Final Project Report

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Abstract

Project P10.01.07 is the federating project for the En-route and Approach ATC System domain, whose role is therefore to develop the ER APP ATC System architecture as a tool to assist the coordination between ATC system primary projects in the development of technical specifications, to manage the contribution of the ER APP ATC System architecture to the system-of-systems architecture, to contribute the architecture model to EATMA, and to manage the contribution of ER APP ATC system aspects to the integrated roadmap / master plan.

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Rational for rejection
None.

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00.01.02	14/03/2016	Updated		Re-submitted to SJU after project review and updates
01.00.00	25/04/2016	Final		Final

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This deliverable consists of SJU foreground.

Acronyms

Acronym	Definition
ADD	Architecture Design Document
APP	Approach
ATC	Air Traffic Control
ATM	Air Traffic Management
EATMA	European ATM Architecture
ER	En Route
OI	Operational Improvement
TAD	Technical Architecture Description
WP	Work Package

1 Project Overview

Project P10.01.07 is the federating project of the Enroute and Approach ATC Systems domain and, as such, was responsible for producing the ER APP ATC domain system architecture, managing the definition and planning of ER APP ATC enablers, and contributing to system engineering tasks such as reviewing deliverables and participation in release reviews, all in coordination with the ATC system primary projects and other federating and transverse projects as necessary.

1.1 Project progress and contribution to the Master Plan

The SESAR programme contained a large number of primary projects producing operational and technical requirements and the interaction between the projects was complex; operational requirements produced in separate projects often overlapped, multiple technical primary projects often had to collaborate to produce a prototype, and technical primary projects often “served” multiple operational primary projects. The main purpose of the functional decomposition provided by P10.01.07 was to facilitate the development of complete, consistent and coherent technical specifications by the primary projects for the en-route and TMA domains. On the basis of this functional architecture, project P10.01.07 allocated operational requirements to the functional blocks where it expected the primary projects to develop corresponding technical requirements, and also allocated enablers to the ATC system primary projects, proposing solutions for any potential conflicting scopes. In addition, project P10.01.07 modelled the functional block interactions to better understand each Functional Block scope, and provided sequence diagrams depicting the dynamic functional behaviour of the system, also showing how the system behaviour mapped to operational processes and to enablers.

The functional model produced by P10.01.07 was submitted for inclusion in the system-of-systems architecture documented in the Architecture Design Document (ADD).

The project directly contributed to the creation of the European ATM Architecture (EATMA) model. In doing so, inconsistencies between the ER APP ATC model and the models of other domains were identified and resolved in cooperation with other concerned federating projects.

For the bi-annual update of the Roadmap, project P10.01.07 initially provided advice regarding the update of ER APP ATC master plan enablers. From dataset 10, with the revised Roadmap process, project P10.01.07 was responsible for originating change requests itself and coordinating these with relevant primary projects and other federating projects as necessary.

1.2 Project achievements

The main deliverable of P10.01.7 was the Technical Architecture Description (TAD) of the En route and Approach ATC System, which sat between the Architecture Design Document (ADD) and Technical Specifications as shown in the figure overleaf.

In producing the TAD, P10.01.07 worked top-down from the European ATM Master Plan:

1. Managing the alignment of enablers with primary project activities;

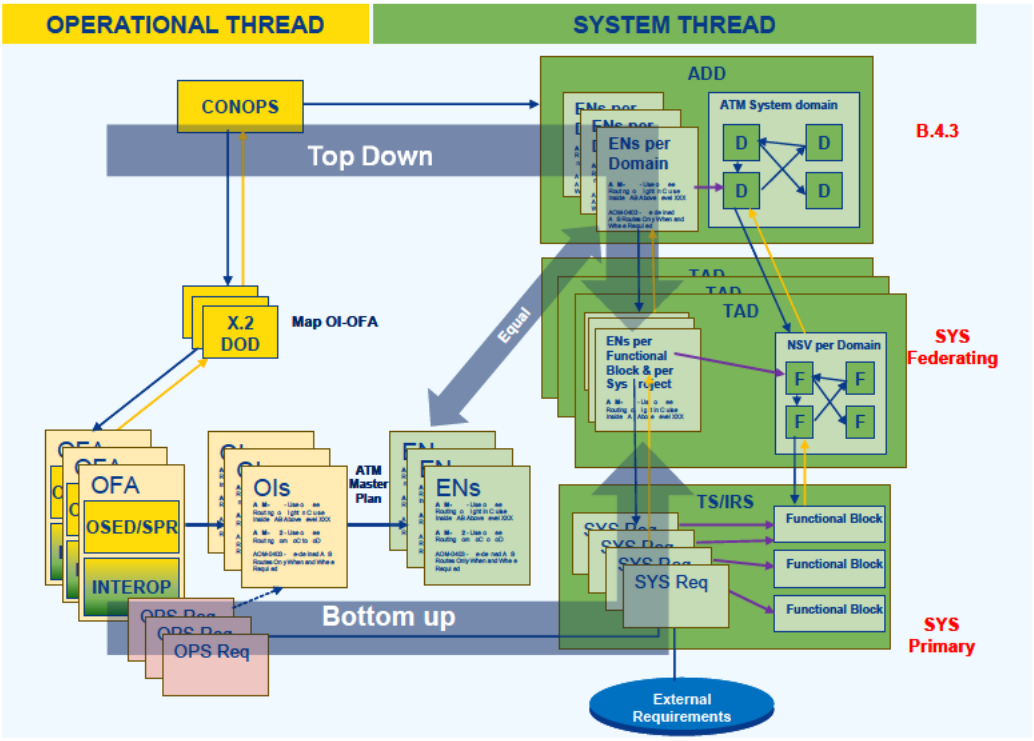
2. Localising the impact of enablers on the functional decomposition;

3. Managing the alignment of enablers with operational improvements.

P10.01.07 also worked more "bottom-up", from the operational requirements:

1. Allocating operational requirements to functional blocks and modelling their interactions;

2. Reviewing technical specifications against the functional architecture and assisting in the consolidation of requirements.



Project P10.01.07 has contributed the ATC system technical architecture component of EATMA, which describes the functional architecture of the system in terms of its constituent functional blocks, identifies interactions between the functional blocks and maps interactions with external systems to system ports. Furthermore, the impact of each of the master plan enablers on the functional architecture is described by identifying the functional blocks that support the enabler and depicting the necessary collaboration between functional blocks by means of sequence diagrams, thereby providing a high level sequential view of the overall system requirements spread across all technical specifications.

The contribution of the architecture to EATMA enabled the consistency with other domains to be ensured and connected the ER APP ATC system architecture with other elements such as the operational process models, service models and master plan enablers. This linking between the different models brings together the various views (operational, service, system, etc.) of the enterprise architecture and allows navigation between the views, answering such questions as "How does the system support this operational process?", and "What services does the system provide/consume to perform this function?".

The Technical Architecture Description, delivered annually but developed as a “living” document, assisted the coordination between ATC system primary projects by allocating operational requirements to the functional blocks and modelling the collaboration of functional blocks, thereby facilitating a consistent basis upon which the various technical specifications were developed. In this way, the technical primary projects that were needed to support a set of operational requirements were more readily identifiable and the role and scope of each was clarified. The primary projects then developed their technical specifications for their appointed functional block[s], and consistency between the specifications was boosted.

The project has maintained the master plan enablers for the ATC domain system, ensuring they remain aligned with the operational improvements and the validation progress, and identifying gaps and coordinating their plugging.

1.3 Project Deliverables

The following table presents the relevant deliverables that have been produced by the project.

Reference	Title	Description
10.01.07-D120	Technical Architecture Document Cycle 5	This deliverable is the final in a cycle of TAD documents produced annually during the life of the project. The TAD provides a generic functional architecture of the ATC system, which is used as a structural basis of technical specifications as a means to ensure their consistency and coherency. The collaboration between functional blocks is modelled in sequence diagrams and these are traced to operational process models and master plan enablers, thereby illustrating the cross-domain dependencies.

1.4 Contribution to Standardisation

Not applicable.

1.5 Project Conclusion and Recommendations

The ATC system architecture described in the TAD is, in its own words, "… a generic model (divorced of any specific implementation) that has been developed … for the purpose of achieving consistency and coherence of the technical specifications". The architecture description has been developed and refined over the duration of the programme, with an annual delivery, culminating in the D120 Final TAD. The mapping of master plan enablers onto functional blocks might assist in the planning of system evolutions by localising the change within the architecture.

Production of the architecture and its dissemination to the primary projects has assisted them, in the later stages of the programme, in achieving consistent and coherent technical specifications.

However, it should be noted that there are subtle but relevant differences between the ATC system physical architectures (i.e. decomposition into components) developed by the three main contributing system suppliers.

Therefore, it should not be assumed that the functional blocks and their defined interfaces can be used as a basis for defining physical components.

This is particularly relevant when considering some emerging business needs (shared and promoted by a significant subset of the ANSPs community) that are proposing alternatives to the current reference architecture (EATMA), with adaptation of the functional scope of the overall ER/APP ATC Domain System, including the re-allocation of certain functions to different/new Domain Systems located in different/new capability configurations, to achieve concepts such as common services and virtual centre.

The definition of an architecture adapted to these new emerging business needs cannot be based directly on the current FBs decomposition of the ER/APP ATC. It may be needed to identify different entity grouping several subsets of different FBs in order to match the emerging services. For this

purpose, complementary studies are needed and should address the technical feasibility of the final architecture for new systems as well as the feasibility of the adaptation of the existing systems.

The project therefore recommends that En-Route and Approach System Technical Architecture Description be used by future activities as an example for facilitating the harmonization and coordination of system specification activities and to achieve completeness and consistency in the technical system description.

2 References

[1] SESAR Programme Management Plan, Edition 03.00.01

[2] European ATM Master Plan

[3] Multilateral Framework Agreement ("MFA") signed between the SJU, EUROCONTROL and its 15 selected members on August 11, 2009, amended on 14 June 2010, 19 October 2010 and 2 July 2012

[4] 10.01.07-D120 ER and APP ATC System Final Technical Architecture Description, 00.01.00, January 2016

[5] 10.01.07-D115 ER and APP ATC System Technical Architecture Description - Cycle 2014, 00.01.01, 20/5/2015

[6] 10.01.07-D110 ER and APP ATC System Technical Architecture Description - Cycle 2013, 00.01.00, 20/4/2014

[7] 10.01.07-D109 Specifications and Issues Cycle 3, 00.01.00, 14/3/2014

[8] 10.01.07-D108 Allocated Requirements & Models Cycle 3, 00.01.00, 14/3/2014

[9] 10.01.07-D107 Functional Decomposition Cycle 3, 00.01.00, 14/3/2014

[10] 10.01.07-D106 ER APP Enablers Cycle 3, 00.01.00, 14/3/2014

[11] 10.01.07-D105 ER and APP ATC System Technical Architecture Description - Cycle 2012, 00.01.00, 3/5/2013

[12] 10.01.07-D104 Specifications and Issues Cycle 2, 00.01.00, 27/2/2013

[13] 10.01.07-D103 Allocated Requirements & Models Cycle 2, 00.01.00, 27/2/2013

[14] 10.01.07-D102 Functional Decomposition Cycle 2, 00.01.00, 27/2/2013

[15] 10.01.07-D101 ER APP Enablers Cycle 2, 00.01.00, 27/2/2013

[16] 10.01.07-D100 ER and APP ATC System Technical Architecture Description, 00.01.01, 16/4/2012

[17] 10.01.07-D38 Pilot AMAN Baseline Specification, 00.01.00, 10/1/2011

[18] 10.01.07-D37 Pilot ATC System Architecture - Arrival Manager, 00.04.00, 12/7/2011

[19] 10.01.07-D42 Pilot Architecture Review and Coordination, 00.01.00, 1/3/2013

[20] 10.01.07-D35 Methodology and Requirements Management Principles, 00.01.01, 20/01/2012

[21] 10.01.07-D32 Methodology and Requirements Management Principles (Initial), 00.01.00, 26/1/2011

[22] 10.01.07-D01 Technical Specification - ATC System Baseline, 00.01.00, 10/1/2011

[23] ATM Master Plan / Integrated Roadmap - dataset 15

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