & definitions

### 1.3.1 Acronyms

Acronym	Definition
ANSP	Air Navigation Service Provider
ASTERIX	All Purpose STructured EUROCONTROL SuRveillance Information EXchange
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Service
ATSU	Air Traffic Service Unit
BM	BLUE MED FAB
BMP	The BLUE MED Partners
BM-SSIR	BLUE MED - Single Sky Implementation Roadmap
CNS	Communication Navigation & Surveillance
CWP	Controller Working Position
DCAC	Department of Civil Aviation of Cyprus – Cypriot ANSP
DGCA	Directorate General of Civil Aviation of Albania – Albanian ANSP
EATMP	European Air Traffic Management Project
EC	European Commission
ENAV	Società Nazionale per l'Assistenza Al Volo – Italian ANSP
ESCAPE	EUROCONTROL Simulation Capability and Platform for Experimentation
ESSIP	European Single Sky Implementation Plan
FAB	Functional Airspace Block
FDD	Flight Data Domain
FDP	Flight Data Processor
FDPS	Flight Data Processing System
FDU	Flight Data User
FO	Flight Object
FOC	Flight Object Client
FOIPS	Flight Object Interoperability Proposed Standard
FOP	Flight Objects Provider
FOS	Flight Object Server
HCAA	Hellenic Civil Aviation Authority – Greek ANSP
HMI	Human Machine Interface



ICOG	Interoperability Consultancy Group
IOP	Interoperability
LSSIP	Local Single Sky Implementation Plan
MATS	Malta Air Traffic Services – Maltese ANSP
MITC	Ministry for Infrastructure, Transport and Communications of Malta
NANSC	National Air Navigation Services Company – Egyptian ANSP
NSA	National Safety Agency
OACA	Office de L'Aviation Civile et des Aéroports - Tunisian ANSP
OLDI	On-Line Data Interchange
R&D	Research and Development
RTS	Real Time Simulation
SDD	Surveillance Data Domain
SES	Single European Sky
SESAR	Single European Sky ATM Research
SWIM	System Wide Information Management
TEN-T	Trans European Network – Transport
WP	Work Package

Table 1 – Acronyms



### 1.3.2 Definitions

Term	Definition
Asterix	The acronym ASTERIX, standing for All Purpose STructured Eurocontrol Radar Information EXchange, devised by the Study Group on the exchange of surveillance related data between processors of ATC systems. This group was a subgroup of the former Radar Systems Specialist Panel (RSSP), whose responsibilities have been taken over by the Surveillance Team (SURT) as from April 1994. ASTERIX was approved by the former RSSP at their 15th Meeting held on 1/4 July 1986. The ASTERIX standard is now under the responsibility of the Surveillance Task Force for Radar Data Exchange (STFRDE). The expansion of the application domains of ASTERIX led to a modification of the significance of the acronym ASTERIX, now standing for All Purpose STructured Eurocontrol SuRveillance Information EXchange.
Flight Object	The system view of a flight shared between IOP stakeholders in a given IOP area. This view is the global view of a flight in an area that may comprise several AOR's.
Implementation	This term is used to identify an ATC item which is in operations, assuming that phases as test, integration, validation and verification are completed.
Interoperability	The Interoperability is the ability of two or more (different) ATM Systems to interoperate exchanging information and using such information in the same way, providing the same level of Quality of Service (Qos).

Table 2 – Definitions



## 1.4 Applicable and referenced documents

This section provides the list of documents which are applicable, as EC-Regulations or Interface specification or used as a reference in this document.

### 1.4.1 Applicable documents

- [1] Interoperability of the European Air Traffic Management Network (EATMN) EUROPEAN REGULATION (EC) No 552/2004  
(<http://www.eurocontrol.int/ses/gallery/content/public/docs/pdf/ses/eudocuments/interoperability.pdf>)  
Version : 10/03/2004
- [2] Commission Regulation (EC) N° 262/2009 of 30 March 2009 laying down requirements for the coordinated allocation and use of Mode S interrogator codes for the single European sky
- [3] Commission Regulation (EC) N° 30/2009 of 16 January 2009 amending Regulation (EC) N° 1032/2006 as far as the requirements for automatic systems for the exchange of flight data supporting data link services are concerned
- [4] Commission Regulation (EC) N° 29/2009 of 16 January 2009 laying down requirements on data link services for the single European sky
- [5] Commission Regulation (EC) N° 1265/2007 of 26 October 2007 laying down requirements on air-ground voice channel spacing for the single European sky
- [6] Commission Regulation (EC) N° 633/2007 of 7 June 2007 laying down requirements for the application of a flight message transfer protocol used for the purpose of notification, coordination and transfer of flights between air traffic control units
- [7] 2010-2014 European Single Sky Implementation Plan (ESSIP)  
ESSIP 2010-2014 Detailed Objectives Descriptions DOD -  
([http://www.eurocontrol.int/essip/gallery/content/public/DOD\\_2010\\_2014.pdf](http://www.eurocontrol.int/essip/gallery/content/public/DOD_2010_2014.pdf))  
Version : 2009
- [8] 2011-2015 European Single Sky Implementation Plan (ESSIP)  
ESSIP 2011-2015 Detailed Objectives Descriptions DOD –  
(<http://www.eurocontrol.int/essip/gallery/content/public/2011-15DOD.pdf>)  
Version : 2010
- [9] European ATM Master Plan  
(<https://www.atmmasterplan.eu>)  
Version : 1.0 30 March 2009
- [10] OLDI – On Line Data Interchange specifications v.2.3  
EUROCONTROL - DPS.ET1.ST06-STD-01-01  
Edition 2.3, date December 2001
- [11] OLDI – On Line Data Interchange specifications v.4.1  
EUROCONTROL - SPEC-0106  
Edition 4.1, date 16/01/2008



- [12] Flight Object Interoperability Proposed Standard (FOIPS)  
EUROCONTROL  
([http://www.eurocontrol.int/aim/public/standard\\_page/foips.html](http://www.eurocontrol.int/aim/public/standard_page/foips.html))
- [13] Interoperability Consultancy Group for the IOP Interface Specification (ICOG)  
Cooperation between iTEC-eFDP and Coflight-eFDP projects  
([http://www.eurocontrol.int/aim/public/standard\\_page/foips.html](http://www.eurocontrol.int/aim/public/standard_page/foips.html) )
- [14] Flight Object Interoperability specifications  
EUROCAE – ED133  
June, 2009
- [15] Air Traffic Control System – System Supported Co-Ordination – SYSCO  
Concept and Functional Description  
EUROCONTROL - DPS.ET1.ST06.7000-OCD-01-00  
Edition 1.1 - 15 January 1997

#### **1.4.2 Referenced documents**

- [16] BLUE MED phase 1- Feasibility Study – Final Report  
Version : 2.0 24/06/2008
- [17] BLUE MED phase 1- Mediterranean FAB Operational Analysis  
Version : 1.0 21/02/2008
- [18] BLUE MED Project Definition phase – D2.1a – BLUE MED FAB Early Technical implementation and Quick Wins  
Version : 2.0 30/07/2010
- [19] BLUE MED Project Definition phase – D2.1b - Technical Analysis of Operational Requirements  
Version : 1.2 02/05/2010
- [20] BLUE MED Project Definition phase – D2.2 – Interoperability Definition and System Design Report  
Version : 2.0 05/04/2010



## 2 PRELIMINARY OVERVIEW

FAB technical activities are strongly increasing in importance, since the technical part of the overall European ATM fragmentation is addressed as candidate for short-medium term harmonisation. FAB technical activities are evidently overlapping SESAR and its expected timeframes, since most of the technical plans that each FAB shall develop are going to not only tackle the short-term harmonisation, but also are going to phase and coordinate implementation plans dealing with the medium-longer term.

SESAR is just starting and nowadays we have additional technical elements from SESAR and results from some European projects in the direction of SESAR ( i.e. SWIM-SUIT). BLUE MED should of course make best use of these results and has to be fully aligned with initial provisions and milestones of SESAR. Additionally, target of the BLUE MED Member States is to perform a trial addressing legacy systems foreseen for the short term up to a mature FAB framework (2015), and not a stand-alone validation activity with no link either to SESAR and to local legacy systems.

To this respect, the exercise to be constructed under this specifications aims at verifying part of the virtual centre concept (as it is described below) allowing all 2012-2015 BLUE MED local legacy systems and BLUE MED next generation systems to share a seamless set of information.

### 2.1 The BLUE MED Virtual Centre

The BLUE MED FAB interoperability approach is based on the concept of “Virtual Centre”, defined as a group of ACC remotely located, but interconnected and with the capabilities to operate as a single ATM centre.

The level of interoperability enabled by the Virtual Centre will provide any controller in the BLUE MED FAB with uniformly replicated information and functionalities in respect of flights (track information, tools, coordination means, etc...).

This will provide a comparable level of operations between sectors, allowing remotely located ATCOs to share the same picture of the cross-border traffic, exploit harmonised ATC tools and Safety Nets while applying an enhanced set of operational procedures. This will allow the provision of seamless and uniform services at FAB scale and the management of possible contingencies.

Different implementation scenarios have been identified within WP2 for the Virtual Centre, , starting from the existing national strategies for implementation towards more challenging solutions.

The BLUE MED “Virtual Centre” will be a federation of ATM systems, each of them:

- responsible for the ATS provision of a part of the BLUE MED Area designed according to the network and airspace optimisation (e.g. not taking into account national boundaries) agreed and
- interoperable with the other in order to guarantee seamless operations.

Each system will be composed of several subsystems:

- Flight Data Processing
- Surveillance Data Processing
- Correlation
- Controller Workstation
- Safety Nets
- ATC tools (Conflict Tools, Sequencing Tools)
- Ground-Ground IOP
- Operational and Technical Supervision



- Flight Data Operator Workstation
- Supporting Functions (e.g. Recording, Playback)

The interoperability with the CFMU will rely on additional subsystems to perform Traffic Demand and Capacity balancing.

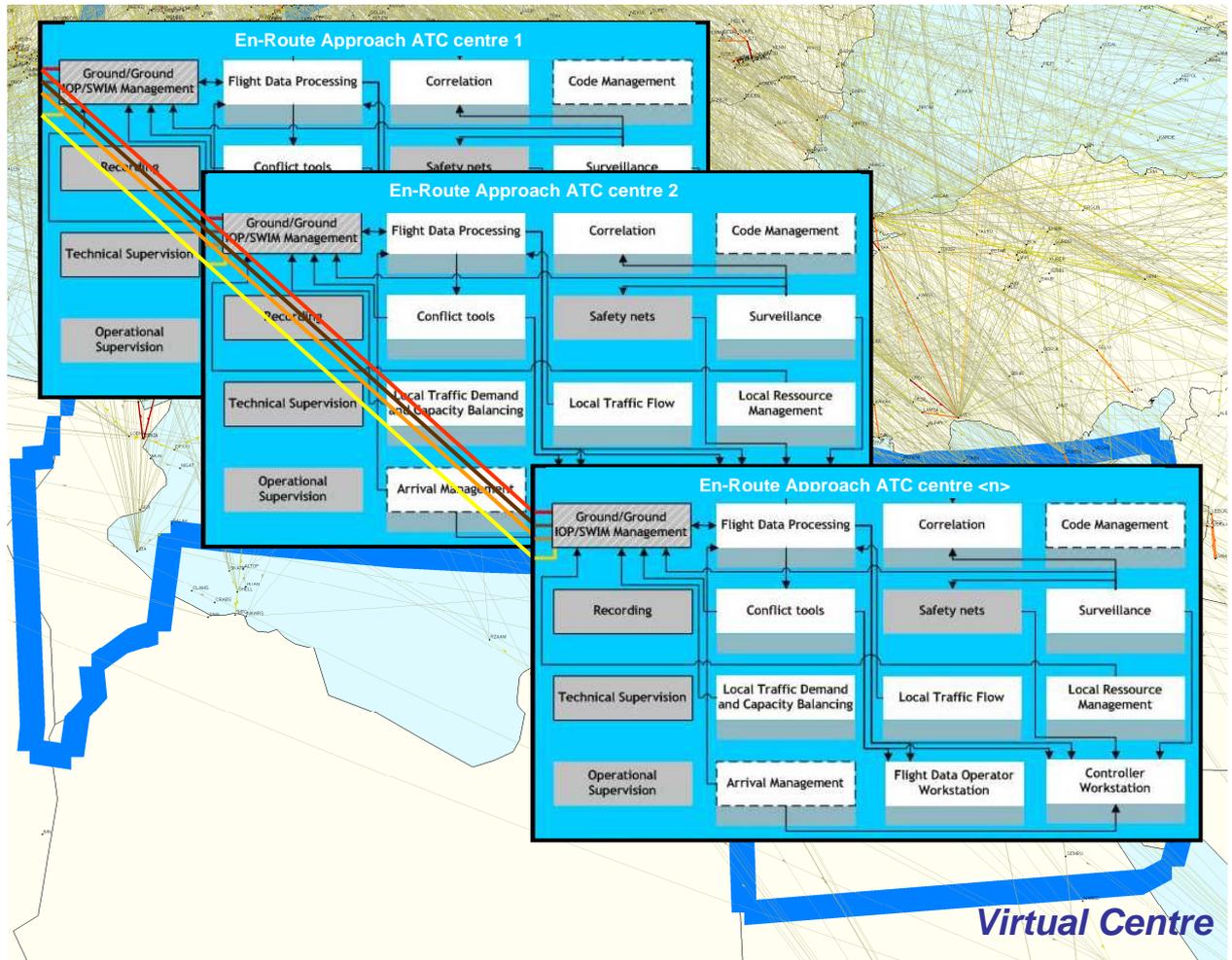


Figure 1: The BLUE MED FAB Virtual Centre concept

The real benefits of the Virtual Centre implementation will derive from the improvements of the ATSU-ATSU interoperability, allowing the implementation of standards and the interoperability with other stakeholders (e.g. CFMU, Aircraft and Airport Operators, other external FAB ATSUs).

Communication, Navigation and Surveillance infrastructures will support the ATM Systems in their operation.

The ATM System will require a certain level of quality for ground-ground data and voice communications. Point to point solutions or IP network based ones guarantee in different ways an infrastructure for supporting the needed data exchange among the different parts of the Virtual Centre.

Air situation picture will be built by means of the network of sensors (surveillance infrastructure) available or to be installed in the FAB. Each ATM system will rely on surveillance data coming from sensors independently from the national boundary: sharing of sensors or distribution of surveillance data processing capabilities (e.g. ARTAS).



## 2.2 Interoperability overview

The Interoperability (IOP) is the ability of two or more (and different) ATM Systems to interoperate exchanging information and using such information in the same way. More in detail, the Interoperability consists in an exhaustive exchange of data with the partners in order to guarantee:

- Information sharing (ATS, AIS, OPS and MET);
- Common understanding of information;
- Comparable processing performances;
- Common operational performances;
- Common Safety level achievement.

The main goal of the interoperability is to improve consistency of Flight Data available to stakeholder systems, thereby improving operational efficiency and safety.

When the FAB Full-IOP is completely in force, the following stakeholders will benefit from IOP:

- Aircraft Operators: improved capacity will bring reduced delays and shorter routes,
- Airports: better information about incoming flights permits better use of airside and landside resources,
- Air Defence: more consistent and up-to-date information on aircraft intentions,
- ATC and ATFM: better information on current and future flights permits better planning of resources,
- Supplier Industry: standards based on modern technology permits cost reductions and lower risk.

### 2.2.1 The European Interoperability Regulation

The objective of the 552 Regulation (552/04 of 10 March 2004) [3] is to achieve interoperability between the different systems, constituents and associated procedures of the European Air Traffic Management Network (EATMN), taking due account of the relevant international rules. This Regulation aims also at ensuring the coordinated and rapid introduction of new agreed and validated concepts of operations or technology in air traffic management.

In order to create the Single European Sky, measures should be adopted in relation to systems, constituents and associated procedures with the objective of ensuring the interoperability of the European air traffic management network (EATMN) consistent with the provision of air navigation services.

### 2.2.2 Technical enablers for interoperability

#### 2.2.2.1 On Line Data Interchange – OLDI

Today the major enabler for interoperability among ATM Systems is the On-Line Data Interchange system (OLDI) deployed onto a dedicated network. The OLDI is a standard defined by EUROCONTROL in 1992 based on the exchange of messages between ATC units, with the aim of handling flights which are being provided with an ATC service to be transferred from one ATC unit to the next one in a manner designed to ensure complete safety.

In order to accomplish this objective, OLDI provides a standard procedure that the passage of each flight across the boundary of the areas of responsibility of the two units is co-ordinated between them beforehand and that the control of the flight is transferred when it is at, or adjacent to, the said boundary.

Where it is carried out by telephone, the passing of data on individual flights as part of the coordination process is a major support task at ATC units, particularly at Area Control Centres ACCs. The operational use of connections between Flight Data Processing Systems (FDPs) at ACCs for the purpose of replacing such



verbal "estimates", referred to as On-Line Data Interchange (OLDI), began within Europe in the early nineteen eighties.

In order to facilitate implementation, common rules and message formats were elaborated and agreed by the agencies concerned and incorporated in Edition 4.1 of the EUROCONTROL Standard for On-Line Data Interchange [11]; this document has been produced to meet the requirements of EATM and to incorporate feedback received as a result of the implementation of earlier versions.

The implementation and operational use of the notification, co-ordination and transfer processes are prescribed in EUROCONTROL or Community regulatory material (i.e. European Commission implementing rules) depending on the area of applicability of these processes. A relevant example for OLDI is the European Commission Regulation 1032/2006 laying down requirements for automatic systems for the exchange of flight data for the purpose of notification, co-ordination and transfer of flights between Air Traffic Control Units.

If OLDI messages are implemented as the result of regulatory provisions, or based on bilateral agreement between Air Traffic Control Units, then the requirements outlined as mandatory in this specification for those messages become mandatory for implementation. This is required in order to meet the purpose of the messages and to ensure interoperability between systems.

#### 2.2.2.2 System-Wide Information Management (SWIM)

In the framework of the SESAR activities, (the SESAR programme is the European Air Traffic Management modernisation programme), SWIM has been identified as the essential enabler for future ATM applications, providing relevant up-to-date information to all parties involved.

The System-Wide Information Management (SWIM) can be defined as the vehicle to promote the development and implementation of such mechanisms at the legal, institutional, business, organisational, operational and technical levels.

SWIM is a 'horizontal' support process whose aim it is to establish the concepts and mechanisms which combine the forces of all suppliers of shared ATM information so as to assemble the best possible integrated picture of the past, present and (planned) future state of the ATM situation, as a basis for improved decision making by all ATM stakeholders during their strategic, pre-tactical and tactical planning processes, including real-time operations and post-flight activities.

In late 2004 EUROCONTROL launched the "Flight Object Interoperability Proposed Standard (FOIPS)" study with EUROCAE as lead contractor to define a UML model for the Flight Object.

The only architectural assumption made at the beginning of the FOIPS study was that the Flight Object concept would be supported by a network of "Flight Object Servers (FOS)", and hence the FOIPS study was tasked with defining two interfaces: the interface between a FOS and its clients, and the interface between different instances of a FOS.

The FOIPS model defines the Flight Object. It is composed of two complementary models: an 'analysis model' and a 'usability model'. The analysis model is a UML model of the flight object, defining a standard set of services that it must provide. The usability model defines a set of access rights that determine under what conditions each stakeholder can invoke the services defined in the analysis model.

The usability model also identifies a set of "distribution clusters" defining the sub-components of the Flight Object that will be distributed and under what conditions the distribution will be performed. Following the FOIPS delivery, ICOG developed a detailed interface definition based on the FOIPS and the updated ICOG model.

The exposed solution for ATC-to-ATC interoperability will constitute in the near future an interoperable network of Flight Object Servers across the entire European airspace, which will be used by the ATC systems to share its flight view via those Flight Objects.



The main benefit of this solution for the ATC systems is the knowledge in real time of any data affecting the flights that are or will be of interest in the medium term. Since real flight data are known by the ATC system long time before they enter in its Aol (Area of Interest), the interoperable ATC system will be able to provide information widely in advance to its decision support tools, such as Medium Term Conflict Detection or Arrival Managers.

It is important to highlight that this architecture does not only provide a method for exchanging information, but defines a real collaborative process for handling the flight data in advance. The resulting EUROCAE document “ED-133 Flight Object Interoperability Specification” [14] defines the interface between different instances of civilian ATC Flight Data Processing Systems (FDPS), in support of En-route and Terminal ATC Operations, and is available from EUROCAE since September 2009.

The implemented improvement is supposed to generate benefits in the following areas:

- Flight efficiency, thanks to the more flexible cross-border trajectories enabled by silent coordination capabilities;
- Capacity, reducing ATCOs and pilots workload for remote coordination;
- Safety, by providing system assisted transmission of Flight Object data between ACCs;
- Environmental sustainability, as a result of the improved flight efficiency;
- Human resources, by improving the ATCOs operational environment.

Interoperability is major challenge of the SESAR program. ICOG ([13]) paved in the years 2005-2008 the way and the outcomes have been endorsed as an IOP standard by EUROCAE WG59 end of 2008, the EUROCAE Specifications ED-133 version 1.0 ([14]).

The plan nowadays is to validate such standard with pre-operational validation performed in the context of SESAR and then to produce a standard amended with the outcomes of the validation. To this respect, the SESAR WP 10.2.5 is in charge of the building of 3 FDP platforms and to verify the ED-133 elementary requirements while the WP 3.4 is, in particular, in charge of the pre-operational validation of the IOP concept.

## 2.3 Seamless operations

The European Regulation 552/04 lays down requirements for flight data processing systems to interoperate in terms of the timely sharing of correct and consistent information, and a common operational understanding of that information, in order to ensure a coherent and consistent planning process and resource-efficient tactical coordination throughout the EATMN during all phases of flight.

In order to ensure safe, smooth and expeditious processing throughout the EATMN, flight data processing performances shall be equivalent and appropriate for a given environment (surface, terminal manoeuvring area (TMA), en-route), with known traffic characteristics and exploited under an agreed and validated operational concept, in particular in terms of accuracy and error tolerance of processing results.

Moreover, human-machine interfaces of ground air traffic management systems shall be designed, built, maintained and operated using the appropriate and validated procedures, in such a way as to offer to all control staff a progressively harmonised working environment, including functions and ergonomics, meeting the required performance for a given environment (surface, TMA, en-route), with known traffic characteristics.

### 2.3.1 System Supported Co-ordination - SYSCO

The OLDI will be the mid-term enabler for the deployment for SYSCO Level 1 capabilities throughout the BLUE MED FAB, starting from the enhancement of capability related to the seamless operations for coordination and transfer of control of flights at cross border.

The SYSCO specifications ([15]) define up to 4 level of implementation of operational concepts: those are hereafter summarized.



The pre-SYSCO (OLDI) level, as defined in the EUROCONTROL OLDI Standard, provides basic automation for the co-ordination process, thereby substantially decreasing controller workload. The pre-SYSCO (OLDI) level provides the capability to electronically forward coordination data, in the form of flight plan data and transfer conditions. All data transmissions are confirmed as having arrived at the appropriate operational point, and data is usually automatically generated and transmitted based on predefined, bilaterally agreed parameters.

The pre-SYSCO (OLDI) level consists of 'single pass' data transmission (i.e. no dialogue facility), has limited facilities for system-supported controller intervention, and does not provide full support information to controllers and support systems.

To achieve this level, ATC units must implement the following functionalities:

- **Co-ordination input devices**, required for input and modification of data for transmission
- **Basic display**, required for review of received data and associated warnings
- **Basic flight plan processing**, required for storage, manipulation, and automatic generation of data for transmission and display
- **Message exchange facility**, required for transmission and receipt of at least the mandatory OLDI messages

SYSCO level 1 provides an intermediate level of automated co-ordination and transfer, with the objective of introducing significant operational and technical aspects of the full SYSCO concept and providing further enhancements to airspace usage and reductions in controller workload. This level is the identified starting point for the BLUE MED FAB overall interoperability capabilities, since is guaranteeing the required level of seamless operations for the FAB.

SYSCO level 1 introduces the dialogue, filter, and other system facilities pre-requisite to level 2. Level 1 is more sophisticated than the pre-SYSCO (OLDI) level in that it provides much greater capability for system-supported controller intervention, thereby further reducing verbal co-ordination, and lays the technical foundation for more complete automated support through incorporation of the filter facility. It is less sophisticated than level 2, in that it does not provide full support information to controllers and their systems. This disadvantage will continue to have a negative effect on controller workload and airspace usage.

To achieve level 1, ATC units must implement the following SYSCO functionalities:

- **All minimum functionality for the pre-SYSCO (OLDI) level;**
- **Basic surveillance**, required to support the dialogue facility. Surveillance data must be available to provide systems with the aircraft positional information which is required for at least decisions on dialogue type (i.e. restricted versus automatic modification processes), and for dialogue time-outs (i.e. when a process must be terminated due to aircraft proximity to the transfer point);
- **Dialogue facility**, required to decrease the remaining cases of verbal co-ordination and transfer, to allow system-supported controller intervention and to introduce an essential part of the full SYSCO concept. The dialogue facility may be initiated by either partner;
- **Filtering facility**, the decision-making algorithm required to support the dialogue facility and to introduce a basic step towards the full SYSCO concept. Introduction of the filtering facility may be gradual;
- **Basic trajectory prediction**, required to support the dialogue facility (i.e. at least dialogue time-outs);
- **Transfer functions**, required to introduce a basic step towards the full SYSCO concepts.

SYSCO Level 2 provides full SYSCO automation, with major enhancements to airspace usage and reductions in controller workload.



SYSCO Level 2 is more sophisticated than level 1, in that it provides full capability for system-supported controller intervention, thereby reducing verbal co-ordination to a minimum. It also provides full support information to controllers and their systems, substantially reducing workload and enabling more efficient use of available airspace.

To achieve level 2, ATC units must implement the following SYSCO functionalities:

- **All minimum functionalities for SYSCO level 1;**
- **High-definition, interactive display and input devices** : required to support the ACI<sup>1</sup> facility and to make full use of the environmental data processing, advanced surveillance and flight plan data processing, and conflict detection functions;
- **Common database updates** : required to support the ACI facility and the conflict detection function;
- **Environmental data processing**: required to support the ACI facility and the conflict detection function;
- **Advanced surveillance and flight plan data processing**: required to support the ACI facility and the conflict detection function;
- **Advanced trajectory prediction**: required to support the dialogue facility (i.e. at least dialogue time-outs).
- **ACI facility**: required as an essential element of the full SYSCO concept;
- **Conflict detection**: required to support the ACI facility thereby further expanding the capabilities of the filtering facility.
- **System Forced Transfer function**: required to support the ACI facility.

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<sup>1</sup> ACI, Area of Common Interest.



## 3 THE BLUE MED FAB INTEROPERABILITY

### 3.1 Introduction

In the framework of the activities of the Work Package 2 for the technical implementation of the FAB, it was identified the lack of mature SESAR oriented IOP solutions to be considered by the BLUE MED Partnership. In this respect, within WP2 it has been defined that the implementation of the Virtual Centre of the BLUE MED FAB at 2012 shall start from the regional exchange of a set of OLDI messages (§2.2.2.1) to improve inter-centres coordination capabilities and the sharing of relevant information to all traffic operating within the region.

Afterwards, as soon as SESAR will deliver an updated standard by 2015, such requirements may be taken into consideration for the evolution of the IOP platform for the Virtual Centre and ATM Systems composing the FAB shall start a migration towards the SESAR IOP requirements accordingly.

For such reasons, the activities described in this document and in its final report (D2.4 – Validation Report) aim at the verification of the solution identified for the establishment of the Virtual Centre of the BLUE MED FAB of 2012 based on an enhanced interoperability over the OLDI network.

### 3.2 The BLUE MED FAB Scenario of 2012

#### 3.2.1 Description

For what concerns the Communication domain, apart the migration to new protocols (FMTP, IPv6), the definition and the implementation of a common baseline of OLDI messages will improve the flights notification, coordination and transfer of control capabilities. This will be a fundamental stepping-stone toward a higher level of interoperability and integration of distributed ATM Systems, providing at the same time benefits such as:

- Reduction of ATCOs workload;
- Enhancement of inter-ATSUs notification and coordination;
- Consistency of flight data distributed over the FAB and towards adjacent FABs or ATSUs.

The Surveillance service throughout the FAB will be improved by a massive turn to the radar data sharing in order to enhance the coverage capability at cross border, achieving benefits in capacity and accommodating operational requirements such as the achievement of a separation minima and the aircrafts' separation at transfer of radar control. The legacy RDPS will be compliant to a standard interface to ease the exchange of radar data with a counterpart.

Moreover, a migration will start toward advanced surveillance technologies as the Mode-S and the ADS-B, providing benefits in the aircrafts identification and more accuracy related to the surveillance capability.

Finally, the harmonisation of the deployment of the existing Network and of the Navigation infrastructure accordingly, will accommodate new concepts of operations, reducing route lengths and separation minima across borders with a direct advantage in terms of cost and environment impact.

At ATM System level, the identified components necessary for the interoperability (FDPS, GGDC\_OLDI, FPDS and CODM) will evolve according to the deployment of the abovementioned capabilities (see D2.2 [20]).



### 3.2.2 *Technical improvements*

By the 2012, the following technical enablers and procedures are expected to be implemented and available throughout the BLUE MED FAB (see [18] and [20]):

- Migration of ground international or regional X.25 data networks or services to the Internet Protocol (IP);
- Application of a common flight message transfer protocol (FMTP/IPv6);
- Implementation of Mode-S Elementary Surveillance (ELS);
- Improvements of OLDI message exchanges;
- Harmonization of Surveillance Data Processing Systems (at interface level, i.e. ASTERIX);
- Cross/Border improvements based on radar data sharing;
- Implementation of collaborative flight planning;
- Implementation of the connection to the European Aeronautical Information Services (AIS) Database;
- Improvement of ground-based surveillance using ADS-B in Non Radar Airspace (NRA);
- Implementation of Advanced Surface Movement Guidance and Control System (A-SMGCS) Level I;
- Implementation of airport Collaborative Decision Making (CDM);
- Implementation of Airport Airside Capacity Planning Method;
- Implementation of ground based safety nets - Short Term Conflict Alert (STCA) - level 2;
- Migration from AFTN/CIDIN to AMHS for international communications;
- Implementation of enhanced tactical flow management services;
- Implementation of Precision Area Navigation RNAV (P-RNAV);
- Implementation of airside capacity enhancement method and best practices based on EUROCONTROL capacity and efficiency implementation manual;
- Harmonisation of Operational Air Traffic (OAT) and General Air Traffic (GAT) handling;
- Implementation of ATS Route Network (ARN) - Version 6;
- Improvement of runway safety by preventing runway incursions;
- Implementation of integrated briefing.



### 3.2.3 Functional improvements

Starting from the Operational need identified by the Operational Package WP1 and analyzed by the Technical Package WP2 in the BLUEMED Project Definition phase ([19]), the ATM Systems composing the Virtual Centre of the FAB need a first step of harmonisation towards the OLDI standard 2.3 ([10]), and a basic set of messages has been identified:

- The basic messages **ABI**, **ACT** and **LAM** are nowadays everywhere available (but Cyprus, which will be automatically compliant with the new ATM system expected in operations by end of 2011), while **TIM**, **ROF**, **COF** and **MAS** are to be implemented;

The abovementioned implementations, together with the ones described in §3.2.2, define that the interoperability scenario for the Virtual Centre of the BLUE MED FAB at 2012 will be based on a enhanced cooperation over the OLDI network (§2.2.2.1) by the use of additional messages.

All necessary links between actions performed by the ATCOs and OLDI messages sent to adjacent ATC centres shall also be provided. These improvements shall provide ATCOs with functionalities defined by the pre-SYSCO (OLDI) Level and with some concepts from the SYSCO Level1 (§2.3.1), such as:

- **Co-ordination input devices**, required for input and modification of data for transmission
- **Basic display**, required for review of received data and associated warnings
- **Basic flight plan processing**, required for storage, manipulation, and automatic generation of data for transmission and display
- **Message exchange facility**, required for transmission and receipt of at least the mandatory OLDI messages
- **Dialogue facility**, required to decrease the remaining cases of verbal co-ordination and transfer, to allow system-supported controller intervention and to introduce an essential part of the full SYSCO concept. The dialogue facility may be initiated by either partner;
- **Transfer functions**, required to introduce a basic step towards the full SYSCO concepts.

The expected benefits for improving the set of OLDI messages identified are:

- 1) Reduction of the ATCOs' workload, enhancing the inter-ACCs coordination;
- 2) Reduction of phone coordination;
- 3) Reduction of potential errors;
- 4) Potential benefit for the achievement of ATM capacity improvements.

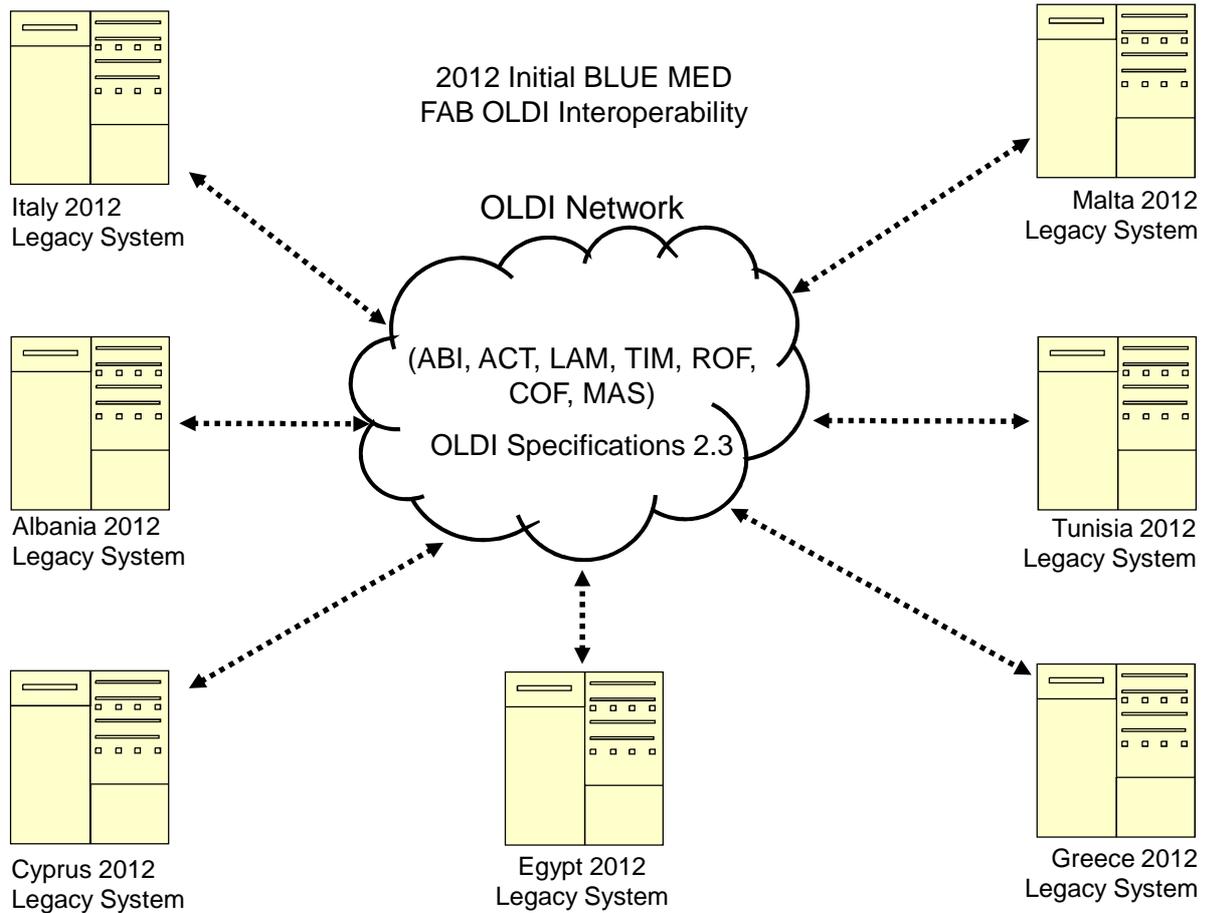


Figure 2: The BLUE MED Virtual Centre of 2012



### 3.2.3.1 Selected OLDI messages

These OLDI messages, which are hereafter detailed, aim to accommodate the harmonization of traffic flow and procedures in the upper airspace with improvements of notification, coordination and handover capabilities at cross-border.

#### 3.2.3.1.1 The ABI (Advance Boundary Information) message

The implementation of the Advance Boundary Information (**ABI**) notification message will satisfy the following operational requirements:

- Provision of missing flight plan data;
- Provision of advance boundary information and revisions thereto for the next ATC unit;
- Update the basic flight plan data;
- Facilitate early correlation of radar tracks;
- Facilitate accurate short-term sector load assessment.

#### 3.2.3.1.2 The ACT (Activate) message

The implementation of the Activate (**ACT**) message will satisfy the following operational requirements:

- Replacement of the verbal boundary estimate by transmitting automatically details of a flight from one ATC unit to the next prior to the transfer of control;
- Update the basic flight plan data in the receiving ATC unit with the most recent information;
- Facilitate distribution and display of flight plan data within the receiving ATC unit to the working positions involved;
- Expedite display of callsign/code correlation in the receiving ATC unit;
- Provision of transfer conditions to the receiving ATC unit.

#### 3.2.3.1.3 The LAM (Logical Acknowledgement) message

The implementation of the Logical Acknowledgement (**LAM**) message

- To warn the ATC staff of the transferring unit, when no acknowledgement has been received,
- To indicate the ATC staff of the transferring unit, that a message being acknowledged has been received, processed successfully, found free of errors, stored and, where relevant, is available for presentation to the appropriate working position(s).

The LAM is the means by which the receipt and safeguarding of a transmitted message is indicated to the sending unit by the receiving unit.



#### 3.2.3.1.4 *The Transfer Initiation (TIM) message*

The implementation of the Transfer Initiation (**TIM**) message will satisfy the following operational requirements:

- To signify the Transfer Initiation (TI) event (the end of the co-ordination phase and the start of the transfer phase);
- To forward executive control data from the transferring to the accepting unit.

#### 3.2.3.1.5 *The Request on Frequency (ROF) message*

The ROF is sent by the accepting unit to the transferring unit, when required, requesting the transferring controller to instruct the aircraft to change to the frequency of the accepting controller.

The implementation of the Request on Frequency (**ROF**) message will satisfy the following operational requirements:

- To signify the acceptance of the flight under the proposed conditions;
- To request an early transfer of the flight.

#### 3.2.3.1.6 *The Change of Frequency (COF) message*

A COF message is sent from the transferring unit to the accepting one, to indicate that the flight has been instructed to contact the accepting controller.

The message may include the facility for the transferring controller to release the flight from the agreed transfer conditions when it has established radio communication with the accepting controller.

#### 3.2.3.1.7 *The Manual Assumption of Communications (MAS) message*

The MAS is sent by the accepting unit to the transferring unit indicating that two-way radio contact has been established with the flight.

### 3.2.3.2 Impact on legacy ATM Systems

The OLDI improvements shall affect at least the Flight Data Process Server and the Human Machine Interfaces (HMI-CWP) components/functions of the existing Legacies.

The next figure depicts the flow of OLDI message (e.g. MAS and COF messages) across the FDP Systems:

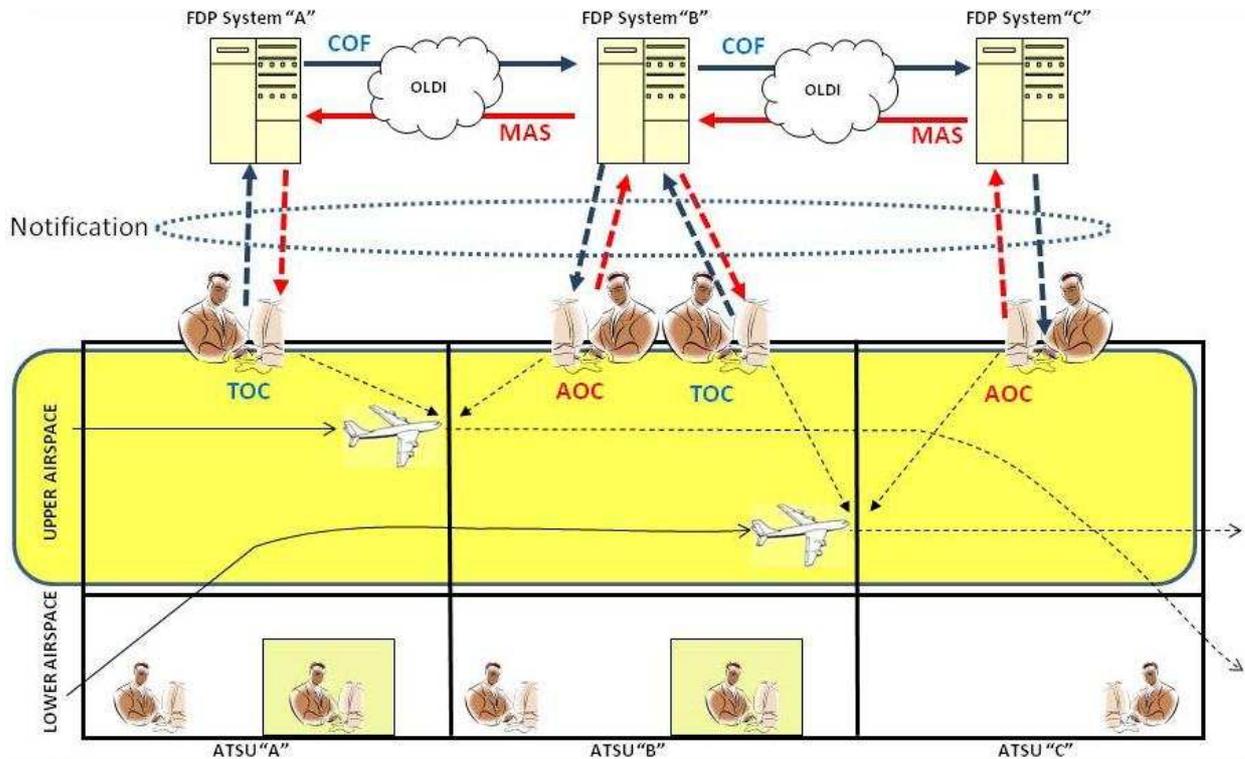


Figure 3: OLDI Messages flow

A “notification layer” usually provides a link between actions performed by the ATCO’ on the HMI and the OLDI message to be sent by the FDPS, in particular:

- The “notification layer” of the transferring unit shall notify the FDPS when the ATCO manually starts the Transfer of Control (TOC) of the flight. In this case the FDPS will physically sent the COF message to the downstream ATSU over the OLDI network;
- The “notification layer” of the accepting shall notify the ATCO about the reception of a COF OLDI message from the upstream ATSU.
- The “notification layer” of the accepting shall notify the FDPS when the ATCO manually perform the Assumption of Control (AOC) of the flight. In this case the FDPS will physically sent the MAS message to the upstream ATSU over the OLDI network;
- The “notification layer” of the transferring shall notify the ATCO about the reception of a MAS OLDI message from the upstream ATSU.



## 4 THE BLUE MED FAB TECHNICAL PLATFORM DESCRIPTION

According to the aims of the exercise (§3) and due to the unavailability of legacy experimental/test platforms (that could have been upgraded and interconnected in order to run the OLDI simulation onto a wider scale), the verification of the 2012 scenario will consist in a Real Time Simulation performed on the ESCAPE platform in ENAV Validation centre in Rome.

### 4.1 The OLDI Real Time Simulations

The OLDI RTS will investigate the acceptability of the proposed technical/graphical solutions (HMI, System) and the benefits of the OLDI implementation on cross borders operations within the FAB. A special attention is dedicated to impact and recovery procedures from non-nominal events.

The ESCAPE platform, which is a real-time air traffic control simulator, will be used to perform the OLDI exercise. Clones of legacy HMIs (Greek, Italian and Maltese) are also provided in order to minimize the impact on the ATCOs that will be called to execute the OLDI RTS.

Most relevant feedbacks expected from the OLDI RTS are operational, such as the evaluation by the involved ATCOs:

- of the benefits in having such OLDI messages act transparently according to their normal operations;
- of the graphical solutions (associated to messages) which are implemented over their legacy HMIs;
- of the errors recognition

From a technical point of view, it will be ensured that the application of standards and uniform principles, together with improved technical and operational interoperability of aircraft and ATM Systems enable an improvement of benefits in the following areas:

- **Communications**, assessing the capability of FDP Systems to increase interoperability by easily improving and managing a limited set of additional OLDI messages;
- **Interoperability**, improving Flight Plan data Consistency after and even before departure;
- **Safety**, improving awareness and accuracy of incoming traffic at cross border will lead to an improved advanced conflict detection.

#### 4.1.1 Context of the exercise

The scope of the Real Time Simulation aims to evaluate the messages applied in a OLDI airspace operations within BLUE MED project applied in the FAB area involving cross border sectors of Rome ACC, Brindisi ACC, Malta ACC and Athinai ACC.

The Real Time Simulation has been defined to artificially represent the possible implementation of new working methods, practises and procedure (OLDI airspace operations). It could come up with requirements for coherent deployment with a change management process to ensure smooth and safe transition to the next generation applied to harmonize the FAB' operations.

As general principle, the RTS covers the implementation of the OLDI concept in the En-Route area operations. This includes the ATC sectors where the operational environment may range from low to high traffic density and complexity.

The most significant impact of the new procedure is expected on the Air Traffic Controllers taking into account that the “simulated world” is not real and is affected by a certain degree of approximation.



#### **4.1.2 Simulated Airspace**

The airspace defined for the OLDI RTS consists in a subset of adjacent sectors of Rome, Brindisi, Malta and Athinai ACC. Due to the dimension of the concerned airspace, as well as the dimension of the available Simulation Platform, it was not possible to include in the simulation all the concerned partners. Furthermore, Cyprus will also take profit of a new ATM System that will ensure full compliance with the messages object of the Simulation.

All of these abovementioned sectors have been selected as a target environment for the OLDI concept in the En-Route area operations in the framework for the BLUE MED project.

#### **4.1.3 HMIs graphical specifications**

The RTS will focus the development on the HMI part of the simulator. The HMI used in the RTS reflects as much as possible that implemented in today's Rome ACC ops room (CDS 2000 OPEN).

The CWP subsystem, containing the HMI component developed in EONS is customised according to the requirements specified in the **Annex 1** for the HMI elements that differs from the CDS 2000 OPEN standard.

#### **4.1.4 The OLDI specifications**

All requirements from the OLDI specification 2.3 [10] concerning to the TIM, MAS, COF and ROF messages are applicable, provided that ABI, ACT and LAM messages are already implemented according to same specifications.

#### **4.1.5 Simulation Analysis**

Data analysis will start at the end of the RTS and will last two months: qualitative and quantitative data collected during the study will be analysed in an integrated way.

At the end of the analysis a report will be produced, (D2.4 – Technical Validation Report) presenting all the results of the RTS related to the simulation objectives defined in this document and in the **Annex 1**. In such report, qualitative and quantitative results will be integrated.



**BLUE MED WP2 - FAB Technical Implementation**  
**D2.3 – Technical Platform Description**



(END OF MAIN DOCUMENT)



## 5 APPENDIX 1 – WP2 CONTRIBUTORS

Organization	Contributor
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## 6 ANNEX 1 – RTS EXPERIMENTAL HANDBOOK AND ANALYSIS PLAN