



Final Project Report

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Abstract

P03.03.02, as part of the transversal WP03 was a key actor in platform adaptation and provision to operational projects. Based on requirements elaborated as input by other WP03 projects, it also developed requested Validation & Verification Infrastructure and integrated it with prototypes provided by System Projects. This led to deployment of platforms on single or multi-sites and delivery to P03.03.03 "V&V Platform acceptance and support" for final testing and provision to SESAR Validation & Verification Exercises.

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This deliverable consists of SJU foreground.

Acronyms

Acronym	Definition
ADD	Architecture Design Document
ASPA -S&M	Airborne Spacing - Sequencing & Merging
ATC	Air Traffic Control
ATM	Air Traffic Management
ED	EUROCAE Document
I4D	Initial 4 Dimensions
IBP	Industry Based Platform
IOP	Initial Interoperability
ITR	Integration Test Report
M4	Milestone 4 : Platform Modified
M5	Milestone 5 : Platform Integrated
SESAR	Single European Sky ATM Research Programme
SI	Software Items
SWIM	System-Wide Information Management
TMA	Terminal Manoeuvring Area
V&V	Validation & Verification
V&VI	Validation & Verification Infrastructure
V&VP	Validation & Verification Platform
WG	Working Group
WP	Work Package

1 Project Overview

P03.03.02 supported the adaptation of Industry Based pre-operational V&V Platforms (IBP) used to validate the SESAR concepts in different projects. P03.03.02 developed the V&V Infrastructure (V&VI) based on technical requirements specified by P03.01.03 "V&V Platform System Requirements" and architecture specified by P03.03.01 "V&V Platform architecture and specifications" for several SESAR V&V Exercises. Additionally, P03.03.02 supported the integration of system prototypes into V&V Platforms.

1.1 Project progress and contribution to the Master Plan

As part of a transversal work package dealing with the adaptation and integration of Validation Infrastructure, P03.03.02 did not directly contribute to deployment activities as defined in the Air Traffic Management (ATM) Master Plan [2].

Nevertheless, P03.03.02 by providing a V&VI (Validation & Verification Infrastructure) enabled to evolve maturity of the Operational Improvement steps by supporting the verification and validation of system prototypes. P03.03.02 enabled operational projects to evaluate solutions implemented by system projects through integration of prototypes into IBPs (Industry Based Platforms).

P03.03.02 was a key actor in building and assembling the V&V Platforms on which the target concept was evaluated.

The figure 1 below provides an overview of the overall WP03 process, its projects, deliverables and interactions. As shown, P03.03.02 collaborates with P03.03.01 "V&VP Architecture and Specifications" that provides the Architecture Design Documents (ADD), V&VP Specifications and associated Integration Test Plans, to build the V&VI.

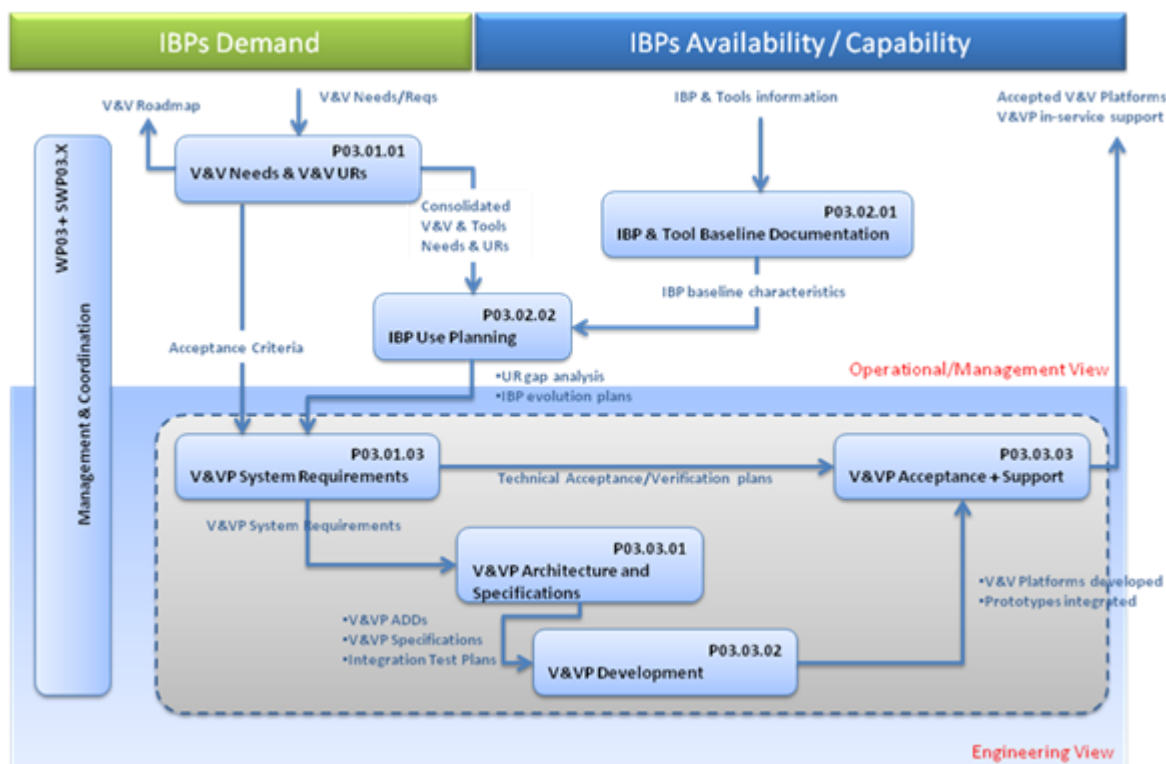


Figure 1 - WP03 overall process diagram

One stream of P03.03.02 was involved in translating ADD and V&VP specifications into software requirements and implementing associated Software Items (SI) to deliver associated V&VI.

Second stream of P03.03.02 was dedicated to deployment and integration of the V&VI and prototypes into the IBPs. This stream was responsible to execute set of tests by consolidating Integration Test Plans provided P03.03.01 and additional tests in relation with V&VI and system prototypes implementations.

After first set of Validation Exercises, P03.03.02 initiated the role of exercise coordinator for Validation Exercises supported by WP03; purpose of this role was to coordinate the V cycle activities among all involved projects from specification to delivery to Operational project and to report progress. This role has been kept in other steps of the programme as a central responsibility in the global process.

The outcomes of P03.03.02 are "Integrated V&V Platforms", represented by the achievement of milestones M4 (Platform Modified) and M5 (Platform Integrated) formalised through Integration Test Reports (ITR).

1.2 Project achievements

P03.03.02 represented a critical step in the WP03 Engineering Process as it ensured the deployment and integration of V&V platforms prior to exercises execution.

For every V&V Exercise requesting WP03 support, project 03.03.02 implemented requested V&V Infrastructure and integrated it with prototypes provided by system projects. Resulting V&V Platforms were integrated and results provided in Integration Test Reports both being delivered to P03.03.03 "V&V Platform acceptance and support".

During the lifecycle of the project, P03.03.02 supported around 100 validation exercises belonging to the different ATM operational domains: En Route, TMA, Airport and Network Management. These validation exercises were performed in 39 different Industry Based Platforms from up to 11 different partners and were located all around Europe.

In scope of P03.03.02, V&VPs have been implemented, deployed and integrated based on common interface specifications and by sharing expertise and techniques between partners. This collaborative environment has been built for multi-site/multi-node simulations (around 20% of the total amount of exercises), enabling validation of some key operational concepts:

- i4D (initial 4D Trajectory): sharing air-ground trajectory information
- IOP: Initial (ground-ground) interoperability
- ASPA S&M (Airborne Spacing - Sequencing & Merging): airborne spacing, sequencing & merging

Being a transversal project, P03.03.02 has contributed to the programme delivery as a whole by evaluating iterative solutions, providing means to refine solutions before live trials, and in general as an enabler for Integration and Verification of prototypes

1.3 Project Deliverables

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

Reference	Title	Description
D15-005	V&VI Software Material for 2016	This deliverable is the last one of a series of quarterly deliverables that relate, for supported exercises, what has been implemented in terms of V&VI to cope with Validation Exercises requests

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D16-005	Integration Report for 2016	This deliverable is the last one of a series of quarterly deliverables that relate, for supported exercises, what has been deployed and integrated in terms of V&VPs for associated Validation Exercises
D17-003	Maintenance Report for S1-2015	This deliverable is the last one of a series of deliverables that relate activity performed in the scope of corrective maintenance on software developed by P03.03.02

In total, P03.03.02 produced 36 deliverables.

1.4 Contribution to Standardisation

P03.03.02 contributed to standardisation activities:

- by providing feedback to WG-59 (Flight Data Processing Interoperability) for ED-133 through IOP testing; ED-133 "Flight Object Interoperability Specification" defines the interface between different instances of civilian ATC Flight Data Processing Systems, in support of En-route and Terminal ATC Operations
- by providing testing results to WG-78 (Standards for Air Traffic Data Communication Services) in scope of i4D
- by providing feedback to WG-81 for ED-147 (purpose of the document being to define a standard addressing interoperability aspects of ATM Validation Platforms) through Multi simulators integration

All this feedback enabled to evaluate and refine standardisation proposals.

1.5 Project Conclusion and Recommendations

This project spanned from 2009 until 2016, involving 12 different European organisations and giving service to around 100 validation exercises throughout the different steps of maturity. In relation with results achieved by P03.03.02 during last six years, it can be concluded that:

- P03.03.02 organised the integration of prototypes and V&VI; as a result, Integration Test Reports were created that provided together with the M4 (Platform modified notification) an overview regarding the readiness of the V&VP for the technical acceptance test
- P03.03.02 represented a useful cooperation environment across domains and validations where different experts shared their views and achievements.
- Following the standard V&V cycle and performing the Integration Tests before the Verification Tests was, in general, the most applied option, as it was deemed essential to guarantee the integration of the IBP before the last tests prior to execution. However, depending on the nature of validation exercises, combining Integration and Verification tests in the same session was identified as an opportunity to take advantage of the synergies that they presented. In this sense, flexibility should be granted in future.
- For validation exercises requesting inter-IBP integration, P03.03.02 has addressed end to end tests related to service instances and data exchange, when they were developed in IBPs, but also when they were part of the prototype. That was deemed as significant added value to facilitate SWIM compliance framework activities, more in particular for the final validation activities.

As a consequence, P03.03.02 would recommend:

- To keep every validation exercises contributor's altogether to take advantages of best practices and lessons learnt related approach

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- Promote collaborative environment building between and to use them in the deployment phases.
- To keep role of “exercise coordinator”
- That V&VI implementation should remain “visible in the whole implementation process” to avoid underestimating associated effort & budget and to remain monitored by the programme

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
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