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PJ22 SEabird

[PROJECT TITLE]

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Abstract

This document is the final report of the PJ22 project's activities. It provides a description of the results achieved with respect to the objectives originally planned for the project and covering specific target area in support of the SESAR Program. In addition to that, the report provides conclusions and recommendations for next phases of the SESAR programme based on the experience from the project members and the global outcomes achieved.

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Executive Summary

The PJ22 “System Engineering for Validation and Demonstration” (SEabird) is one of the SESAR 2020 project and provides transversal support to SESAR solution level or to SESAR program level covering the following three main target areas:

- The provision and maintenance of a System Engineering Data Management Framework (SE-DMF) platform, to support SESAR Solutions in Requirements Management and deliverables production, aiming to allow consistency, coherence and coverage analysis at Programme level. Support and training service has been provided as well. Following significant result has been achieved:
 - o SE-DMF platform, has been made available, fully capable of providing collaboration and sharing functionalities to the users. A total number of 80 Solution areas has been created on SE-DMF; allowing 347 users logged into the system to work on the platform;
 - o The SE Data Model implemented in SE-DMF is compliant with SJU guidelines and templates updates (latest SE Data Model version in line with V02.00.02 and considering the V&V requirements guidelines) to support specific needs from SESAR Solution; ad hoc customisations have been performed;
 - o Execution of a training campaign with 31 sessions performed between April 2017 and April 2019 in F2F or via webex; more than 220 users trained;
 - o SE-DMF platform has been supporting the SESAR Solution Maturity Lifecycle and Gates by means of dashboards and provision of material (Gate support documents) including SE data report and traceability matrices;
 - o A dedicated area has been created in the SE-DMF for the management of the V&V Platform Catalogue with possibility to access to SESAR 1 platform documentation, register new platforms to run validation and verification activities; perform link to Platform artefacts according to the V&V Platform Methodology, and produce live reporting of current status of used platforms
- The maintenance and improvement of the V&VPs, V&VIs and Demonstration Platform Methodology (defined in SESAR 1) to be applied by the SESAR solution and VLSD projects, as well as the provision of training on how to apply the mentioned Methodology.
 - o In this area, the activities were performed as planned and some ‘extra mile’ activities were taken, like Platform data artefact integration into SE-DMF (with support of WP2).
 - o In Total, 4 versions of the Platform Methodology were provided and made available to the Projects. Each Methodology version was enriched with valuable contents, developed considering WP3 expertise, SESAR projects’ input (feedback) and consultations with EUROCAE WG81.
 - o An extra activity has been conducted to allow Platform data artefact integration into SE-DMF).
 - o A Training campaign has been launched with preparation of training material and training plan,



- Communication campaign to spread the Platform Methodology and promote the added value through several communication channels like STELLAR, LinkedIn, newsletters
- The identification of common tools for validation activities and interoperability solutions and the definition of the relevant technical specifications.
 - For various reasons (described in D4.1) the identification of common tools and interoperability solution has met serious difficulties to get inputs from the Solution Projects. However, a set of high-level needs have been identified and described.
 - Regarding the definition of technical specification, the activity was focused on the analysis and specification for improving EUROCAE ED-147 key topics
 - The coordination activity between the project and WG-81 resulted in the integration of all the ED-147 changes requested by the project into a new version ED-147B currently under work and for which the final review is going to be launched before the end of 2019 for a publication by EUROCAE early 2020.



1 Project Overview

The PJ22 “System Engineering for Validation and Demonstration” (SEabird) is one of the SESAR 2020 transversal project. PJ22 is structured around three work packages covering the three main PJ22 target areas, plus the management work package.

The project structure is displayed in the picture below

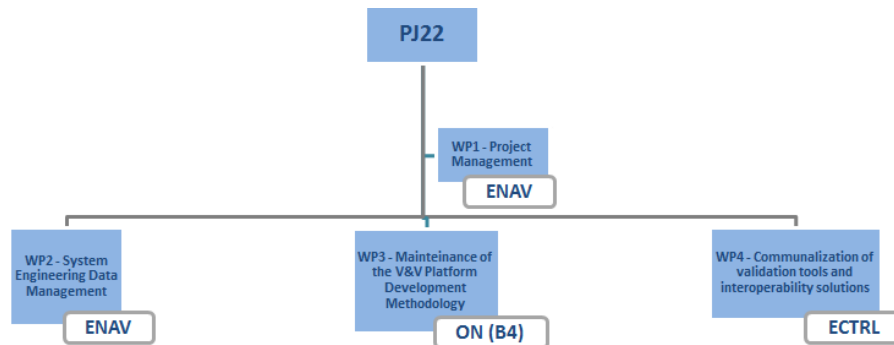


Figure 1 PJ22 Work Breakdown Structure

A more detailed description of the WP content and scope is provided in the following

WP1 – Project management

WPL: ENAV (Global coordinator)

WP1 deals with the provision of management and coordination activities to ensure that the project objectives are met, and expected outputs are provided with the needed level of quality, and in due time. WP1 includes also the monitoring of project status and the progress reporting by means of Quarterly report, as well as the provision of communication activities to spread project communication messages, achievements and results.

WP2 – System Engineering Data Management.

WPL: ENAV.

WP2 is responsible for the development, provision and maintenance of a System Engineering Data Management Framework (SE-DMF) platform, along with relevant processes and methods, to support SESAR Solutions in Requirements Management and deliverables production, aiming to allow consistency, coherence and coverage analysis at Programme level. Besides, WP2 delivers tool training, support service to users and input for Maturity Gates.

WP3 – Maintenance of the Platform Development Methodology.

WPL: ON (B4).

WP3: is responsible for maintaining and improving the V&VPs, V&VIs and Demonstration Platform Methodology (defined in SESAR 1) to be applied by the SESAR solution and VLSD projects, as well as for providing training on how to apply the mentioned Methodology.

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WP4 – Communalization of validation tools and interoperability solutions.

WPL: ECTRL.

WP4: is responsible for supporting the communalization of validation tools and interoperability solutions when appropriate, by enabling the identification and selection of a set of strategic validation tools and interoperability solutions and by producing technical specifications, interoperability requirements and conformance criteria that could be applicable for the different simulators, tools and V&VI.

1.1 Operational/Technical Context

The aim of PJ22 is to address one of the Transversal Activities of SESAR 2020 Program, specifically Validation & Demonstration Engineering. Taking on board the recommendations or needs for improvement coming from SESAR 1 experience, PJ22 focuses on three main problems:

1. Requirement Management:

In SESAR 1, the delivery of information to SJU were typically captured via Word templates requiring significant effort to extract the information without homogeneous level of details, thus insufficient to guarantee the usability and significance for the SESAR Community. In SESAR 2020 the demand was to improve consistently the situation and PJ22 provides a System Engineering Data Management Framework (SE-DMF), aiming to support all SESAR Solutions with a (web based) platform for Requirements Management to capture data in a structured way to allow consistency, coherence and coverage analysis at Programme level.

2. Maintenance of a Common reference methodology for V&V Platform Development

In SESAR 1 the application of an engineering methodology, for development of verification and validation platforms, was optionally mandated to the primary projects, leading to a different level of information available across the Programme.

In SESAR 2020 PJ22 worked to maintain and improve a common and reference development methodology providing high-level guidance and specific recommendations on the Platforms development process to be undertaken by SESAR projects and in line with recommendations of SESAR Project Handbook

3. Communalization of validation tools and interoperability solutions

IN SESAR 1 it was of interest to identify a set of strategic common tools and interoperability solutions that could improve the SESAR 2020 validation process. PJ22 works on the topic stimulating the SESAR solutions teams to analyze such possibility and for the identified proposals, to produce the corresponding high-level specifications.

1.2 Project Scope and Objectives

PJ22 deals with the provision of transversal support to the System Engineering of the Validation and Demonstration activities. Such transversal support was mainly performed in term of:

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- Provision of System Engineering Data Management (SE-DMF) tool that will support:
 - the management of the information and outputs produced by the SESAR solution projects, with regards to the System Engineering Data Management and the Deliverable production.
 - the management of a V&V Platform Catalogue with the list of V&V Platforms and relevant available material to be considered by projects when planning the validation activities
 - the support to Solution Maturity Gates in terms of provision of matrices, graphs and dashboards on SE Data and ad hoc provision of semi-automatic reports for the maturity gates
- Delivery of a V&VP, V&VI and Demonstration Platform Methodology that will provide general engineering process with instruction and expected inputs and outputs to be undertaken while executing the development of the V&V platform.
 - Such methodology is NOT mandatory but recommended as it will promote coherent engineering approach and harmonized outputs for V&V platform development lifecycle.
 - It will identify a minimum set of technical evidences related to the V&V platform development that can be captured in the relevant platform availability note(s).
- Support the communalization of validation tools, by identifying and selecting strategic validation tools and interoperability solutions, producing technical specifications, interoperability requirements and conformance criteria applicable for the different simulators, tools and V&VIs and providing guidance and support to SESAR Solution and VLSD projects

1.3 Work Performed

The work performed by PJ22 is presented basing on the key areas and for each activity the reference to the associated deliverable is enclosed

Project Management

- Project Coordination by preparing the Project Management Plan and assuring proper coordination within PJ22 and between PJ22 and the SESAR 2020 program: corresponding deliverable is D1.1
- Project Reporting by monitoring the project activities, the progress v.r.t. the objectives the risks and to provide relevant reporting via expected quarterly reports: corresponding deliverables are D1.2 to D.13

System Engineering Data Management:

- SE-DMF set up via execution of a pilot phase to consolidate the specification and then development until readiness of the tool for the full execution: corresponding deliverables are D2.1; D2.2; D2.3

- SE-DMF Training to acquaint the users with the tool and make them able to perform basic functionalities in correct and autonomous way.: corresponding deliverable is D2.7
- SE-DMF operation providing the SE-DMF services, such as the direct support to users, the management of roles, profiles and security settings, maintenance interventions: corresponding deliverables are is D2.4; D2.5; D2.6
- Contribute to SESAR Solution Maturity Lifecycle and Gates by providing material (i.e. report on SE data, statistics and traceability matrices) and dashboards (embedded in the tool).to be used for the maturity analysis: corresponding deliverables are D2.8; D2.9; D2.10
- Maintenance of the existing V&V Platform Catalogue and associated documentation from SESAR 1, basing on the descriptions of their current capabilities and their planned evolution (as described by Solutions into the tool): corresponding deliverables are D2.11; D2.12; D2.13

Maintenance of the V&VP, V&VI and Demonstration Platform Methodology:

- Definition and improvement of the V&VPs, V&VIs and Demonstration Platform Development Methodologies to be applied by the SESAR solution and VLSD projects basing from SESAR 1 documentation: corresponding deliverable is D3.1
- Training of V&VPs, V&VIs and Demonstration Platform Development Methodology: corresponding deliverables are D3.2; D3.3; D3.4
- Maintenance of V&VPs, V&VIs and Demonstration Platform Development Methodologies to keep the Methodology annually updated basing on analysis of Solution, Enabling and VLD projects' feedback: corresponding deliverables are D3.5; D3.6; D3.7

Communalized Validation Tool and Interoperability Solution:

- Identification of the list of validation tools and interoperability solutions that emerge from S2020 projects and could be communalized: corresponding deliverable is D4.1
- Development of specifications/requirements for tools and solutions proposed in D4.1: corresponding deliverable is D4.3
- Coordination and contribution to EUROCAE WG-81 to feed WG-81 with S2020 needs and coordinate the use of intermediate materials produced by WG-81 according to the required S2020 validation planning

1.4 Key Project Results

Project results are described per key area:

System Engineering Data Management:

The System Engineering Management Framework has been defined, set-up and delivered for operational use. The SE-DMF tool consists of a collaborative web based platform which allows Solutions to share and manage SE data (requirements, objectives, results) in a structured way, in line with guidelines and templates provided by SJU.

A set of 200+ users have been trained, and provided with training material (User Manual, video tutorials, presentations) available on a dedicated website (<https://www.se-dmf.eu/>). Eighty-one Solutions have been supported and more than 400 users logged into the system.

The maintenance during operations (at infrastructure and application level, in relation to templates update and SW upgrade) has been performed. Ad-hoc technical intervention requests on specific solutions were assessed and, when possible, implemented on the tool.

Dedicated Support service to solutions has been provided by means of Help Desk and supporting team.

Figures about adoption status were provided monthly to SJU in order to report about the adoption of the tool and possibly spot idle solutions.

A synchronisation mechanism has been defined in coordination with PJ19 in order to perform a periodic alignment of the EATMA elements (as defined into MEGA) into SE-DMF tool, so to allow users to link requirements to EATMA elements; a first synchronisation process was run successfully resulting in a mirroring of DS18 EATMA elements into the SE-DMF tool, ready to instantiate traceability links with requirements. The second run of alignment found technical complications in the exchange of data, causing delay in the procedure and the need to revise scope and process.

Support to SESAR Solution Maturity Lifecycle and Gates substantiated into dashboards and provision of Supporting material (Gate support documents) including SE data report and traceability matrices;

The structure of the V&V Platform Catalogue has been defined and implemented in cooperation with WP3; thirty-six requests for inclusion of 50 new Platforms were handled.

Maintenance of the V&VP, V&VI and Demonstration Platform Methodology:

Activities were performed as planned and some ‘extra mile’ activities were taken, like Platform data artefact integration into SE-DMF

In Total, 4 versions of the Platform Methodology were provided and made available to the Projects. Each Methodology version was enriched with valuable content, developed considering WP3 expertise, SESAR projects’ input (feedback) and consultations with WG81.

Also, 2 Training plans were prepared, and 2 versions of Platform Methodology Training were available to SESAR Platform developers. 52 persons (out of 196 contacts available to WP3) registered for the Training and had possibility to access Training sessions.

In addition, 2 Methodology application Surveys were launched. 25 answers were received to the first Survey and 19 answers – to the second.

To ensure quality updates of the Platform Methodology as well as to mitigate the risk of insufficient feedback through ‘mass’ communication dedicated initiatives were organized to collect needed input

Communalization of validation tools and interoperability solution: main results are

- Specification of a cheap V&VI interoperability solution, a.k.a. OEVIS
- Specification of a tool to generate automatically physical service payloads from their logical definitions developed in EATMA

- Proposal of various improvements to the EUROCAE standard ED-147/148 (e.g. clarification of the AIXM and WXXM usage within the standard)

The ED-147/148 proposals have been deeply discussed and coordinated with WG81, and are now packaged in a new version of the standard that is about to be published in support to SESAR W2.

1.5 Technical Deliverables

In the following table the deliverable produced in the frame of the technical WP are presented.

WP2 Deliverables

Reference	Title	Delivery Date ¹	Dissemination Level ²
Description			
D2.1	SE-DMF Service Requirement Analysis and Specification – SE Tool Development Plan	03/04/2017	PU
The deliverable includes user requirements of the System Engineering Data Management Framework (SE-DMF) tool and the initial development plan.			
D2.2	SE-DMF Pilot and pre-service verification	03/04/2018	PU
For the development of the SE-DMF, a pilot phase was put in place in order to let a set of selected SESAR 2020 Projects to get familiar with the capabilities of the tool v0.1.0 and to gather relevant feedback for the subsequent development and refinement of the tool itself.			
D2.7	SE-DMF Training Plan	31/07/2017	PU
This document aims to provide a Training Plan for the SE-DMF tool, in order to illustrate the objectives and to identify the way to perform education in terms of audience, organisational requirements, training initiatives, plan definition.			
D2.14	SE-DMF Service Requirement Analysis and Specification – Final version	31/07/2017	PU
This document aims at providing key information, development plan and main requirements, at user level, on the System Engineering Data Management Framework (SE-DMF) tool, developed and provided to be used by SESAR 2020 Solution Projects for the structured and coherent capturing of the SE data.			
D2.3	SE-DMF Cloud Service Roll-out	04/08/2017	PU
The deliverable aims to document the roll out activities (including infrastructure and software provisioning, configuration, installation and customization) carried out for the delivery of the SE-DMF platform.			
D2.11	V&V Platforms and Demonstration Catalogue for Y1	29/09/2017	PU
This deliverable describes the definition of the structure of the catalogue along with its information sources and			

¹ Delivery data of latest edition

² Public or Confidential

of the implementation of the catalogue into the SE-DMF platform.

D2.4	SE-DMF Yearly Service Operation Quality and Status Report for Y1	27/11/2017	PU
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The deliverable is a report on SE-DMF service operation and status of the system during the full operation phase, on the basis of service quality monitoring.

D2.8	SE Data Reports for Gates - Y1	06/12/2017	PU
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This deliverable describes the design and implementation proposal for the report of SE data of interest.

D2.12	V&V Platforms and Demonstration Catalogue for Y2	28/09/2018	PU
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This Deliverable includes a definition of the final structure of the catalogue and its information sources, and a description of the implementation of the catalogue into the SE-DMF platform as agreed among WP2 and WP3. Furthermore, this document also includes the number and description of new platforms that have been proposed for inclusion into the catalogue.

D2.9	SE Data Reports for Gates - Y2	28/09/2018	PU
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This Deliverable provides visibility on Solutions supported in the SE-DMF and on traceability and coverage figures on SE data, during the full operation phase.

D2.5	SE-DMF Yearly Service Operation Quality and Status Report for Y2	28/09/2018	PU
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This Deliverable is a report on SE-DMF service operation and to document the status of the system during the full operation phase. The document provides the progress status during the period of full operations release and a description of the most relevant changes in terms of infrastructure and service/functionality updates/upgrades.

D2.10	SE Data Reports for Gates – Y3	30/06/2019	PU
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This Deliverable provides visibility on Solutions supported in the SE-DMF and reports about traceability and coverage figures on SE data, during the full operation phase.

D2.13	V&V Platforms and Demonstration Catalogue for Y3	30/06/2019	PU
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. The Deliverable includes a definition of the final structure of the catalogue and its information sources and a description of the implementation of the catalogue into the SE-DMF platform.

D2.6	SE-DMF Yearly Service Operation Quality and Status Report for Y3	30/09/2019	PU
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This Deliverable is a report on SE-DMF service operation and to document the status of the system during the full operation phase.

WP3 Deliverables

Reference	Title	Delivery Date ³	Dissemination Level ⁴
Description			
Deliverable N°D3.1	V&VPs, V&VIs and Demonstration Platform Development Methodology	18/04/2019	PU
<p>This deliverable provides key information elements and instructions on V&VP, V&VI and Demonstration Platform development process to be undertaken by SESAR ATM Solution projects, Enabling projects and Very large scale demonstration projects (VLDs) while executing validation, verification and demonstration activities in line with the SESAR Project Handbook recommendations.</p>			
Deliverable N°D3.2	V&VI, V&VP, V&VIs and Demonstration Platform Methodology Training Plan (first version)	26/09/2017	PU
<p>This document provides the V&VP, V&VI and Demonstration Platform Development Methodology Training Plan. The Methodology training provided guidance on the application of the key topics of the latest version of the V&VP, V&VI and Demonstration Platform Development. The Training Plan defined the Training concept and provides detailed explanation of the activities to be taken.</p>			
Deliverable N°D3.3	V&VI, V&VP, V&VIs and Demonstration Platform Methodology Training Plan (second version)	28/09/2018	PU
<p>The document provides the V&VP, V&VI and Demonstration Platform Development Methodology Training Plan, Second version and it is renewed and updated edition of the Plan provided in deliverable D3.2 (V&VP, V&VI and Demonstration Platform Development Methodology Training Plan, 00.01.01, date 26/09/2017). The Plan provides V&VP, V&VI and Demonstration Platform Development Methodology Training concept, content topics, schedule and Training-related activities to be performed by PJ22 WP3 (Maintenance of the Platform Development methodology) from 10/2018 till 06/2019. This document was prepared after evaluation of PJ22 WP3 experience in D3.2 implementation as well as respective feedback received from SESAR 2020 Projects.</p>			
Deliverable N°D3.4	Final report on V&VPs, V&VIs and Demonstration Platform Methodology Training Activities	26/06/2019 (resubmitted 12/08/2019)	PU
<p>This document provides the Final Report on V&VPs, V&VIs and Demonstration Platform Development Methodology Training Activities. The document overviews the outcomes of the training activities performed within the programme duration and makes their quantitative and quality analysis. Besides that, the document overviews the feedback on V&VP, V&VI and Demonstration Platform Development Methodology application, collected by PJ22 WP3 through surveys, analysis of available documents, Practical case preparation experience and individual communication with ATM Solution, Enabling and Very Large Scale Demonstration projects.</p>			
D3.5	Updated V&VI, V&VP and Demonstration Platform Methodology (first intermediate release)	24/04/2018 (resubmitted 09/07/2018)	PU
<p>This deliverable provides updates to deliverable D3.1. The document covers (with modifications) all key topics</p>			

³ Delivery data of latest edition

⁴ Public or Confidential

of the previous Methodology edition and new features (updated terminology; Customized concept of Platform definition; Structured explanation of the Methodology approach; Clarification of data artefacts traceability; Platform versioning and its management; Better explained links with Solution lifecycles and potential Platform data reuse at higher maturity levels; introduction of interoperability standard).

D3.6	Updated V&VI, V&VP and Demonstration Platform Methodology (second intermediate release)	28/11/2018	PU
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This deliverable provides updates to deliverable D3.5. The document covers (with modifications) all key topics of the previous Methodology edition and new features (The Methodology in a Nutshell; The Methodology split into Core elements and Additional Suggestions to Platform developers; The new sections “Links with Platform Catalogue” and “Platform Methodology Training” are added; the Compliance Check List has been updated considering information on the Platform Catalogue; The Platform Development artefacts templates have been updated).

D3.7	Updated V&VI, V&VP and Demonstration Platform Methodology (final release)	28/11/2017	PU
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This deliverable provides updates to deliverable D3.6. The document covers (with modifications) all key topics of the previous Methodology edition and new features (Section *Additional Suggestions to Platform developers* is redesigned as following: Platform versioning remains the only content of this section, The sub-section *Platform Methodology Training* is removed as Training activities are almost finished at the moment of publication of this document; The content of sub-section *Introduction to IOP standard* is moved to the new section - *Complex Platform Management: Interoperability as a key UR*, which provides valuable guidance to Complex Platform developers; One more new section added - *Conclusions and Reminders*)

WP4 Deliverables

Reference	Title	Delivery Date ⁵	Dissemination Level ⁶
Description			
D4.1	List of candidate communalized Validation Tools and Interoperability solutions	18/04/2019	PU
The deliverable has reported the three validation tools and interoperability solutions requested by the projects and provided their high-level description.			
D4.2	Technical specifications document for communalized Validation Tools and Interoperability solutions (first intermediate release)	28/11/2017	PU
The deliverable has proposed specifications refining the ED-147 specifications relative to AIXM offline data preparation.			
D4.3	Technical specifications document for communalized Validation Tools and Interoperability solutions (second	18/10/2018	PU

⁵ Delivery data of latest edition

⁶ Public or Confidential

	intermediate release)		
The deliverable has specified the tool automatically deriving the logical data models developed in EATMA into and XML physical data model, the redesign of the ED-147 geographical data structures and the offline weather data model.			
D4.4	Technical specifications document for communalized Validation Tools and Interoperability solutions (final release)	21/06/2019	PU
The deliverable has specified the OEVIS solution, the redesign of the ED-147 Flight Object and the specific ATFN message.			

Table 1: Project Deliverables

2 Links to SESAR Programme

2.1 Contribution to the ATM Master Plan

PJ22 role was to support the SESAR project ensuring consistency and coherency at requirement level. Additionally PJ22 worked to maintain a reference Validation Platform Methodology which is linked to the validation activities that contribute to validate the ATM Master Plan.

2.2 Contribution to Standardisation and regulatory activities

EUROCAE WG-81 develops interoperability specifications for platforms that support the validation and the implementation of ATM concepts, up to the level of detail required for an implementation. Those specifications are published in the EUROCAE Standard ED-147A.

The objective of T4.025 task is to feed WG-81 with the S2020 needs that are relevant for ED-147 and coordinate the use of intermediate materials produced by WG-81 according to the required S2020 validation planning.

The ED-147 is the standard to be used by SESAR multi platforms exercises to address the interoperability aspects that are not already covered by operational standards, so mostly in the area of validation infrastructure interoperability (e.g. traffic generator replacing real aircraft).

The Terms of Reference of the WG-81 is referencing its collaboration with SESAR PJ22, while the ED-147B edition timescale has been synchronized with S2020 W1 so that it integrates PJ22 specifications and it is published by the end of 2019 for officially supporting SESAR W2.

The various PJ22 contributions to the standard are listed through its deliverables in section 1.5.

3 Conclusion and Next Steps

This section provides a short description structured around the key project area of what are the conclusions that can be derived from the project's results together with recommendation that can be considered for next R&D phase

3.1 Conclusions

Following the results described in the previous part of the report and basing on the experience gained by the project team, the following conclusions can be summarized per each key activity:

System Engineering Data Management.

Tool status and adoption

After an initial ramp-up and consolidation phase, the maturity of the tool can be recognised at operating phase. The added value of working with a structured environment is recognised to the point that users even recommend a louder promotion of the SE-DMF tool at Programme level. The adoption of the tool shows an increasing trend. More than 500 accounts were created. Over 200 users took part to training sessions.

Users have largely taken advantage and appreciated the support provided by means of help desk service and of direct coaching actions.

Ad hoc customisations have been requested, analysed from a feasibility point of view and, when possible, implemented into the system in close coordination with the user.

Implemented in coordination with PJ22-WP3 members as a structured collection of information, the Platform Catalogue could represent an added value for the Programme, providing a clear overlook of the usage of the Platforms throughout the Programme.

But, considering the required additional knowledge and actions from the users (increase of workload), it seems that it is not perceived by users as a key aspect. Furthermore, the current process of inclusion of new platforms is merely procedural, but it should require some content check by subject experts.

So far, 35 support documents were provided as input to Maturity Gates. . In consideration of the PJ22 closure (September 2019), all Supporting Documents will be provided by then, even if they might be considered as not yet finalised by Solutions. Solutions have been advised and recommended to anticipate the input of SE data and documents into the SE-DMF.

Long teamwork with PJ19, substantiated first of all into the definition of the scope and the nominal process of the alignment. The defined synchronisation mechanism that has been put in place requires manual intervention by the two sides (PJ19 on MEGA and PJ22 on SE-DMF).

In October 2018, a first synchronisation between the two data repositories was performed so SE-DMF users are able to instantiate link between SE data and EATMA elements (DS18). Then, the intention to repeat the alignment periodically found some technical obstacles. At the time this report is drafted, the synchronisation process is in place, not yet finalised.

Deviations with respect to the agreed process, complications in the exchange of data, latest discovery of the need to perform changes in the Data Model, necessity to de-scope (due to the huge amount of data) have been faced.

Maintenance of the Platform Development Methodology.

The analysis of WP3 activities as well as SESAR Projects feedback on Platform Methodologies and the Training is provided in details in D3.4 (Final Project Report).

One of the main conclusions is that Projects do need a Methodology to perform their Platform Development activities in efficient way and mitigate issues during Exercises, and therefore, PJ22 Platform Methodology should be considered as valuable support, even if there is no clear evidence on what degree it was applied.

Important point is that PJ22, as transversal project, provided many so called ‘products’ – SE-DMF tool itself, SE-DMF Training, Platform Catalogue, Platform Methodologies, Platform artefacts in the SE-DMF, Methodology Training, WP3 and WP4 Surveys and communicated mainly separately (i.e. on behalf of each WP), which caused some confusion among the SESAR projects (e.g. Platform Training was sometimes mistaken for SE-DMF Training).

Even more important point is that Projects faced both mandatory and non-mandatory guidance (mandatory and non-mandatory documents to produce, mandatory and non-mandatory tools to use, mandatory and non-mandatory trainings, etc). The better results could have been taken in case of better structured and clearly communicated processes.

It is true that the Projects, during SESAR 2020, received big quantities of information, guidance and supporting material. And it is natural that optional documents like the Platform Methodology might look excessive. The considerations provided in D3.4, however, prove that Methodology application in Platform development is important, and it is mainly matter of its timely provision, prompt presentation and explanations (not only through the Training, but especially through prompt communication and support by the SJU).

Communalization of validation tools and interoperability solutions.

The identification of common tools and interoperability solutions does not appear as a very successful initiative. Just focussing on the specifications aspect of common facilities does not raise a lot of interest from the Solution Projects. They do not really have any incentive in planning and developing tools (resources and budget) that are specified by another project, where they see additional risks to manage.

Eventually the few specifications developed by PJ22 have been useful thanks to the fact that the people involved in PJ22 were also the ones involved in other projects for producing an implementation, thus mitigating the lack of incentive and expected risks.

The collaboration between PJ22 and WG-81 has been efficient, and like with SESAR1, S2020 remains a key driver of the ED-147 contents. All the PJ22 proposals were mature enough and well aligned with WG-81 expectations to be integrated without significant amendment.

3.2 Plan for next R&D phase (Next steps)

To conclude the report, the following recommendations are provided to be considered for next R&D phase:

System Engineering Data Management.

- Scope of implementations in SE-DMF.

For the sake of definition of Data Model, major contribution for system specifications come from templates and guidelines, where SE data structure (artefacts and their attributes) and relationships between them were defined.

The scope of implementations to be addressed from a Requirement Management perspective was defined (in coordination with SJU).

Concerning the information content expected into the templates but left out of the system implementation scope, its implementation into the system as structured content was not expected by SJU, but sometimes of interest or requested by users (the structured requirement management could be helpful for their activities). As an example, the relationship between Validation Objectives and Exercise Validation Objectives, or the HP log.

Some high level requirements (such as the link to CONOPS) gathered during Wave, were kept into consideration for possible implementation during Wave2: the extent of new implementation is to be confirmed by SJU.

Therefore, it is recommended to consolidate the scope of system implementation (data model) that is of interest for the Wave 2 of the Programme.

- Adherence to processes and templates.

Sometimes it was noted that, during the drafting of the documents, Solutions were allowed to put in place practical shortcuts that were not in line with specifications or deviated by the nominal process (e.g. one deliverable was produced for several solutions; use of inexistent category for a defined attribute). When using a data centric approach (in practice, when this contents need to be input into the system), some difficulties arise and ad-hoc refinements are required on the tool itself to make the things work (adjustments of solution areas, adjustments of data model), causing waste of effort and divergences from the nominal modus operandi (which needs also to be maintained).

Therefore, it is recommended to promote and keep the strict adherence to templates and guidelines.

- Promotion of the tool and no shortcuts.

Once the tool has been finalised and maturity reached, the added value of working with operational requirement management was recognised, to the point that some of the projects recommended a louder promotion of the SE-DMF tool at Programme level to emphasize the importance of having a structured approach to the System Engineering aspects.

Therefore, a wider promotion of the tool at Programme level is recommended.

- Link with EATMA

Large effort was spent in cooperation with PJ19 team to synchronise the MEGA and SE-DMF. Synchronisation task was found to be the most troublesome one.

It must be highlighted that, in the synchronisation phase, some discrepancies were found in terminology and relationships, between artefacts implemented in SE-DMF (on the basis of templates and guidelines) and elements in MEGA (reference architecture).

Furthermore, the process of alignment found obstacles in the two ways exchange of data procedure.

Deviations with respect to the process agreed, complications in the exchange of data, need to perform changes in the Data Model, necessity to de-scope (due to the huge amount of data) have been faced. Hence, the success and the efficacy of the alignment procedure cannot be ensured at the time being.

Therefore, it is recommended:

1. to plan a preliminary phase of harmonisation between the two toolsets in order to consolidate the terminology and relationships (with benefit/impact to templates also);
 2. to put in place a mechanism between the two toolsets to grant a full automatic synchronisation that doesn't require human intervention.
- Training:

The training was basically focused on the tool and aimed at familiarizing the users with the basic functionalities. Anyhow, at training entry level, there should be a minimum necessary level of knowledge about System Engineering and on expectations by SJU on SE data and traceability.

Furthermore, different backgrounds and mind-set lead to different training exit levels as well as to different approaches to the learning. The so called PEBCAK (problem exists between chair and keyboard) were recorded, due to the fact that a training session can't provide the whole knowledge and that the know-how is built via a daily work, based on an open-minded, sufficiently skilled background.

"Creative" approaches to the data input caused the dispersion of data that required to be retrieved by means of the help of support team (e.g. requirements input outside modules risk to be disregarded at the reporting stage and therefore need to be reallocated).

Therefore, it is recommended:

1. to disseminate System Engineering culture and make clear the SJU expectations on SE data and traceability;
2. to train people, strictly adhering to a best practice approach.

Maintenance of the Platform Development Methodology.

In the loop of Wave 2, WP3 would emphasize the following aspects: clear and timely procedures, mandatory (or at least better communicated) processes, global data traceability and single tool. All these aspects are needed to help the Projects manage their Platform development better and SJU to get better quality data on the Programme level.

It is recommended to provide the Platform Methodology to the Projects in the beginning of the programme (together with the SESAR Handbook (if it is to be prepared for the Wave 2) and/or promote the existence of the Methodology through the Handbook, for example, integrating "The Methodology in a Nutshell" section into the Handbook);

Founding Members

- In Platform development it is important to have quality starting information, that's why Platform registration in the Platform Catalogue and availability of an updated Platform Baseline description should not be put under doubt by the Projects. It would be also useful to SJU who seeks to have complete view and quality data programme-wide (in Wave 1 it also could have help PJ22 WP3 in its analysis);
- It is recommended to better connect the mandatory documents (their Platform-related elements) to the Methodology. Another possible approach to connecting Platform-related documents (mandatory and optional) could be some level of integration of the Methodology into TVALP/VALP/DEMOP, TVALR/VALR/DEMOR and AN. As for further evolution of the Methodology itself, interoperability of Platform components is the aspect that could be developed further.
- More details on the recommendations above are provided in D3.4, section 5.3.

Communalization of validation tools and interoperability solutions.

If some communalization of validation tools and interoperability solutions activities are still planned, the project incentive issue might be addressed, for example, by:

- Contributors for transversal activities that could be provided by the projects, by defining a specific Project Content Integration role
- Dedicated activities or tasks relative to alignment with transversal projects that could be planned in the projects

Only addressing specifications is also not convincing the projects to adhere to the approach. The provision of complete solutions, including development and support, probably gives a better chance to dissemination of communalized facilities, given that it may always be slowed down by optionality, which leaves projects to prefer, whenever they can, solutions on which they have a total control.

At some point it is also important to keep on ensuring a feedback mechanism to WG-81 on any ED-147 adaptations within S2020 projects. Even if this is not formally materialised in a specific S2020 W2 project, this should be reminded, so that at least rough information is passed on to WG-81.

4 References

- [1] SESAR Project Handbook, 01.00.01, date 27/04/2017
- [2] PJ22 Project Management Plan, 00.01.00, date 07/04/2017 (SESAR deliverable D1.1)
- [3] SJU Stellar portal <https://stellar.sesarju.eu/>
- [4] EUROCAE ED 147 “ATM Platforms Interoperability Specification”

4.1 Project Deliverables

- | | | | | | |
|------|------|---|-------|----------|------------|
| [1] | PJ22 | Progress Report for Q1 | D1.2 | 00.01.00 | 15/12/2017 |
| [2] | PJ22 | Project Management Plan | D1.1 | 00.01.00 | 07/04/2017 |
| [3] | PJ22 | Progress Report for Q2 | D1.3 | 00.01.01 | 30/04/2017 |
| [4] | PJ22 | Progress Report for Q3 | D1.4 | 00.01.00 | 31/07/2017 |
| [5] | PJ22 | Progress Report for Q4 | D1.5 | 00.01.00 | 31/10/2017 |
| [6] | PJ22 | Progress Report for Q5 | D1.6 | 00.01.00 | 31/01/2018 |
| [7] | PJ22 | Progress Report for Q6 | D1.7 | 00.01.00 | 26/04/2018 |
| [8] | PJ22 | Progress Report for Q7 | D1.8 | 00.01.00 | 30/07/2018 |
| [9] | PJ22 | Progress Report for Q8 | D1.9 | 00.01.00 | 30/11/2018 |
| [10] | PJ22 | Progress Report for Q9 | D1.10 | 00.01.00 | 31/01/2019 |
| [11] | PJ22 | Progress Report for Q10 | D1.11 | 00.01.00 | 30/04/2019 |
| [12] | PJ22 | Progress Report for Q11 | D1.13 | 00.01.00 | 30/07/2019 |
| [13] | PJ22 | Final Report | D1.12 | | |
| [14] | PJ22 | SE-DMF Training Plan | D2.7 | 00.02.00 | 31/07/2017 |
| [15] | PJ22 | SE-DMF Service Requirement Analysis and specification -SE Tool Development Plan | D2.1 | 00.01.01 | 03/04/2017 |
| [16] | PJ22 | SE-DMF Pilot and pre-service verification | D2.2 | 00.02.00 | 03/04/2017 |
| [17] | PJ22 | SE-DMF Service Requirement Analysis and Specification - Final Version | D2.14 | 00.01.00 | 31/07/2017 |
| [18] | PJ22 | SE-DMF Cloud Service Roll-out | D2.3 | 00.01.00 | 04/08/2017 |
| [19] | PJ22 | SE data Report for Gates - Y1 | D2.8 | 00.01.01 | 06/12/2017 |

- [20] PJ22 V&V Platform and Demonstration Catalogue for Y1 D2.11 00.01.00
29/09/2017
- [21] PJ22 SE-DMF Yearly Service Operation Quality and Status report for Y1 D2.4
00.01.01 27/11/2017
- [22] PJ22 V & V Platform and Demonstration Catalogue for Y2 D2.12 00.01.01
28/09/2018
- [23] PJ22 SE data Report for Gates - Y2 D2.9 00.01.01 28/09/2018
- [24] PJ22 SE-DMF Yearly Service Operation Quality and Status report for Y2 D2.5
00.01.01 28/09/2018
- [25] PJ22 SE data Report for Gates - Y3 D2.10 00.01.00 30/06/2019
- [26] PJ22 DV & V Platform and Demonstration Catalogue for Y3 D2.13 00.01.00
30/06/2019
- [27] PJ22 SE-DMF Yearly Service Operation Quality and Status report for Y3 D2.6
to be delivered on 30/09/2019
- [28] PJ22 V&VPs, V&Vis and Demonstration Platform Development Methodology D3.1
00.01.00 28/06/2017
- [29] PJ22 V&VI, V&VP, V&Vis and Demonstration Platform Methodology Training Plan first
version D3.2 00.01,00 27/09/2017
- [30] PJ22 Updated V&VI, V&VP and Demonstration Platform Methodology (First Intermediate
Release) D3.5 00.01.01 26/04/2018
- [31] PJ22 V&VI, V&VP, V&VIs and Demonstration Platform Methodology Training Plan second
version D3.3 00.01.00 28/09/2018
- [32] PJ22 Updated V&VI, V&VP and Demonstration Platform Methodology (Second
Intermediate Release) D3.6 00.01.00 30/11/2018
- [33] PJ22 Final Report on V&VPs, V&VIs and Demonstration Platform Development
Methodology Training Activities D3.4 00.01.01 30/06/2019
- [34] PJ22 Updated V&VI, V&VP and Demonstration Platform Methodology (Final Release) D3.7
00.01.00 30/06/2019
- [35] PJ22 Technical specifications document for communalized Validation Tools and
Interoperability solutions (first intermediate release) D4.2 00.01.01 06/10/2017
- [36] PJ22 Technical specifications document for communalized Validation Tools and
Interoperability solutions (second intermediate release) D4.3 00.01.01 28/09/2018
- [37] PJ22 List of candidate communalized Validation Tools and Interoperability solutions D4.1
00.01.01 12/03/2019

[38] PJ22 Technical specifications document for communalized Validation Tools and Interoperability solutions (final release) D4.4 00.01.00 26/06/2019

4.2 Project Communication and Dissemination papers

Project Communication

WP2 communication Reference

- Communication to SE-DMF users via Flash Info email, about:
- SE-DMF releases;
- prioritisation criteria towards SESAR 2020 Wave 1 closure;
- Extraordinary maintenance activities;
- Training invitation;
- Alignment to EATMA.
- [Latest publications](#) on PJ22 website

WP3 communication on Training activities:

- STELLAR announcements;
- Campaign performed by ON (B4): LinkedIn announcements and sponsored posts, Newsletter to all SESAR partners, website www.oronavigacija.lt;
- Announcement to SESAR SJU LinkedIn group (done by PJ22 Project Manager);
- Newsletter to SE-DMF users (done in co-ordination with PJ22 WP2).

Appendix A Glossary of Terms, Acronyms and Terminology

A.1 Glossary of terms

Term	Definition	Source of the definition
Demonstration platform	It is an Operational Environment implying validation by using end-user systems where the proof of concept for a dedicated SESAR Solution (of maturity levels V3/TRL6 or V3+/TRL7) can be demonstrated and evaluated according to the assigned validation objectives	Updated V&VP, V&VI and Demonstration Platform Development Methodology (first intermediate version), 00.01.01, date 24/04/2018
EUROCAE WG-81	Eurocae Working Group Nr 81, responsible for ATM Validation Platforms Interoperability Specification ED-147A and its application guidance	https://www.eurocae.net/
Methodology	Consolidated title for all versions of V&VP, V&VI and Demonstration Platform Development Methodology provided by PJ22 WP3 (deliverables D3.1, D3.5, D3.6 and D3.7)	Definition provided by PJ22-WP3
Platform Catalogue	V&V and Demonstration Platforms Catalogue developed under the scope of PJ22-02 deliverable D2.12 (V&V and Demonstration Platforms Catalogue the for Y2, edition 00.01.00 date 24/09/2018 and further deliverable D.2.13 (V&V Platform and Demonstration Catalogue for Y3)	Definition provided by PJ22-WP2
SE-DMF	System Engineering Data Management Framework tool provided by PJ22 for requirements management as well as for management of the Platform development data artefacts and document production. The tool allows data entry, reporting and traceability functions.	Definition provided by PJ22-WP2
SE data	System Engineering data included into the SE-DMF defined data model (mainly requirements, objectives, exercises, results)	Definition provided by PJ22-WP2
SESAR Solution	A term used when referring to both SESAR ATM Solution and SESAR Technological Solution	SESAR Project Handbook 01.00.01
SESAR ATM Solution	Programme output is defined and packed in the form of SESAR Solutions. These contain outputs from R&I activities which relate to either an operational improvement (OI) step or group of OI steps and associated enablers which have been designed,	SESAR Project Handbook, version 01.00.01, date 27/04/2017

	developed and validated in response to validation targets that when implemented, will deliver performance improvements to European ATM	
SESAR Technological Solution	New technology that enables future SESAR ATM Solutions, verified as feasible, safe and to support or enable Performance Improvements	SESAR Project Handbook, version 01.00.01, date 27/04/2017
SESAR Solution project	A term introduced to refer to a project that delivers one or more SESAR Solutions and that is either a SESAR Enabling project or a SESAR ATM Solution project	SESAR Project Handbook, version 01.00.01, date 27/04/2017
SESAR ATM Solution project	A project delivering SESAR ATM Solutions	SESAR Project Handbook, version 01.00.01, date 27/04/2017
SESAR Enabling project	A project delivering SESAR Technological Solutions is known as an 'enabling project'	SESAR Project Handbook, version 01.00.01, date 27/04/2017
Validation and Verification platform (V&VP)	A sophisticated environment supporting V&V exercises and combining V&V Infrastructure, IBPs and Concepts/Systems under test. It is collection of integrated tools, facilities, test equipment, mock-ups and prototypes that, together, provide a resource for the running of V&V activities and which may itself be further enhanced in functionality by the addition of tools and prototypes for a specific V&V activity. It is not necessarily a single monolithic installation, and may be used to describe an integrated set of equipment and facilities that could be also distributed over different sites and domains	Definition provided by PJ22-WP3
Very large-scale demonstration project (VLD)	A project set-up with the aim to de-risk the start date of the full-scale deployment	SESAR Project Handbook 01.00.01

Table 2: Glossary

A.2 Acronyms and Terminology

Term	Definition
AN	Availability Note
ATM	Air Traffic Management

EATMA	European Air Traffic Management Architecture
EXE	Validation, verification or demonstration Exercise
IBP	Industry Based Platform
IaaS	Infrastructure as a Service
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SE	System Engineering
SE-DMF	System engineering data management Framework
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SR	System Requirement
V&V	Validation and verification
V&VI	Validation and verification infrastructure
V&VP	Validation and verification platform
VALP/VALR	Validation plan/report
VLD	Very large demonstration
WG 81	Working Group 81

Table 3: Acronyms and technology