



[SESAR 2020 PJ18-04a TVALR for TRL6]

Deliverable ID:	D4.1.130
Dissemination Level:	PU
Project Acronym:	PJ18-04a
Grant:	734161
Call:	[H2020-SESAR-2015-2]
Topic:	SESAR.IR-VLD.Wave1-21-2015
Consortium Coordinator:	INDRA
Edition Date:	17 March 2020
Edition:	00.01.01
Template Edition:	02.00.01

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Document History

Edition	Date	Status	Author	Justification
00.00.01	26/08/2019	Draft	Yi Xiong	New document
00.00.02	04/11/2019	Draft	Yi Xiong	Consolidated input from ENAV
00.00.03	18/11/2019	Final Draft	Serena Rubbioli Yi Xiong	Integrated additional input from ENAV
00.00.04	20/11/2019	Final Draft	Yi Xiong	Amended based on comments received
00.00.05	25/11/2019	Final Draft	Serena Rubbioli	Added additional information on D-Notam Event Information service to take into account feedback from PJ18 SL
00.00.06	28/11/2019	Final Draft	Yi Xiong	Updated cost appraisal based on comments
00.00.07	15/01/2020	Final Draft	Yi Xiong	Updated based on SJU assessment
00.01.00	13/02/2020	Final	Yi Xiong	Restructured based on SJU assessment
00.01.01	17/03/2020	Final	Yi Xiong	Updated review and approval table

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PJ18-04a

[IMPROVED AIM INFORMATION]

This technical validation report is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 734161 under European Union's Horizon 2020 research and innovation programme.



Abstract

This document is the technical validation report of SESAR 2020 Industrial Research (IR) programme PJ.18-04a Improved AIM information with target maturity level of TRL6. The purpose is to present the results of the validation activities of PJ.18-04a described in the PJ.18-04a technical validation plan.

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1 Executive summary

PJ.18-04a designs and develops improved aeronautical (AIM) information services that provide AIM information contributing to enhanced situational awareness of information consumer. The activities of PJ.18-04a are organised with operational use in mind where the information services are developed based on the need of operational solutions within the SESAR 2020 Industrial Research (IR) programme.

In the context of PJ.18-04a, an Aeronautical Dataset Service has been developed that provides a solution for the provision of digital aeronautical datasets. The information service has been created with the objective to satisfy the need of the SESAR 2020 Solution PJ03a-04 and coupled with a wider scope which intends to meet the requirements set by ICAO regarding the provision of aeronautical datasets. **PJ.18-04a proposes the Aeronautical Dataset Service as the TRL6 solution in Wave 1.**

In addition, PJ18-04a has developed two D-NOTAM information services in support of other ATM solutions, PJ09-02 and PJ24. **These services are considered as activities supporting the validation exercises of the other ATM solutions, not as part of the solution PJ18-04a proposes for maturity assessment.**

This document presents the results of the technical validation exercise conducted by PJ18-04a. The TVALR focuses on the validation results of the Aeronautical Dataset Service targeting TRL6. However, the validation results of D-NOTAM Event Information service supporting PJ09-02 exercise are also documented in this TVALR due to the constraint of PJ09-02 that was unable to integrate these in their deliverable.

The validation exercise of the Aeronautical Dataset Service has been performed at maturity level TRL6. The main objective of the technical validations is to ensure that the developed services are “fit for purpose” in view of their potential incorporation in various ATM systems, serving various ATM operational objectives expressed by the ATM Solutions.

The exercise EXE-18-04a-TRL6-001_ECTL validating the Aeronautical Dataset Service was performed adopting two-tier approach to ensure the objective is met. The information service was technically validated against validation objectives and functional requirements, followed by an evaluation by solution PJ.03a-04 to assess the added value.

The technical validation exercise focused on the technical feasibility of the service, where the system capabilities turned out to be functional, able to provide the output (data) as expected. The follow-up evaluation showed that the ATM solution considers it to be beneficial to use this information and its data in a manner that quality and consistency are maintained.

For the Aeronautical Dataset Service, it is recommended to further refine prototype to prepare for implementation.

2 Introduction

2.1 Purpose of the document

This document presents the technical validation report of PJ.18-04a for maturity phase TRL6. The report consolidates validation results of the validation exercises described in the PJ18-04a technical validation plan. It describes the activities that have been performed to meet the validate objectives, the performed exercises performed and the outcome.

PJ.18-04a activities comprise one solution and two activities in support of other ATM solutions.

- Aeronautical Dataset service as the Solution to be proposed for TRL6
- D-NOTAM Event Information service as activity in support of PJ09-02 validation exercise.
- D-NOTAM Distribution service as activity in support PJ24 Demonstration

This document **only** addresses the validation results of Aeronautical Dataset Service targeting TRL6 and D-NOTAM Event Information service. The validation results of D-NOTAM Distribution service are documented in PJ24 Demo Report [54].

2.2 Intended readership

The intended readership of this document is PJ.18-04a partners and other solutions for which the developed AIM services primarily will serve (PJ.03a-04, PJ.09-02 and PJ.24), PJ.19, the SJU and other project partners of PJ.18 4D Trajectory Management who have an interest in aeronautical information service development.

Other ATM projects and/or architectural projects and solutions within the SESAR 2020 programme may also have an interest.

2.3 Background

In SESAR 1, AIM activities mainly focussed on the development of Digital Integrated Briefing [49] which addressed provision of AIS and MET information to pilots and dispatchers in the form of briefing products and services.

The Aeronautical Dataset Service is a new solution in SESAR 2020. The objective is to develop a SWIM service providing (ICAO) Datasets. The service is defined and developed following the guidelines defined in the SWIM Specifications. The expected outcome is a web service that is sufficiently mature to be deployed (V3), therefore this service forms the core part of the solution PJ.18-04a targeting TRL6.

The D-NOTAM services developed for PJ.09-02 and PJ.24 respectively, are considered as activities in support of other solutions where maturity depends on the customer solutions.

2.4 Structure of the document

Chapter [\[Error! No se encuentra el origen de la referencia.\]](#) provides a summary of the key information and elements contained in the document.

Chapter ¡Error! No se encuentra el origen de la referencia. informs on the purpose of the document, the intended audience, structure of the document and explains the abbreviations and acronyms used throughout the document.

Chapter ¡Error! No se encuentra el origen de la referencia. describes the general background for the technical validation report for TRL6, provides a summary of the validation plan.

Chapter ¡Error! No se encuentra el origen de la referencia. presents the technical validation results including analysis of validation results per validation objective.

Chapter ¡Error! No se encuentra el origen de la referencia. presents the conclusions and recommendations.

Chapter ¡Error! No se encuentra el origen de la referencia. lists all the applicable reference documents

2.5 Glossary of terms

Term	Definition	Source of the definition
AIR-REPORT	A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting.	ICAO Annex 3 [44]
Air Traffic Flow and Capacity Management (ATFCM)	A service complementary to Air Traffic Control (ATC), the objective of which is to ensure an optimum flow of air traffic to or through areas within which traffic demand at times exceeds the available capacity of the ATC system.	EUROCONTROL, CFMU (2002), Air Traffic Flow Management Operations: ATFM Users Manual, Edition 8.0, 18.3.2002
Air Traffic Management (ATM)	The dynamic, integrated management of air traffic and airspace including air traffic services, airspace management and air traffic flow management — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all parties	ICAO Doc 4444 [43]
Air Traffic Services (ATS)	A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service).	ICAO Doc 4444 [43]
dataset	identifiable collection of data --NOTE A dataset may be a smaller grouping of data which, though limited by some constraint such as spatial extent	ISO 19131:2007

	<p>or feature type, is located physically within a larger dataset. Theoretically, a dataset may be as small as a single feature or</p> <p>feature attribute contained within a larger dataset. A hardcopy map or chart may be considered a dataset.</p>	
aeronautical data	A representation of aeronautical facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing.	ICAO Annex 15
aeronautical information	Information resulting from the assembly, analysis and formatting of aeronautical data.	ICAO Annex 15
metadata	Data about data (ISO 19115*). Note: A structured description of the content, quality, condition or other characteristics of data.	ICAO Annex 15

Table 1: Glossary of terms

2.6 Acronyms and Terminology

Term	Definition
AIM	Aeronautical Information Management
ADD	Architecture Definition Document
AIS	Aeronautical Information Service
ASM	Airspace Management
ATFM	Air Traffic Flow Management
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
CONOPS	Concept of Operation
CVS	Combined Vision System
D-NOTAM	Digital Notice To Airmen
DCB	Demand Capacity Balance
E-ATMS	European Air Traffic Management System
E-OCVM	European Operational Concept Validation Methodology

FMP	Flow Management Position
ICAO	International Civil Aviation Organisation
IRS	Interface Requirements Specification
INAP	Integrated Network Management and extended ATC Planning
INTEROP	Interoperability Requirements
IS	Information Service
ISO	International Organization for Standardization
ISRM	Information Service Reference Model
MET	Meteorology
NOTAM	Notice To Air Men
OFA	Operational Focus Areas
OSED	Operational Service and Environment Definition
RTS	Real Time Simulation
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SPR	Safety and Performance Requirements
STAM	Short Term ATFCM Measure
SUT	System Under Test
SWIM	System-Wide Information Management
TRL	Technology Readiness Level
TS	Technical Specification
TVALP	Technical Validation Plan
TVALR	Technical Validation Report
VALP	Validation Plan
VALR	Validation Report

VALS	Validation Strategy
VLD	Very Large Demonstration
VP	Plan
VR	Report
VS	Strategy

Table 2: Acronyms and terminology

3 Context of the Technical Validation

This chapter describes the context of the technical validation. It provides a summary of PJ18-04a, the validation plan and validation exercises.

3.1 SESAR Technological Solution PJ18-04a: a summary

PJ.18-04a provides new and/or enhanced aeronautical information with the objective that this contributes, now or in the future, to an improvement of the European ATM System. These improvements are measured by validating the information in their specific use case, and where PJ.18-04a is expected to deliver information services that support these validations.

PJ.18-04a has developed three information services: an Aeronautical Dataset Service that is matured in Wave 1 and aims to reach to TRL6 and two D-NOTAM information services are considered as activities in support of other ATM solutions, PJ09-02 and PJ24. The Aeronautical Dataset service forms the solution for which the maturity should be assessed.

As an enabling services to operational solutions, PJ.18-04a has for this purpose coordinated with operational solutions to identify their need for AIM information. This has resulted in established dependencies with PJ03a-04, PJ.09-02 and PJ.24.

Based on the identified operational need, the solution contributes to the following domains which mainly contains information service development and validation for a specific (operational) scenario:

18-04a.IS.1 - AIM Information Services to support High Performing Airport Operations

18-04a.IS.2 - AIM Information Services to support Optimised ATM Network Services

SESAR Technological Solution ID	SESAR Technological Solution Description	Master Contributing (M or C)	or	Contribution to the SESAR Technological Solution short description	Enablers ref. (from EATMA)
PJ.18-04a Improved information	AIM Solution defines 18.04a and delivers technically validated AIM Information Services for identified Operational Solutions	M		Solution PJ.18-04a is centred on the identification, development and integration of AIM Information Services taking into account the needs of the operational solutions.	SVC-041 target TRL6 [CR03591] SVC-042 [CR03592]

Table 3: SESAR Technological Solution(s) under Validation

In the course of Wave 1, new enablers have been created to describe the changes that are to be realised.

The solution Aeronautical Dataset Service is covered by the new EN SVC-41 Provision of Aeronautical Dataset Service.

3.2 Summary of the Technical Validation Plan

3.2.1 Validation Plan Purpose

The PJ.18-04a technical validation objective is to validate that the developed information services are fit for purpose in view of their incorporation in various ATM systems, serving the ATM operational objectives expressed by the Operational Solutions.

According to the planned activities, the following high-level objectives are established:

- Evaluate AIM information need by ATM Solutions;
- Provide appropriate AIM information service to meet ATM Solutions’ validation objectives, and

Technical validation is considered to validate the Technical Solution on its operational usability in terms of providing the users (represented in an operational validation exercise) an indication of the confidence they will be able to place in the served information. Technical validation is conducted after verification, which is limited to verifying prototypes and provided information services against the stated requirements.

3.2.2 Summary of Technical Validation Objectives and success criteria

The technical validation plan contains validation objectives of two information services developed by the solution, the Aeronautical Dataset service and D-NOTAM Event information service. The validation objectives related to D-NOTAM Distribution service were integrated in the Demo plan of PJ.24 and results of that validation were documented in the PJ.24 Demo report.

Validation objectives of Aeronautical Dataset Service

[OBJ]

Identifier	OBJ-18.04a-TRL6-TVALP-ECTL-0010
Objective	To validate that the Aeronautical Dataset Service prototype allows query of defined aeronautical data.

Identifier	Success Criterion
CRT-18.04a-TRL6-TVALP-ECTL.0010.001	The PJ.18-04a Aeronautical Dataset Service prototype enables the query of defined required aeronautical data.

--	--

[OBJ]

Identifier	OBJ-18.04a-TRL6-TVALP-ECTL-0020
Objective	To validate that the Aeronautical Dataset Service provides the expected aeronautical data for the intended usage, in accordance with the defined query parameters.

Identifier	Success Criterion
CRT-18.04a-TRL6-TVALP-ECTL.0020.001	PJ.18-04a Aeronautical Dataset Service is capable of providing the expected aeronautical data for the intended usage through the SWIM infrastructure.

This document also contains elements of the D-NOTAM Event Information Service since PJ09-02 was not able to integrate these in their respective deliverables.

Validation objectives of D-NOTAM Event Information service

[OBJ]

Identifier	OBJ-18.04a-TRL6-TVALP-ENAV-0010
Objective	To validate that the <i>D-NOTAM Event Information</i> service provides the list of flight plans impacted by a specific D-Notam
Title	Assessment of operational needs

Identifier	Success Criterion
CRT-18.04a-TRL6-TVALP-ENAV-0010	Solution PJ.18-04a, using the D-NOTAM Event Information service, is capable to provide the list of flights impacted by a specific D-NOTAM as required in the validation exercise PJ.09-02.03 (ENAV scenario, Workflow for Ground Delay due to D-NOTAM reception).

[OBJ]

Identifier	OBJ-18.04a-TRL6-TVALP-ENAV-0020
------------	---------------------------------

Objective	To provide evidence of the exchange of D-NOTAM between CRONOS and ATFM tool ¹ .
Title	Validation of D-NOTAM provision

Identifier	Success Criterion
CRT-18.04a-TRL6-TVALP-ENAV-0020	Solution PJ.18-04a is capable to provide D-NOTAM via SWIM Infrastructure, in accordance with ISRM interface definitions.

[OBJ]

Identifier	OBJ-18.04a-TRL6-TVALP-ENAV-0030
Objective	To provide evidence of the functionality of calculating the list of Flight Plan impacted by a specific D-NOTAM.
Title	Capability of calculating the Flight Plans impacted by a D-NOTAM

Identifier	Success Criterion
CRT-18.04a-TRL6-TVALP-ENAV.0030	Solution PJ.18-04 is capable to calculate the list of Flight Plan impacted by a D-NOTAM and to provide this information via SWIM Infrastructure, in accordance with ISRM interface definitions.

3.2.3 Technical Validation Assumptions

The following assumption are applicable for the validation exercises. Specific validation assumptions are detailed for each exercise and described in the appropriate sections.

¹ that are the platforms involved in the Validation Exercise EXE-09-02.03

Identifier	Title	Type of Assumption	Description	Justification	Flight Phase	KPA Impacted	Source	Value(s)	Owner	Impact on Assessment
ASS-18.04a-001	Platform availability	Ground Tools / Technology	All tools needed will be available to run the validation exercise	Pre-condition to perform the validation	N/A		N/A	N/A	PJ.18-04a	
ASS-18.04a-002	Know-how on prototypes	Usage of prototypes from user side	The participants shall know how to use prototypes to be able to perform actions on the system	Pre-condition to perform the validation	N/A		N/A	N/A	PJ.18-04a	
ASS-18.04a-003	Know-how on AIXM 5.x temporality concept		The participants (NOTAM operators) are familiar with the AIXM 5.x temporality concept;	Pre-condition to develop the service	N/A		N/A	N/A	PJ18-04a	

Table 4: Technical Validation Assumptions overview

3.2.4 Technical Validation Exercises List

The validation objectives listed in 3.2.2 are validated in two validation exercises, performed by PJ18-04a and PJ09-02 respectively.

- Aeronautical Dataset service validated in EXE-18-04a-TRL6-001_ECTL
- D-NOTAM Event Information service validated in EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03)

[EXE]

Identifier	EXE-18-04a-TRL6-001_ECTL
Title	Aeronautical Dataset Service
Description	To validate that the PJ.18-04a Aeronautical Dataset Service prototype can provide the operational required aeronautical information, as an enhanced AIM service.
Expected achievements	Technical feasibility, support to situational awareness improvement
TRL	TRL6
T. Validation Technique	Laboratory test
Start Date	01/06/2019
End Date	30/07/2019
T. Validation Coordinator	Walter van Hamme Yi Xiong
T. Validation Platform	PRISME platform
T. Validation Location	Brussels EUROCONTROL HQ
Status	Validated
Dependencies	The technical validation exercise comprises the PJ.18-04a verification of the Aeronautical Dataset Service prototype and the operational usability of the data and/or aeronautical information service following the coordination with experts from the dependency Operational Solution PJ.03a-04.

[EXE]

Identifier ²	EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03)
-------------------------	--

² Source: PJ09-02: Validation Plan (VALP) for V2 – Part I v. 00.01.08 (12 March 2018) – see section 4.5 Validation Exercise List

Title	ASM/DCB Integration and collaborative constraint management Assessment of nuisance alerts
Description	<p>This exercise will investigate the scope of the requirements, processes and procedures associated to integration of ASM into DCB and collaborative constraint management, as well as it will test the initial INAP position and the relationship among functionalities, systems and actors. To that aim all the ANSP prototypes need to connect with INNOVE in a RTS mode. The topics to be validated in this exercise include:</p> <ul style="list-style-type: none"> • Increase situational awareness through the efficient management of airspace and constraints, including synchronisation and considering the preferences and priorities from the partners involved. • What-if network impact assessment, taking into account the confidence index. <p>This exercise will count with the collaboration of different partners' prototypes willing to connect with INNOVE to ensure the integration of ASM into DCB and to ensure a collaborative constraint management between the local DCB tools and the network.</p>
Expected achievements	<p>This exercise expects achievements based on the following OIs:</p> <ul style="list-style-type: none"> • CM-0104-B: Automated support to INAP (Integrated Network Management and ATC Planning) function • DCB-0210: Full integration of Dynamic Airspace Configurations into DCB. • CM-0302: Ground based Automated Support for Managing Traffic Complexity Across Several Sectors.
TRL	<TRL 4>
V Phase	<V2>
T. Validation Technique	<Real Time Simulation>
Start Date ³	29/01/2019
End Date ⁴	30/01/2019
T. Validation Coordinator	ENAIRES

³ wrt the section part of validation exercise, where the D-NOTAM Event Information service has been validated

⁴ wrt the section part of validation exercise, where the D-NOTAM Event Information service has been validated

T. Validation Platform	INNOVE with local platforms connected via B2B (ENAV IDS ATFM tool + CRONOS tool)
T. Validation Location	Rome (ENAV Premises)
Status	<validated>
Dependencies	<ul style="list-style-type: none"> • Link with exercise EXE 09-02.01: INAP Processes & Knowledge Management. • Link with exercise EXE 09-02.02: Initial INAP: DCB/ATC link. • Coordination needed with EXE 09-01.02 (Improved Demand Prediction).

3.3 Deviations

3.3.1 Deviations with respect to the SJU Project Handbook

No deviation with respect to the SJU Project Handbook

3.3.2 Deviations with respect to the Technical Validation Plan

No deviation with respect to the SJU Project Handbook

4 SESAR Technological Solution PJ.18-04a Validation Results

4.1 Summary of SESAR Technological Solution PJ.18-04a Validation Results

This section presents a summary of the validation results of the solution Aeronautical Dataset Service.

SESAR Technological Solution Technical Validation Objective ID	SESAR Technological Solution Technical Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technical Validation Objective Status
OBJ-18.04a-TRL6-TVALP-ECTL-0010	Query parameters	CRT-18.04a-TRL6-TVALP-ECTL.0010.001	The PJ.18-04a Aeronautical Dataset Service prototype enables the query of defined required aeronautical data.	The result shows a list of pre-defined parameters comprise title, geographical scope, limitation, period of validity, dataset series were available for query purposes.	OK
OBJ-18.04a-TRL6-TVALP-ECTL-0020	Data output	CRT-18.04a-TRL6-TVALP-ECTL.0020.001	PJ.18-04a Aeronautical Dataset Service is capable of providing the expected aeronautical data for the intended usage through the SWIM infrastructure.	Query was performed on the available datasets based on define query parameters. As output, a file with required dataset was available for retrieval. The airport ground lights datasets of four airports were made available for the query. The query could be performed by inputting Airport names or designators	OK

SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution Validation Results	SESAR Technological Solution
Technical Validation Objective ID	Technical Validation Objective Title	Success Criterion ID	Success Criterion		Technical Validation Objective Status
				and it returned a list of dataset that meets the criteria.	

Since it was not feasible to integrate the validation results of the D-NOTAM Event Information Service in the PJ.09-02 VALR, the results are therefore included in the table below.

SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution Validation Results	SESAR Technological Solution
Technical Validation Objective ID	Technical Validation Objective Title	Success Criterion ID	Success Criterion		Technical Validation Objective Status
OBJ-18.04a-TRL6-TVALP-ENAV-0010	Assessment of operational needs	CRT-18.04a-TRL6-TVALP-ENAV-0010	Solution PJ.18-04a, using the D-NOTAM Event Information service, is capable to provide the list of flights impacted by a specific D-NOTAM as required in the validation exercise PJ.09-02.03 (ENAV scenario, Workflow for Ground Delay due to D-NOTAM reception).	During the second part of the EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03), a pop-up on the screen of the ATFM tool has shown to the user information on a specific D-NOTAM (event : closure of an airport) and the list of the flights impacted by that event. The list contains both landing and departing flights for the airport planned to be closed within a certain timeframe.	OK

SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution Validation Results	SESAR Technological Solution
Technical Validation Objective ID	Technical Validation Objective Title	Success Criterion ID	Success Criterion		Technical Validation Objective Status
OBJ-18.04a-TRL6-TVALP-ENAV-0020	Validation of D-NOTAM provision	CRT-18.04a-TRL6-TVALP-ENAV-0020	Solution PJ.18-04a is capable to provide D-NOTAM via SWIM Infrastructure, in accordance with ISRM interface definitions.	During the second part of the EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03), the user is warned that a D-NOTAM will be affecting his/her operations (e.g. area of interest, traffic to be managed). D-NOTAM warning shows NOTAM ID, Location, Reason, timeframe. The user may query the D-NOTAM full text.	OK
OBJ-18.04a-TRL6-TVALP-ENAV-0030	Capability of calculating the Flight Plans impacted by a D-NOTAM	CRT-18.04a-TRL6-TVALP-ENAV-0030	Solution PJ.18-04a is capable to calculate the list of Flight Plan impacted by a D-NOTAM and to provide this information via SWIM Infrastructure, in accordance with ISRM interface definitions.	During the second part of the EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03), the list of flights impacted by the received D-NOTAM received has been calculated in real time. The screen of the ATFM tool has shown information on a specific D-NOTAM (event : closure of an airport) and the list of the flights impacted by that event.	OK

Table 5: Summary of Technical Validation Exercises Results

4.2 Detailed analysis of SESAR Technological Solution Validation Results per Validation objective

4.2.1 OBJ-18.04a-TRL6-TVALP-ECTL-0010 Results

The objective aims to validate that the Aeronautical Dataset Service prototype allows query of defined aeronautical data and to cover the requirements REQ-18-04a-TS-ECT1.0010 and REQ-18-04a-TS-ECT1.0030 defined in the PJ.18-04a TS/IRS.

The result shows that the objective has been met.

The Service is deployed on a test infrastructure with a web interface that allows query for the defined aeronautical data(sets). A list of pre-defined parameters comprise title, geographical scope, limitation, period of validity, dataset series were available for query purposes.

Attributes that are defined to perform the query can be found in the service definition document attached to PJ18-04a TS/IRS.

4.2.2 OBJ-18.04a-TRL6-TVALP-ECTL-0020 Results

The objective aims to validate that the Aeronautical Dataset Service provides the expected aeronautical data for the intended usage, in accordance with the defined query parameters. The requirement REQ-18-04a-TS-ECT1.0020 was covered.

The result shows that the objective has been met.

Query was performed on the available datasets based on define query parameters. As output, a file with required dataset was available for retrieval. The airport ground lights datasets of four airports were made available for the query. The query could be performed by inputting Airport names or designators and it returned a list of dataset that meets the criteria.

4.2.3 OBJ-18.04a-TRL6-TVALP-ENAV-0010 Results

This objective was validated by exercise EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03).

The objective aims to validate that the prototype used in the exercise 09-02.03 is capable to provide the list of flights impacted by a specific D-NOTAM to cover the requirements REQ-18-04a-TS-ENAV.0060 and REQ-18-04a-TS-ENAV.0070 defined in the PJ.18-04a TS/IRS.

The result shows that the objective has been met.

The user has been prompted with the list of flights impacted by the received D-NOTAM affecting his/her operations. The list included both landing and departing flights for the airport planned to be closed within a certain timeframe. For that airport and within the closure timeframe, all the planned landing flights are by default to be delayed at departure.

4.2.4 OBJ-18.04a-TRL6-TVALP-ENAV-0020 Results

This objective was validated by exercise EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03).

Founding Members

The objective aims to validate that the prototype used in the exercise 09-02.03 is capable to provide D-NOTAM to cover the requirements REQ-18-04a-TS-ENAV.0060 and REQ-18-04a-TS-ENAV.0070 defined in the PJ.18-04a TS/IRS.

The result shows that the objective has been met.

The user was warned that a D-NOTAM was affecting his operations (e.g. area of interest, traffic to be managed). D-NOTAM warning showed NOTAM ID, Location, Reason and Timeframe. The user was able to query the D-NOTAM full text. The D-NOTAM referred to an Italian airport closure.

4.2.5 OBJ-18.04a-TRL6-TVALP-ENAV-0030 Results

This objective was validated by exercise EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03).

The objective aims to validate that the prototype used in the exercise 09-02.03 is capable to calculate the list of Flight Plan impacted by a specific D-NOTAM and to provide this information via SWIM Infrastructure, to cover the requirements REQ-18-04a-TS-ENAV.0050 defined in the PJ.18-04a TS/IRS.

The result shows that the objective has been met.

The user received the list of flights impacted by a specific D-NOTAM, calculated by the prototype used in the validation exercise.

4.3 Confidence in the Validation Results

4.3.1 Limitations of Technical Validation Results

Validation results of Aeronautical Dataset Service

The service has been designed to provide datasets and dataset series for consumers who require this type of information. In the context of Wave 1, dataset samples related to airport ground lights have been used in coordination with PJ03a-04. However, the scope of the service is to cover five categories of datasets as defined by ICAO Annex 15, these are:

- AIP data set
- Obstacle data set
- Terrain data set
- Airport mapping data set
- Instrument flight procedure data set

The attributes of the query parameter have been defined as such that any of these datasets could be queried using defined attributes.

Following the technical validation, the service has been proven to be able to perform functions as required. Since the validation only addressed the specific case (i.e. ground lights data of four airports), although it demonstrated that the information was provided according to the requirements, however the full potential of the service has not been explored when large amount of data samples are available.

Validation results of D-NOTAM Event Information service

During the execution of PJ09-02.03 validation exercise the exchange of information⁵ provided by the D-NOTAM Event Information service has been demonstrated according to the requirements and also the usage of that information in order to provide STAM measure.

Since the validation only addressed the specific event (i.e. closure of an airport) the full potential of the service has not been explored.

4.3.1.1 Quality of Technical Validation Exercises Results

Quality of technical validation exercise EXE-18-04a-TRL6-001 ECTL results

The service aims to provide datasets that have been made available by other sources through a web service and the output of the validation was as expected, there was no change in the quality of the data.

As described in the PJ.18-04a TVALP, the validation exercise also aims to assess the value of the service from a customer perspective, therefore the operational solution PJ.03a-04 was invited to assess whether the service and information provided are fit to their purpose. As a result, the outcome met the need expressed by PJ.03a-04 to have digital dataset of ground lighting data of a specific airport, in this case the data samples were four airport from the United States. The data were provided in a machine-readable format to ensure the quality and consistency.

Feedback from PJ03a-04:

“The solution PJ.03a-04 has tested provided Aeronautical dataset web service prototype. The service is based on a query of defined aeronautical data stored in a database. Primary interest of PJ.03a-04 is in digital dataset of ground lighting data of a specific airport. In the database, four different datasets of ground lighting data from different airports in the US were found. The query tasks were fully functional and provided 100% match with the user's requests which indicate a high quality of the service. The tested service provides an important benefit to PJ.03a-04 solution.”

For the quality of validation exercise 09.02-03b, please refer to the section C.4.4 of [41].

The D-NOTAM Event Information service aims to provide information about D-NOTAM and the list of flights impacted by it, so the output of the validation was as expected. The required level of quality has been reached.

As a result, the outcome met the need expressed by PJ.09-02 to have the list of flights impacted by a D-NOTAM in order to contribute to the measure proposal sent to the Stakeholders.

4.3.1.2 Significance of Technical Validation Exercises Results

Significance of technical validation exercise EXE-18-04a-TRL6-001 ECTL results

⁵ The list of flight impacted by a specific D-NOTAM referred to an airport closure

Solution PJ.18-04a was designed to develop aeronautical information service that meet the need of operational solutions. The significant of the results should therefore measure by the perceived added value by the operational solutions.

Solution PJ.03a-04 supported the evaluation of the information service, considered that the web service is useful and could have more benefit when more data samples were available. The web service is considered to be used in support of similar activity in Wave 2.

Feedback from PJ.03a-04:

“The solution PJ.03a-04 requested to test four different datasets of ground lighting data from different airports in the US. All tested queries were successfully resolved with no mismatch. The significance of the validation task is for the purposes of PJ.03a-04 good enough.”

Solution PJ.09-02 supported the evaluation of the D-NOTAM Event Information service, considered that the service provides data useful to decide which STAM measure can be exchanged with an adjacent ANSP. The service can be used for each kind of D-NOTAM event.

5 Conclusions and recommendations

5.1 Conclusions

The technical validation results show that the validation objectives have been met.

Both Aeronautical Dataset service information service and D-NOTAM Event information service have provided output as required.

The technical validation exercise focused on the technical feasibility of the service, where the system capabilities turned out to be functional, able to provide the output (data) as expected. The follow-up evaluation showed that the ATM solution consider it to beneficial to use this information and its data in a manner that quality and consistency are maintained.

5.1.1 Conclusions on SESAR Technological Solution maturity

The target maturity of the solution is TRL6 where the Aeronautical Dataset Service is considered as the core of the solution. D-NOTAM services are considered as activity in support of other solutions where maturity is linked with the maturity of the ATM solutions.

Regarding D-NOTAM Event Information service, with respect to the TRL4 validation an improvement on the Infrastructure Validation has been performed towards TRL6 in terms of the prototypes: service interfaces are defined, developed and integrated into appropriate Industry Based Platforms (IBP) and validated in a research environment.

5.1.2 Conclusions on technical feasibility

The two information services validated in the context of the solutions have demonstrated that the required information can be provided through these services, i.e. technically feasible.

5.1.3 Conclusions on performance assessments

As a technological solution that develops information service. The performance should be assessed when the service is used in an operational context, which is beyond the scope of this solution.

5.2 Recommendations

Regarding Aeronautical Dataset service, it is recommended to refine the interface to adapt for deployment as the solution believes that the prototype has demonstrated its technical feasibility and proven to be useful.

As highlighted in the section on limitations, the scope and capabilities of the web service is wider than in the validation context. It should provide datasets defined by ICAO Annex 15 to in order to provide the benefit of having one service that is fit for all dataset needs.

About D-NOTAM Event Information service one recommendation for all stakeholders is to promote the use of Open Architecture and standardized service interfaces.

5.2.1 Recommendations for next phase

Regarding Aeronautical Dataset service, the solution believes that it is ready for deployment. It is recommended for any service provider who are interested in providing datasets to adopt the service definition and start implementing an instance of this service.

Concerning the prototype, it is envisaged that this service could be further refined to support activities in Wave 2 by providing more datasets as needed.

About D-NOTAM Event Information service, it could be used by other prototypes integrated into appropriate Industry Based Platforms (IBP) and validated in an operational environment.

5.2.2 Recommendations for updating ATM Master Plan Level 2

No specific recommendation for updating ATM Master Plan Level 2. A specific enabler (SVC-041) has been created to describe the Aeronautical Dataset service and another one (SVC-042) to describe D-NOTAM services.

5.2.3 Recommendations on regulation and standardisation initiatives

The Aeronautical Dataset Service is defined in accordance with the existing SWIM Specifications for Service Description, Information Definition and Technical Infrastructure Yellow Profile [50][51][52]. The extended purpose of the service is to support the concept of aeronautical information product *digital data set* as defined by ICAO Annex 15.

In general, the service is fully conformant to the existing standards.

Also D-NOTAM Event Information service is conformant to the existing standards since it has been defined in accordance with the SWIM Specifications for Service Description, Information Definition and Technical Infrastructure Yellow Profile.

6 References

6.1 Applicable Documents

Content Integration

- [1] B.04.01 D138 EATMA Guidance Material
- [2] EATMA Community pages
- [3] SESAR ATM Lexicon

Content Development

- [4] B4.2 D106 Transition Concept of Operations SESAR 2020

System and Service Development

- [5] 08.01.01 D52: SWIM Foundation v2
- [6] 08.01.01 D49: SWIM Compliance Criteria
- [7] 08.01.03 D47: AIRM v4.1.0
- [8] 08.03.10 D45: ISRM Foundation v00.08.00
- [9] B.04.03 D102 SESAR Working Method on Services
- [10] B.04.03 D128 ADD SESAR1
- [11] B.04.05 Common Service Foundation Method

Performance Management

- [12] B.04.01 D108 SESAR 2020 Transition Performance Framework
- [13] B.04.01 D42 SESAR2020 Transition Validation
- [14] B.05 D86 Guidance on KPIs and Data Collection support to SESAR 2020 transition.
- [15] 16.06.06-D68 Part 1 –SESAR Cost Benefit Analysis – Integrated Model
- [16] 16.06.06-D51-SESAR_1 Business Case Consolidated_Deliverable-00.01.00 and CBA
- [17] Method to assess cost of European ATM improvements and technologies, EUROCONTROL (2014)
- [18] ATM Cost Breakdown Structure_ed02_2014
- [19] Standard Inputs for EUROCONTROL Cost Benefit Analyses

[20]16.06.06_D26-08 ATM CBA Quality Checklist

[21]16.06.06_D26_04_Guidelines_for_Producing_Benefit_and_Impact_Mechanisms

Validation

[22]03.00 D16 WP3 Engineering methodology

[23]Transition VALS SESAR 2020 - Consolidated deliverable with contribution from Operational Federating Projects

[24]European Operational Concept Validation Methodology (E-OCVM) - 3.0 [February 2010]

System Engineering

[25]SESAR Requirements and V&V guidelines

Safety

[26]SESAR, Safety Reference Material, Edition 4.0, April 2016

[27]SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016

[28]SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015

[29]SESAR, Resilience Engineering Guidance, May 2016

Human Performance

[30]16.06.05 D 27 HP Reference Material D27

[31]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

[32]SESAR, Environment Reference Material, alias, “Environmental impact assessment as part of the global SESAR validation”, Project 16.06.03, Deliverable D26, 2014.

[33]ICAO CAEP – “Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes” document, Doc 10031.

Security

[34]16.06.02 D103 SESAR Security Ref Material Level

[35]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[36]16.06.02 D131 Security Database Application (CTRL_S)

6.2 Reference Documents

- [37] ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.⁶
- [38] Common assumptions for CBAs as maintained by Pj19 (provisionally the ones included in the 16.06.06- D68_Part 1, New CBA Model and Methods 2015, Edition 00.01.01 can be used)
- [39] PJ09-02: Validation Plan (VALP) for V2 - Part I v.00.01.08
- [40] PJ09 OSED for V2 – Part I v.00.00.02
- [41] PJ09-02 VALR, edition 01.00.00
- [42] ICAO Annex 15 Aeronautical Information Service, Ed.16, November 2018.
- [43] ICAO Doc.4444 Procedures for Air Navigation Services Air Traffic Management Sixteenth Edition, 2016
- [44] ICAO Annex 3 Meteorological Service for International Air Navigation, 19th Edition, 2016
- [45] PJ.03a-04 Validation Plan (VALP)
- [46] PJ.24 Demo Plan PJ24 NCM D1.1, edition 01.02.05, dated 25 Feb 2019
- [47] D4.1.140 PJ.18-04a TS/IRS, Ed 00.01.00
- [48] D4.1.070 PJ.18-04a TVALP, Ed.00.01.02, Date 15 March 2019
- [49] SESAR 1 Solution#34 Release 5 Digital Integrated Briefing
- [50] EUROCONTROL Specification for SWIM Service Description (Ed. 1.0)
- [51] EUROCONTROL Specification for SWIM Information Definition (Ed 1.0)
- [52] EUROCONTROL Specification for SWIM Technical Infrastructure Yellow Profile (Ed 1.0)
- [53] PJ09-02-03 Availability Note, edition 00.01.00
- [54] D1.2 PJ24 NCM Demonstration Report, Edition 00.01.00, date 30 October 2019

Appendix A Technical Validation Exercise #1 Report

A.1 Summary of the Technical Validation Exercise #1 Plan

This section provides details about the validation exercise EXE-18-04a-TRL6-001_ECTL. It summarises the technical validation plan, describes the validation exercise and presents the results.

A.2 Technical Validation Exercise #1 description and scope

The scope of technical validation exercise EXE-18-04a-TRL6-001_ECTL is to validate the development of the Aeronautical Dataset Service prototype, which is providing pre-defined digital data sets containing required aeronautical data. The Aeronautical Dataset Service is supporting the SESAR2020 PJ.03a-04 on Enhanced Visual Operations, by allowing the Combined Vision System (CVS) to access specified aerodrome data, terrain and obstacle data for defined aerodromes in accordance with specified quality requirements.

The technical validation exercise aims to validate the following validation objectives with corresponding success criteria:

- To validate that the Aeronautical Dataset Service prototype allows query of defined aeronautical data.
- To validate that the Aeronautical Dataset Service provides the expected aeronautical data for the intended usage, in accordance with the defined query parameters.

The following scenarios were considered:

- Required aeronautical data fulfilling the requirements of PJ.03a-04 Enhanced Visual Operations developments on content and quality requirements is provided as an improved AIM information service.
- The aeronautical datasets providing the required aeronautical data for PJ.03a-04 Enhanced Visual Operations developments are provided through the Aeronautical Dataset Service, though SWIM enabled service.

Furthermore, the Aeronautical Dataset Service is a new service implementation that has been validated using the PRISME validation platform, a dedicated web interface developed by EUROCONTROL, data is hosted on an internal server. The validation method is laboratory testing and platform domain is AIM. [Summary of Exercise #1 Technical Validation Objectives and success criteria](#)

The technical validation exercise addressed the following technical validation objectives and corresponding success criteria and link with technical requirements:

[OBJ]

Identifier	OBJ-18.04a-TRL6-TVALP-ECTL-0010
Objective	To validate that the Aeronautical Dataset Service prototype allows query of defined aeronautical data.
Title	Query parameters

Category	<technical feasibility>
Key environment conditions	Aeronautical data exchange environment
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	PJ.03a-04
<COVERS>	<ATMS Requirement>	REQ-18-04a-TS-ECT1.0010
<COVERS>	<ATMS Requirement>	REQ-18-04a-TS-ECT1.0030

[OBJ Suc]

Identifier	Success Criterion
CRT-18.04a-TRL6-TVALP-ECTL.0010.001	The PJ.18-04a Aeronautical Dataset Service prototype enables the query of defined required aeronautical data.

[OBJ]

Identifier	OBJ-18.04a-TRL6-TVALP-ECTL-0020
Objective	To validate that the Aeronautical Dataset Service provides the expected aeronautical data for the intended usage, in accordance with the defined query parameters.
Title	Data output
Category	<technical feasibility>
Key environment conditions	Aeronautical data exchange environment
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	SESAR Solution	PJ.03a-04
<COVERS>	<ATMS Requirement>	REQ-18-04a-TS-ECT1.0020
<COVERS>	<ATMS Requirement>	REQ-18-04a-TS-ECT1.0040
<COVERS>	<ATMS Requirement>	REQ-18-04a-TS-ECT1.0050

[OBJ Suc]

Identifier	Success Criterion
CRT-18.04a-TRL6-TVALP-ECTL.0020.001	PJ.18-04a Aeronautical Dataset Service is capable of providing the expected aeronautical data for the intended usage through the SWIM infrastructure.

A.4 Summary of Technical Validation Exercise #1 Validation scenarios

Reference scenario:

- Aeronautical Dataset Service through SWIM enabled service is currently not defined.

Solution scenarios

- Required aeronautical data fulfilling the requirements of PJ.03a-04 Enhanced Visual Operations developments on content and quality requirements is provided as an improved AIM information service.
- The aeronautical datasets providing the required aeronautical data for PJ.03a-04 Enhanced Visual Operations developments are provided through the Aeronautical Dataset Service, though SWIM enabled service.

A.5 Summary Technical Validation Exercise #1 Assumptions

The exercise took into account one assumption:

Identifier	Title	Type of Assumption	Description	Justification	Flight Phase	KPA Impacted	Source	Value(s)	Owner	Impact on Assessment
ASS-18.04a-001	Platform availability	Ground Tools / Technology	All tools needed will be available to run the validation exercise	Pre-condition to perform the validation	N/A		N/A	N/A	PJ.18-04a	

Table 6: Technical Validation Assumptions overview

The only relevant assumption is that the platform and data are available for the validation exercise.

A.6 Deviation from the planned activities

The technical validation exercise has been conducted by PJ18-04a, not by PJ03a-04 which was the intention at the beginning of the project.

PJ.03a-04 was unable to validate the information service in their validation exercise due to different plan. Although the input of PJ.03a-04 was used in this validation exercise as a means to evaluate the usefulness of the service.

A.7 Technical Validation Exercise #1 Validation Results

A.7.1 Summary of Technical Validation Exercise #1 Results

SESAR Technological Solution Technical Validation Objective ID	SESAR Technological Solution Technical Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technical Validation Objective Status
OBJ-18.04a-TRL6-TVALP-ECTL-0010	Query parameters	CRT-18.04a-TRL6-TVALP-ECTL.0010.001	The PJ.18-04a Aeronautical Dataset Service prototype enables the query of defined required aeronautical data.	The result shows a list of pre-defined parameters comprise title, geographical scope, limitation, period of validity, dataset series were	OK

				available for query purposes.	
OBJ-18.04a-TRL6-TVALP-ECTL-0020	Data output	CRT-18.04a-TRL6-TVALP-ECTL.0020.001	PJ.18-04a Aeronautical Dataset Service is capable of providing the expected aeronautical data for the intended usage through the SWIM infrastructure.	Query was performed on the available datasets based on define query parameters. As output, a file with required dataset was available for retrieval. The airport ground lights datasets of four airports were made available for the query. The query could be performed by inputting Airport names or designators and it returned a list of dataset that meets the criteria.	OK

Table 7: Technical Validation Results EXE-18-04a-TRL6-001_ECTL

1. Results on technical feasibility

The results of the technical validation exercise shows that the information service was able to provide the data(set) as required and it is technically feasibility to provide these information through the developed web interface.

2. Results per KPA

As the prototype only addresses information service where no associated operational activities. KPAs were not in the scope of the validation exercise.

A.7.2 Analysis of Exercise #1 Results per Technical Validation objective

This section provides a consolidated analysis per validation objective

1. OBJ-18.04a-TRL6-TVALP-ECTL-0010 Result

The objective aims to validate that the Aeronautical Dataset Service prototype allows query of defined aeronautical data and to cover the requirements REQ-18-04a-TS-ECT1.0010 and REQ-18-04a-TS-ECT1.0030 defined in the PJ.18-04a TS/IRS.

The result shows that the objective has been met.

The Service is deployed on a test infrastructure with a web interface that allows query for the defined aeronautical data(sets). A list of pre-defined parameters comprise title, geographical scope, limitation, period of validity, dataset series were available for query purposes.

Attributes that are defined to perform the query can be found in the service definition document attached to PJ18-04a TS/IRS. Query could be performed either using free text (e.g. for countries, airport, airspace and region territories) or selection from drop down menu (see picture below).

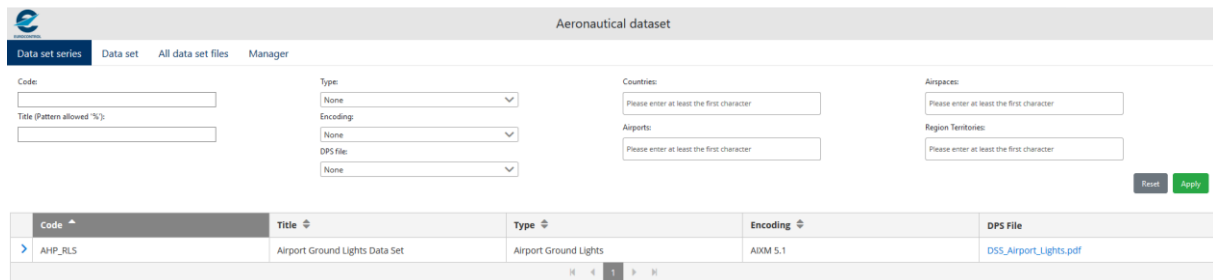


Figure 1: OBJ-18.04a-TRL6-TVALP-ECTL-0010 Result

2. OBJ-18.04a-TRL6-TVALP-ECTL-0020 Result

The objective aims to validate that the Aeronautical Dataset Service provides the expected aeronautical data for the intended usage, in accordance with the defined query parameters.

The result shows that the objective has been met.

Query was performed on the available datasets based on define query parameters. As output, a file with required dataset was available for retrieval. The airport ground lights datasets of four airports were made available for the query. The query could be performed by inputting Airport names or designators and it returned a list of dataset that meets the criteria (see picture below).

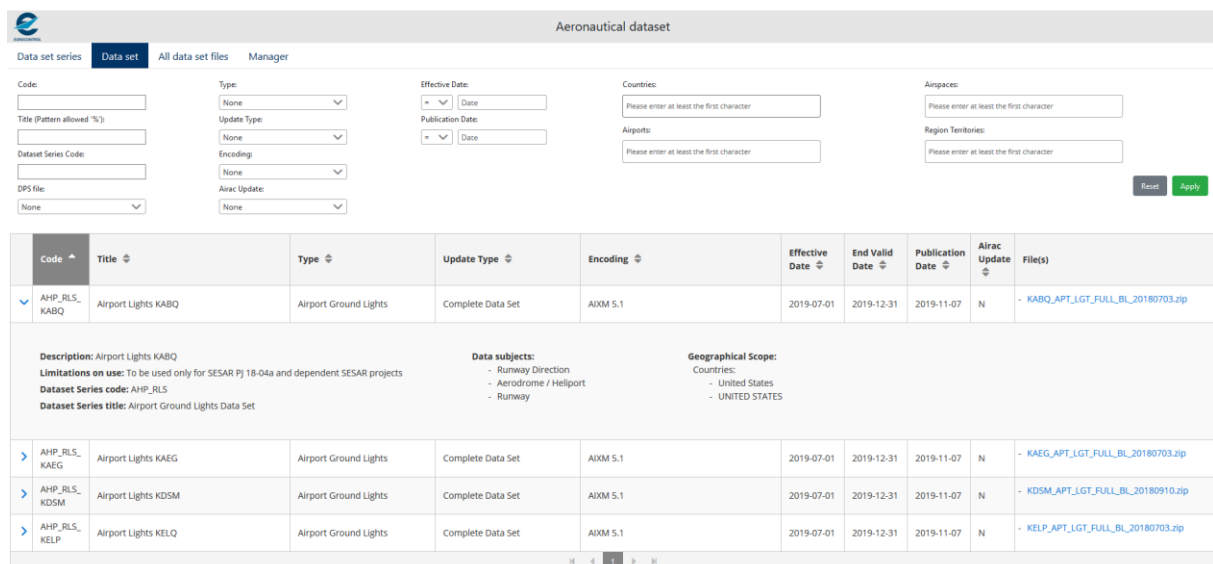


Figure 2: OBJ-18.04a-TRL6-TVALP-ECTL-0020 Result

A.8 Unexpected Behaviours/Results

There was no unexpected behaviour or results

A.9 Confidence in Results of Validation Exercise #1

1. Level of significance/limitations of Technical Validation Exercise Results

The service has been designed to provide datasets and dataset series for consumers who require this type of information. In the context of Wave 1, dataset samples related to airport ground lights have been used in coordination with PJ03a-04. However, the scope of the service is to cover five categories of datasets as defined by ICAO Annex 15, these are:

- AIP data set
- Obstacle data set
- Terrain data set
- Airport mapping data set
- Instrument flight procedure data set

The attributes of the query parameter have been defined as such that any of these datasets could be queried using defined attributes.

Following the technical validation, the service has been proven to be able to perform functions as required. Since the validation only addressed the specific case (i.e. ground lights data of four airports), although it demonstrated that the information was provided according to the requirements, however the full potential of the service has not been explored when large amount of data samples are available.

2. Quality of Technical Validation Exercises Results

The service aims to provide datasets that have been made available by other sources through a web service and the output of the validation was as expected, there was no change in the quality of the data.

As described in the PJ.18-04a TVALP, the validation exercise also aims to assess the value of the service from a customer perspective, therefore the operational solution PJ.03a-04 was invited to assess whether the service and information provided are fit to their purpose. As a result, the outcome met the need expressed by PJ.03a-04 to have digital dataset of ground lighting data of a specific airport, in this case the data samples were four airport from the United States. The data were provided in a machine-readable format to ensure the quality and consistency.

Feedback from PJ03a-04:

“The solution PJ.03a-04 has tested provided Aeronautical dataset web service prototype. The service is based on a query of defined aeronautical data stored in a database. Primary interest of PJ.03a-04 is in digital dataset of ground lighting data of a specific airport. In the database, four different datasets of ground lighting data from different airports in the US were found. The query tasks were fully

functional and provided 100% match with the user's requests which indicate a high quality of the service. The tested service provides an important benefit to PJ.03a-04 solution.”

3. Significance of Technical Validation Exercises Results

Solution PJ.18-04a was designed to develop aeronautical information service that meet the need of operational solutions. The significant of the results should therefore measure by the perceived added value by the operational solutions.

Solution PJ.03a-04 supported the evaluation of the information service, considered that the web service is useful and could have more benefit when more data samples were available. The web service is considered to be used in support of similar activity in Wave 2.

Feedback from PJ.03a-04:

“The solution PJ.03a-04 requested to test four different datasets of ground lighting data from different airports in the US. All tested queries were successfully resolved with no mismatch. The significance of the validation task is for the purposes of PJ.03a-04 good enough.”

A.10 Conclusions

The technical validation results show that the validation objectives have been met.

The technical validation exercise focused on the technical feasibility of the service, where the system capabilities turned out to be functional, able to provide the output (data) as expected. The follow-up evaluation showed that the ATM solution consider it to beneficial to use this information and its data in a manner that quality and consistency are maintained.

1. Conclusions on technical feasibility

The Aeronautical Dataset Service has demonstrated that the required information can be provided through these services, i.e. technically feasible.

2. Conclusions on performance assessments

As a technological solution that develops information services, the performance should be assessed when the service is used in an operational context, which is beyond the scope of this solution.

A.11 Recommendations

The solution believes that it is ready for deployment. It is recommended for any service provider who are interested in providing datasets to adopt the service definition and start implementing an instance of this service.

Concerning the prototype, it is envisage that this service could be further refined to support activities in Wave 2 by providing more datasets as needed.

Appendix B Technical Validation Exercise #02 Report

Details of the validation results of the D-NOTAM Event Information Service are presented due to the constraint of PJ.09-02 of not being able to integrate this in their VALR.

B.1 Summary of the Technical Validation Exercise #02 Plan

D-NOTAM Event Information service has been validated in the second part of validation exercise EXE-09.02.03, that is fully described within Appendix C of the PJ09-02 VALR [41].

In particular, a summary of the EXE-09.02.03 Plan is reported in Appendix C1 of the PJ.09-02 VALR [41].

Deviations from the Validation Plan are described in section B.6B.6.

B.2 Technical Validation Exercise #1 description and scope

Validation exercise EXE09.02-03 description and scope have been reported Appendix C.1.1 of [41].

EXE-09.02-03 has been implemented through two sessions of validation, the second one addressing the Flight Level Capping measure application and the validation of the AIM service defined in the context of PJ18-04a-IS.02 – AIM Information Services to Support Optimised ATM Network services: the Ground Delay triggered by a D-NOTAM reception about the closure of an airport (please see Table #18 - **Summary of Validation Scenarios per EXE09.02-03 sub-exercise** in [41] .

B.3 Summary of Exercise #2 Technical Validation Objectives and success criteria

For the Validation objectives of ENAV EXE-09-02.03, please refer to the section 5.3.3.2 - *ENAV Validation Objectives* of [39].

The technical validation objectives, related to D-NOTAM Event Information service has been described within[48]. For convenience, they are reported in the table below:

SESAR Validation Objective	Solution	SESAR Success criteria	Solution	Coverage and comments on the coverage of SESAR Validation Objective in Exercise 001	Exercise Validation Objective	Exercise Success criteria
OBJ-18.04a-TRL6-TVALP-ENAV-0010		Solution PJ.18-04a, using the D-NOTAM Event Information service, is capable		Fully covered	Please refer to PJ09-02 VALP [39] ⁷	Please refer to PJ09-02 VALP [39]

⁷ The validation of **D-NOTAM Event Information** service is performed in the context of solution PJ09-02.

	to provide the list of flights impacted by a specific D-NOTAM as required in the validation exercise PJ.09-02.03 (ENAV scenario, Workflow for Ground Delay due to D-NOTAM reception).			
OBJ-18.04a-TRL6-TVALP-ENAV-0020	Solution PJ.18-04 is capable to provide D-NOTAM via SWIM Infrastructure, in accordance with ISRM interface definitions.	Fully covered	Please refer to in PJ09-02 VALP[39]	Please refer to in PJ09-02 [39]
OBJ-18.04a-TRL6-TVALP-ENAV-0030	Solution PJ.18-04 is capable to calculate the list of Flight Plan impacted by a D-NOTAM and to provide this information via SWIM Infrastructure, in accordance with ISRM interface definitions.	Fully covered	Please refer to in PJ09-02 VALP[39]	Please refer to in PJ09-02 VALP [39]

B.4 Summary of Technical Validation Exercise #2 Validation scenarios

For more details, please refer to section 5.3.4.2 - *ENAV Validation Scenarios* of [39]).

B.4.1 Reference Scenario(s)

Please refer to section 5.3.4.2.1 – *Reference Scenario(s)* of [39].

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B.4.2 Solution Scenario(s)

Validation exercise EXE 09-02.03 will consist on a Real Time Simulation, based on the operational scenarios and use cases described in SESAR PJ.09S03 OSED (v. 00.00.02 – 04 July 2017).

In EXE 09-02.03 two different situations in an operating environment will be evaluated in order to assess the achievement of the exercise validation objectives:

- Solution Scenario represents a traffic situation where SESAR Operational Improvements addressed by this validation exercise are included.
- Reference Scenario represents the same traffic situation as in the Solution Scenario, except for not including the Operational Improvements addressed by the exercise.

For details please refer to 5.3.4.2.2 – *Solution Scenario(s)* of [39].

B.5 Summary Technical Validation Exercise #2 Assumptions

The table below lists the assumptions under which the exercise is done. The assumptions captured in this table are those that may have an impact on the validation results for the validation exercise EXE-09-02.03.

Identifier	Title	Type of Assumption	Description	Justification	Flight Phase	KPA Impacted	Source	Value(s)	Owner	Impact on Assessment
ASS-18.04 a-001	Platform availability	Ground Tools / Technology	All tools needed will be available to run the validation exercise	Pre-condition to perform the validation	N/A		N/A	N/A	PJ.18-04a	
ASS-18.04 a-002	Know-how on prototypes	Usage of prototypes from user side	The participants shall know how to use prototypes to be able to perform actions on the system	Pre-condition to perform the validation	N/A		N/A	N/A	PJ18-04a	

ASS-18.04a-003	Knowledge on AIXM 5.x temporality concept		The participants (NOTAM operators) are familiar with the AIXM 5.x temporality concept;	Pre-condition to develop the service	N/A		N/A	N/A	PJ18-04a
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Table 8: Technical Validation Assumptions overview

B.6 Deviation from the planned activities

No deviations from the planned activities have been identified at the moment of writing this document.

B.7 Technical Validation Exercise #2 Validation Results

B.7.1 Summary of Technical Validation Exercise #2 Results

SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution	SESAR Technological Solution Validation Results	SESAR Technological Solution
Technical Validation Objective ID	Technical Validation Objective Title	Success Criterion ID	Success Criterion		Technical Validation Objective Status
OBJ-18.04a-TRL6-TVALP-ENAV-0010	Assessment of operational needs	CRT-18.04a-TRL6-TVALP-ENAV-0010	Solution PJ.18-04a, using the D-NOTAM Event Information service, is capable to provide the list of flights impacted by a specific D-NOTAM as required in the validation exercise PJ.09-02.03 (ENAV scenario, Workflow for Ground Delay due	During the second part of the EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03), a pop-up on the screen of the ATFM tool has shown to the user information on a specific D-NOTAM (event : closure of an airport) and the list of the flights impacted	OK

			to D-NOTAM reception).	by that event. The list contains both landing and departing flights for the airport planned to be closed within a certain timeframe.	
OBJ-18.04a-TRL6-TVALP-ENAV-0020	Validation of D-NOTAM provision	CRT-18.04a-TRL6-TVALP-ENAV-0020	Solution PJ.18-04a is capable to provide D-NOTAM via SWIM Infrastructure, in accordance with ISRM interface definitions.	During the second part of the EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03), the user is warned that a D-NOTAM will be affecting his/her operations (e.g. area of interest, traffic to be managed). D-NOTAM warning shows NOTAM ID, Location, Reason, Timeframe. The user may query the D-NOTAM full text.	OK
OBJ-18.04a-TRL6-TVALP-ENAV-0030	Capability of calculating the Flight Plans impacted by a D-NOTAM	CRT-18.04a-TRL6-TVALP-ENAV-0030	Solution PJ.18-04a is capable to calculate the list of Flight Plan impacted by a D-NOTAM and to provide this information via SWIM Infrastructure, in accordance with ISRM interface definitions.	During the second part of the EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03), the list of flights impacted by the received D-Notam has been calculated in real time. The screen of the ATFM tool has shown information on a specific D-Notam (event : closure of an airport) and the list of the flights impacted by that event.	OK

Table 9: Technical Validation Results D-NOTAM Event Information service

In the table below are listed the results of the Technical Validation of D-NOTAM Event Information service (in green) with reference to the workflow for the ground delay due to DNOTAM reception:

No.	Test action	Expected result	Pass
1.	User monitor Traffic Counts on active sectors within a look-ahead time.	-	-
2.	The user can query traffic load with a list of flight contributing to the load of the sector.	-	-
3.	Then the user is warned that a D-NOTAM will be affecting his/her operations (e.g. area of interest, traffic to be managed).	D-NOTAM warning shows NOTAM ID, Location, Reason, timeframe	OK
4.	The user queries the D-NOTAM full text.	The D-NOTAM refers to an airport closure	OK
5.	The user is prompted with the list of affected flights.	The list contains both landing and departing flights for the airport planned to be closed within a certain timeframe.	OK
6.	For that airport and within the closure timeframe, ALL the planned landing flights are by default to be delayed at departure.	The list of ground delayed flights is highlighted to the user.	OK
7.	The user triggers ground delay solution process.	The planned landing flights receive a draft delay proposals according to the landing time order and timeframe window.	OK
8.	User can either accept the proposed delay or optionally override the amount of delay.	The list with delay is visible to the user that can identify flights that have impact on Switzerland and need coordination	OK
9.	The user sends the measure proposal to Stakeholders.	Stakeholders are NM and/or Skyguide for the ITA SWISS flights only. For CH-originated flights, user propose a delay on Swiss departing flights affected by the closing airport.	OK

10.	The user receive counterproposal, if any, from Stakeholder	Feedback from Skyguide	OK
11.	The user evaluates the proposed feedback	-	-
12.	The user decide to accept/refuse	-	-

Table 10: D-NOTAM Event Information service validation results

1. Results on technical feasibility

The results of the technical validation exercise shows that the information service was able to provide the information required to satisfy the operational need and it is technically feasibility to provide these information through the developed interfaces.

2. Results per KPA

As the prototype only addresses information service where no associated operational activities. KPAs were not in the scope of the validation exercise.

B.7.2 Analysis of Exercise #2 Results per Technical Validation objective

This section provides a consolidated analysis per validation objective.

1. OBJ-18.04a-TRL4-TVALP-ENAV-0010 Result

This objective was validated by exercise EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03).

The objective aims to validate that the prototype used in the exercixe 09-02.03 is capable to provide the list of flights impacted by a specific D-NOTAM to cover the requirements REQ-18-04a-TS-ENAV.0060 and REQ-18-04a-TS-ENAV.0070 defined in the PJ.18-04a TS/IRS.

The result shows that the objective has been met.

The user has been prompted with the list of flights impacted by the received D-NOTAM affecting his/her operations. The list included both landing and departing flights for the airport planned to be closed within a certain timeframe. For that airport and within the closure timeframe, all the planned landing flights are by default to be delayed at departure.

As an example, please see the pitcure below that shows the ATFM tool form for the creation of a new measure of type “GROUND DELAY” applied to the flights list impacted by the D-Notam:

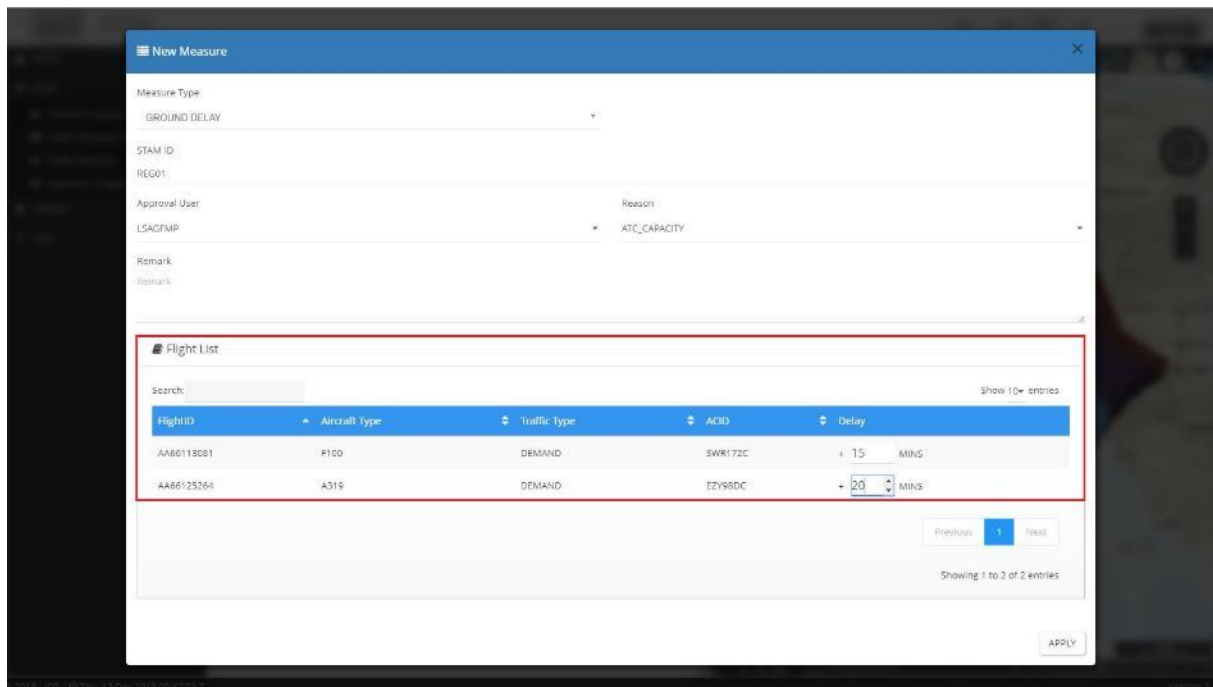


Figure 3: OBJ-18.04a-TRL4-TVALP-ENAV-0010 Result – Measure Ground Delay applied to the list of flights impacted by a D-NOTAM

2. OBJ-18.04a-TRL4-TVALP-ENAV-0020 Result

This objective was validated by exercise EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03).

The objective aims to validate that the prototype used in the exercise 09-02.03 is capable to provide D-NOTAM to cover the requirements REQ-18-04a-TS-ENAV.0060 and REQ-18-04a-TS-ENAV.0070 defined in the PJ.18-04a TS/IRS.

The result shows that the objective has been met.

The user was warned that a D-NOTAM was affecting his operations (e.g. area of interest, traffic to be managed). D-NOTAM warning showed NOTAM ID, Location, Reason and Timeframe. The user was able to query the D-NOTAM full text. The D-NOTAM referred to an Italian airport closure.

For details on D-NOTAM, please see the next validation objective.

3. OBJ-18.04a-TRL4-TVALP-ENAV-0030 Result

This objective was validated by exercise EXE-PJ09.02-V2-VALP-003 (EXE 09-02.03)

The objective aims to validate that the prototype (CRONOS) used in the exercise 09-02.03 is capable to calculate the list of Flight Plan impacted by a specific D-NOTAM and to provide this information via SWIM Infrastructure, to cover the requirements REQ-18-04a-TS-ENAV.0050 defined in the PJ.18-04a TS/IRS.

The result shows that the objective has been met.

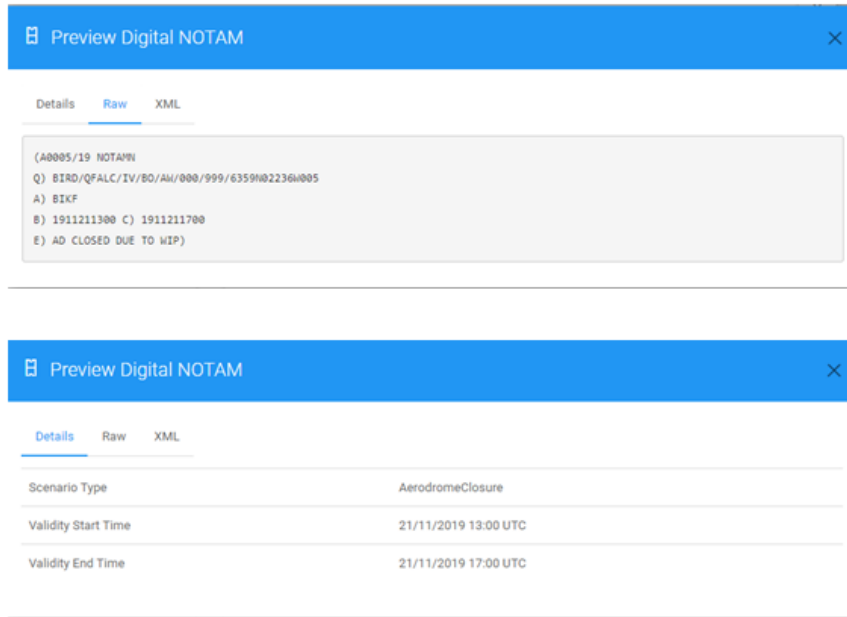


Figure 5: D-NOTAM Preview – Details

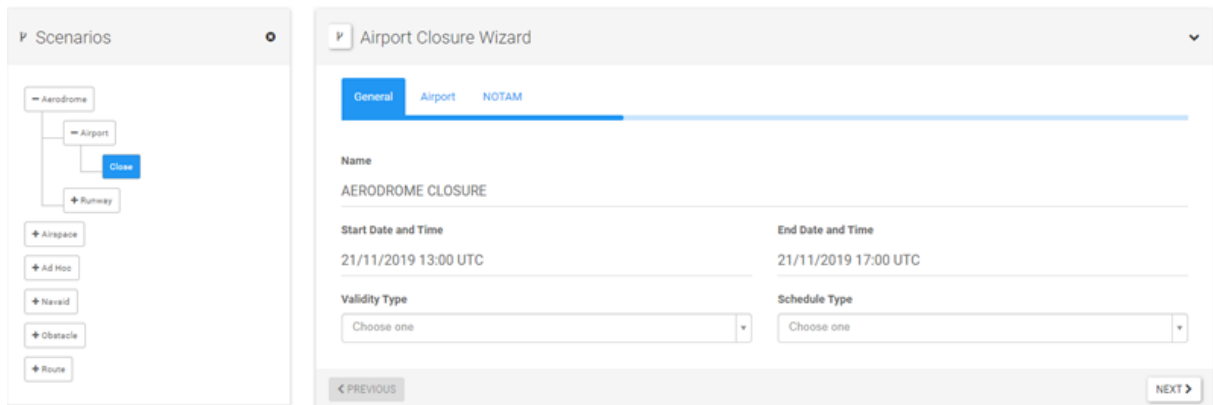


Figure 6: Airport Closure wizard (General tab)

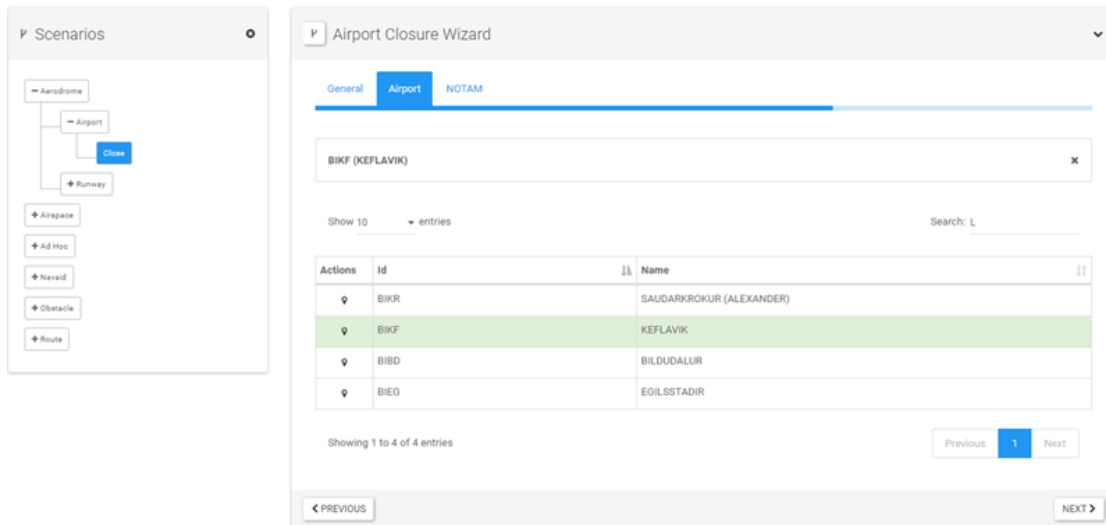


Figure 7: Airport Closure wizard (Airport tab)

B.8 Unexpected Behaviours/Results

There was no unexpected behaviour or results.

B.9 Confidence in Results of Validation Exercise #2

Please refer to section C.4.4 of [41] for details on confidence in results of Validation Exercise EXE 09.02.03-b.

1. Level of significance/limitations of Technical Validation Exercise Results

Following the technical validation, the D-NOTAM Event Information service has been proven to be able to perform functions as required. Since the validation only addressed the specific case/D-NOTAM (event: closure of an airport), although it demonstrated that the information was provided according to the requirements, however the full potential of the service has not been explored.

2. Quality of Technical Validation Exercises Results

The service aims to provide information about D-NOTAM and the list of flights impacted by it, so the output of the validation was as expected. The required level of quality has been reached.

As a result, the outcome met the need expressed by PJ.09-02 to have the list of flights impacted by a D-NOTAM in order to contribute to the measure proposal sent to the Stakeholders.

3. Significance of Technical Validation Exercises Results

Solution PJ.18-04a was designed to develop D-NOTAM Event Information service that meet the need of operational solutions. The significant of the results should therefore measure by the perceived added value by the operational solutions.

Solution PJ.09-02 supported the evaluation of the D-NOTAM Event Information service, considered that the service provides data useful to decide which STAM measure can be exchanged with an adjacent ANSP. The service can be used for each kind of D-NOTAM event.

B.10 Conclusions

The technical validation results show that the validation objectives have been met.

An improvement on the Infrastructure Validation has been performed towards TRL6 in terms of the prototypes (service interfaces) are defined, developed and integrated into appropriate Industry Based Platforms (IBP) and validated in a research environment.

1. Conclusions on technical feasibility

The D-NOTAM Event Information service has demonstrated that the required information can be provided through this service, i.e. technically feasible.

2. Conclusions on performance assessments

As a technological solution that develops information services, the performance should be assessed when the service is used in an operational context, which is beyond the scope of this solution.

B.11 Recommendations

One Recommendation for all stakeholders is to promote the use of Open Architecture and standardized service interfaces.

Appendix C Safety Assessment Report (SAR)

PJ.18-04a focuses on evolution of technology and systems, or capabilities that generate or provide new or enhanced AIM information services. The purpose is to provide information in a new manner (based on SWIM) or with better quality. The activities do not undermine or drastically change the existing AIM information provision required for safe operation.

During the service development phase, requirements from applicable international standards/specifications were taken into account, i.e. ICAO Annex 15 on Aeronautical Information Service and EUROCONTROL Specification for Service Definition and Technical Infrastructure Yellow Profile. The Aeronautical Dataset service as defined in PJ-18-04a TS/IRS is considered safe because meeting the requirements defined by ICAO Annex 15 and SWIM technical infrastructure. Based on this rationale no dedicated SESAR safety assessment was conducted.

Appendix D Security Assessment Report (SecAR)

High-level security requirements have been provided in the PJ.18-04a TS/IRS and PJ.18-04a has completed security assessment questionnaire in coordination with PJ.19-04. The solution considers that security assessment should be performed by ATM solutions where infrastructure is built for providing the services.

Appendix E Human Performance Assessment Report (HPAR)

PJ.18-04a is a technological solution focusing evolution of technology and systems. The activities in PJ.18-04a address information provision in which the role of human is very limited. The validation exercises validate whether the developed services are able to provide the information required, in this process, human intervention is not necessary, therefore consideration of human performance is not needed in this regard.

Following the validation exercise, it is envisaged that more accurate and timely information could lead to better situation awareness. However that will depends on the quality of data and how the data are used by a specific operation or user, which is out of the scope of this solution.

Appendix F SESAR Technological Solution(s) Maturity Assessment

A self-maturity assessment has been conducted and results can be found in the column M of the attached spreadsheet.

It should be emphasised that the core of the solution is the Aeronautical Dataset Service (TRL6) based on which these self-maturity assessment criteria are considered.



PJ.18-04a
Self-maturity assessr

Appendix G High level Economic Appraisal

The high level economic appraisal only addresses the Aeronautical Dataset Service developed by PJ.18-04a. The D-NOTAM services are considered as components of the ATM solutions they support, therefore the economical appraisal of the D-NOTAM services should be considered from the perspective of the ATM solutions.

G.1 Reference Scenario

The reference scenario is that the Aeronautical Dataset service is not available and digital datasets could not be provided and there are no provider of datasets information in a centralised manner. The consumer of this type of information will need to contact each individual information provider for the datasets.

The required information would be provided and transferred in a conventional manner where data quality and consistency cannot be ensured. Exchange of this information would be on a bilateral basis between a provider and a consumer. A need for a dataset should be specifically requested with clearly defined parameters.

G.2 Solution Scenario

The solution scenario is that the Aeronautical Dataset service is implemented and deployed by a service provider, e.g. State AIS, data processing organisation, Regional AIM, etc. The provider of this service would be able to provide the required datasets (defined by ICAO Annex 15) of their own region or on behalf of other regions.

The consequence would be that service could be considered as a one-stop-shop for digital datasets information of a specific state or region. This reduces the number of exchanges between providers and consumers. A single provider would be able to provide the required datasets for any consumers through the service.

Maturity of the prototype

As a result of the technical validation exercise, the service has demonstrated sufficient maturity to be further refined for implementation. The results show that existing prototype is already able to provide the required datasets. The further refinement could entail fine-tuning the interface and populate the service with more data. The IOC could be in the very near future.

One POI (POI-0031) and one EN (SVC-041) have been created for the solution and this service. The estimated IOC date is 31-12-2024.

During the development of the prototype, the following costs were incurred which gives a good estimate of the total cost of the service.

Capital expenditure

The service is designed and developed by EUROCONTROL, hosted on EUROCONTROL PRISME platform. The total development costs amounted to 40,000€.

Operating expenditure

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It is envisaged that to host and maintain the service, an estimate of 10,000€ is required on a yearly basis.

It is not envisaged that EUROCONTROL will provide this service. The purpose of developing this prototype is to demonstrate the feasibility of providing this type of information through a SWIM service. The incurred costs are only representative for the prototyping purpose, not fully representative for the complete deployment.

Potential benefits

The potential benefits would be that a single provider should be able to provide datasets for any consumers. When expanding this to the ECAC level, a potential scenario could be that all AIS providers within the ECAC area will implement this service and provide datasets of their territories to any consumers around of the world.

Since the scope of this solution only addresses the design and development of the service, the potential benefits are the provision of digital information in a centralised manner, thereby meeting the requirements defined by ICAO Annex 15. Potential contribution to cost efficiency (CEF) could be envisaged that, **ideally**, a single provider or a small number providers could provide all required datasets, which will lead to a small number of systems are needed at ECAC level to provide the service. This means we do not have unnecessary instantiations of systems with bilateral exchanges. However, this is an ideal vision that has not been investigated, therefore the potential benefits cannot be monetised yet as direct impact on KPA cannot be determined.

