



# Final Project Report

## Document information

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## **Abstract**

This document, the Final Report of Project 06.05.05, provides a summary of the goals and achievements of project 06.05.05.

The aim of the project P06.05.05 was to develop operational concepts for improved usage of meteorological data within the airport domain. This included the evaluation of the individual impact of various weather parameters on the operational airport environment and resulted in an agreed set of meteorological requirements, which was then translated into a decision rule framework to serve the purpose of standardized and predictable operational decisions. The project has sought to achieve this through collaboration with other operational airport projects, industrial partners and Meteorological service providers

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## Acronyms

Acronym	Definition
AOP	Air Traffic Management
APOC	Airport Operations Centre
ATC	Air Traffic Control
ATM	Air Traffic Management
DCB	Demand Capacity Balancing
E-OCVM	European Operational Concept Validation Methodology
EUROCAE	European Organisation for Civil Aviation Equipment
HMI	Human Machine Interface
ICAO	International Civil Aviation Organisation
INTEROP	Interoperability Requirements
IWIS	Improved Weather Information Systems
IWXXM	ICAO Meteorological Information Exchange Model
KPA	Key Performance Area
MET	Meteorological Department/Unit
OFA	Operational Focus Area
OI	Operational Improvement
OSD	Operational Service and Environment Definition
PIR	Project Initiation Report
SESAR	Single European Sky ATM Research Programme
SESAR Programme	The programme which defines the Research and Development activities and Projects for the SJU
SJU	SESAR Joint Undertaking
SPR	Safety and Performance Requirements
SWIM	System Wide Information Management
VALR	Validation Report
WISADS	Weather Information System Airport and Decision Support

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# 1 Project Overview

Project 06.05.05 improved the usage of weather data in collaborative airport planning, operation and APOC procedures and processes, including the usage of weather forecasts to trigger airport operational changes. Necessary requirements were derived and an evaluation of HMIs produced by industrial Partners in P12.07.05 and P12.6.03 was undertaken

## 1.1 Project progress and contribution to the Master Plan

The Project Initiation report (PIR), published in August 2010, highlighted that the aim of the project was to enhance the use of available airport capacity through the improvement of MET-ATM interfaces. It thereby considered MET-Data as part of the information provided through an APOC, which can be accessed and be individually used by various stakeholders.

In addition, it was highlighted that the project, as a contributing project to Consolidated Business Services (L1) "Demand & Capacity Balancing Services", would focus on development of operational concepts for an improved MET-ATM interface (as part of a future APOC environment) aiming at an operational decision support functionality through higher predictability of weather impact on airport operations. The project intended to develop and validate operational concepts appropriate for ensuring the solution meets stakeholder needs and expectations

After the V1 Validation it was discovered that the original planning would leave numerous gaps in interfaces between projects with context to airport environment. As a result it was decided that those projects should be merged into one overarching operational focus area.

The creation of the OFA05.01.01 - Airport Operations Management - was not without impact on the overall execution of the project. Indeed P06.05.05 was required to align all goals and deadlines between all involved projects within the OFA. As a result, a number of the deliverables produced by P06.05.05 have been done in the context of the OFA05.01.01 and the specific contribution of P06.05.05 has been formalized according to SJU guidelines.

Subsequently, a set of MET requirements was developed in cooperation with all OFA05.01.01 partners and APOC Stakeholders (Airport Authorities, Air Traffic Management, De-Icing Agents, etc.), as well as MET service Providers, in order to provide the overall APOC process (Steer Airport Performance, Monitor Airport Performance, Manage Airport Performance, Post-Operation Analysis) with relevant MET data.

These MET requirements were the basis for the development of the 06.05.05 contribution for the OFA05.01.01 OSED/SPR/INTEROP documents.

According to the roadmap, P06.05.05 contributed to the Master Plan by addressing the OI-steps MET-0101 (Enhanced operational planning decisions) through the V3 (EXE-06.03.01-VP-669: Close out Airport Integration through SWIM).

DCB-0309 (Airport Demand Capacity Balancing) and AO-0801 (Collaborative Airport Planning Interface) are also addressed at that exercise and all three are linked to solution 21 - Airport Operations Plan and AOP-NOP Seamless Integration - and solution 35 - MET Information Exchange. AO-0804 was addressed through the V2 (VP-668) validation.

The methodologies and platforms used, in this case the Finmeccanica platform, are, according to the 06.03.01 D09-002 Validation Plan (V2), part of the OFA05.01.01 and E-OCVM.

The following enablers were covered:

- METEO-01: Integrates & delivers weather information owned by ATM ground systems
- METEO-03: Provision and monitoring of accurate real-time weather information

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- METEO-04b: Generate and provide MET information relevant for airport and TMA related operations, Step 1
- SWIM-STD-09a: Use of standard for SWIM meteorological information services content

The work of the project and the OFA focusses primarily on four OI-Steps as follows:

Code	Name	Project contribution	Maturity at project start	Maturity at project end
MET-0101	Enhanced operational planning decisions through MET information Integration	Development of Met-requirements for airport processes	V1	V2
AO-0801	Collaborative Airport Planning Interface	More accurate MET-data was made available to communicate with the NOP.	V1	V2
AO-0804	Collaborative Airport Performance Management	Suitable Data Set for MET based capacity prediction	V1	V2
DCB-0309	Airport Demand Capacity Balancing	Production of MET-requirements for supporting of the OFA05.01.01	V1	V2

## 1.2 Project achievements

Following the creation of the OFA, the project introduced Change Request (1254) in July 2012 as a means of better aligning itself with the OFA05.01.01. In particular, this Change Request promoted the restructuring of tasks and deliverables of P06.05.05 and to move from OSED, SPR and INTEROP at the project level toward a wider contribution at the OFA level.

As a result and main achievement, the project produced a consolidated list of requirements (consisting of data and HMI requirements) for a wide number of existing and newly designed Airport processes (within OFA05.01.01: Steer, Monitor and Manage Airport Performance Processes). They define, for example, process and data availability in the APOC.

Project 06.05.05 identified a need to use translated MET data in decision support tools. As a result meteorological requirements were defined and categorised as follows:

- General MET requirements
- Technical MET requirements
- MET parameters
- Derived parameters

Furthermore, P06.05.05 looked into the recurring articulation for more accurate and reliable MET data in current formats. As a result of physical and mathematical constraints, improving accuracy and reliability of MET forecasts in those current formats and data contents was hardly possible. Information, such as probabilistic forecasting as a new methodology, seemed feasible as a method to further enhance the performance of the overall system by adding valuable information about probability and accuracy of events.

Therefore, the MET data included probabilistic MET forecasts as well as data derived from Decision Support Tools displaying (probabilistic) impact parameters (e.g. adverse weather, de-icing category).

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MET data based decision rules were implemented in the so called rules engine, and were agreed amongst the stakeholders through the steer airport performance service. Probability thresholds, which trigger operational changes, were established and enabled an improvement of the overall performance not only in adverse conditions. Those thresholds also continuously were evolved by the steer airport performance service. This System was and is applicable for both, short term planning phase and execution phase.

Summarizing, the achieved operational environment consists of the following MET items:

- Standardized and agreed set of MET data from consistent sources
- HMI Evaluation
- Probabilistic forecast of weather elements

As Benefit mechanism, Project 06.05.05 identified operational decision support through higher predictability of weather impact on airport operations and enhanced use of available airport capacity through the improvement of MET interfaces for AOP.

### 1.3 Project Deliverables

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

Reference	Title	Description
D04	MET-HMI mock-up technical description	In this document a “First Set of MET Data relevant for ATM” and the “Operational Service and Environment Definition (OSED) ATM-Interpretation scheme for MET-Data” is presented to the user. It describes, which MET data operators enter into the system and how they do it. In addition it is shown how the data is presented to users on the “receiving end” in order to interpret them and feed their conclusions back into the system.
D05	Validation Report V1	The proposed MET-dataset for DCB environment and a MET-data interpretation scheme for the APOC were presented and discussed with various airport stakeholders. The feedback collected from this expert group and a “paper-validation” is summarized and structured in this validation report document.
D06	Contribution to OFA05.01.01 OSED Ed. 2	The purpose of this document is to study the usage and influence of weather data in APOC procedures and present an agreed set of meteorological data requirements. Project 06.05.05 collected and developed all MET requirements from operational projects within OFA05.01.01 and contributed the MET aspects to the: <ul style="list-style-type: none"> <li>- Steer Airport Performance Service</li> <li>- Monitor Airport Performance Service</li> <li>- MET needs in terms of Performance rules, Performance framework, Performance baseline, Specific AOP content and Post-Operations Analysis.</li> </ul>
D07	Contribution to SPR Ed. 1	This SPR document for OFA05.01.01 – Airport Operations Management - describes the performance requirements in a V2 maturity level

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		<p>associated to the Key Performance Areas Predictability, Efficiency and Flexibility.</p> <p>The safety and performance requirements in this SPR address the MET-requirements at a V1 maturity level.</p>
D08	Contribution to INTEROP Ed.1	<p>This document describes how and when the meteorological data is used to trigger airport operational changes.</p> <p>06.05.05 was part of the task group INTEROP developing the requirements involving MET in cooperation with project 06.06.02.</p>
D09	V2 Validation Report (VALR)	<p>This V2 validation report presents the results of the P06.05.05 validation and provides evidence of the usability of Adverse Conditions management within the APOC concept. The validation exercises were designed as functionality tests using the gaming technique on two prototypes.</p>
D09-02	Validation Plan (V2)	<p>This document provides information about the V2 validation preparation and the validation process.</p> <p>The activities were planned to aim at checking that the MET requirements defined in OFA OSED 05.01.01 are implemented and that the data provided can be used within the APOC.</p>
D10	Contribution to P06.05.04 D16 OFA05.01.01. OSED Ed. 3	<p>P06.05.05 updated all MET requirements for the OSED Ed.3 derived from the validation findings of 06.05.05 and all the other OFA projects. The updated MET requirements were reviewed and checked by OFA projects 06.06.02, 06.05.03, 12.07.05, 12.06.03, 15.04.9c, 11.2.</p> <p>Compared to OSED2, 18 MET requirements were updated, 8 were deleted and 18 new requirements were added, 109 REQs remained unchanged.</p>

In terms of deliverables D05 (Validation Report V1), D09 (V2 Validation Report (VALR)) and D09-02 (Validation Plan V2) more information is provided as follows.

At a very early stage of the project, in the V1 validation a first set of MET data (D02) was evaluated by an expert group of APOC stakeholders and was based only on interviews, since no system was available. The results were documented in the validation report V1.

The methodology for the V2 and V3 validation was based on fast time simulation, whereby, as described in the validation plans, the difference between V2 and V3 validation was, that for the V2 validation only an „isolated“ IWIS and WISADS was available. Thus it was not possible to validate, if the APOC process was improved by the use of the systems IWIS and WISADS, which were developed by projects 12.06.03 and 12.07.05.

For the V3 validation it was planned to have an integrated system available **to measure the exact quality of the results with the integration of the overall APOC process (several APOC stakeholders).** Relevant information about the outcome of the V3 validation can be found in the V3 Validation Report, which belongs to the project’s complementary activities and which is under production.

Even though the outcome of the validations had been mainly of qualitative nature the results served as a useful baseline to develop the requirements and scenarios for the contribution to several editions of the OFA05.01.01 OSED, SPR and INTEROP.

## 1.4 Contribution to Standardisation

After the alignment to OFA05.01.01, project 06.05.05's main scope was to derive requirements for meteorological data and decision support for APOC processes. In that capacity, no direct contribution to standardisation activity like IWXXM or technical developments like SWIM was foreseen, as this was an activity for MET-Service-Providers and industry partners.

The material currently generated by the OFA05.01.01 (OSED, SPR, INTEROP) has not yet been translated into recognised standards and norms (e.g. EUROCAE) although it is likely that in the near future this process will start as the various SESAR Solutions reach V3 maturity and progress forward into deployment.

## 1.5 Project Conclusion and Recommendations

Project 06.05.05 defined a set of MET data, which will help making airport management more efficient and predictable. Besides that, the project found that more effort shall be used to integrate probabilistic MET forecasting in decision and rule making processes.

Project 06.05.05 would recommend more work to be performed in the integration of MET-Data and probabilistic MET forecasting into APOC Processes, particularly with the key stakeholders (Airport Authorities, MET, ATC, Ground handling, etc.). Likewise, more attention shall be paid on the usability of HMLs (human machine interfaces) or GUIs (graphical user interfaces)

Within OFA05.01.01 there are some validation exercises, which provide a particularly good opportunity for testing the collaborative processes to be employed within the APOC, taking into account probabilistic MET forecasting, to work more efficient and predictable.

Within SESAR2020 programme, all OI-Steps MET-0101 (Enhanced operational planning decisions through MET information Integration), AO-0801 (Collaborative Airport Planning Interface), AO-0804 (Collaborative Airport Performance Management) and DCB-0309 (Airport Demand Capacity Balancing) provide the opportunity to take forward the work originally planned in P06.05.05 Integrated Airport Operations.

## 2 References

- [1] SESAR Programme Management Plan, Edition 03.00.01
- [2] [European ATM Master Plan](#)
- [3] Multilateral Framework Agreement (“MFA”) signed between the SJU, EUROCONTROL and its 15 selected members on August 11, 2009, amended on 14 June 2010, 19 October 2010 and 2 July 2012
- [4] WPB.01 Integrated Roadmap version DS14 release note, D82, 00.01.00, July 01, 2015
- [5] SESAR Business Guidance Ed 01.00.00, dated 6th February 2015
- [6] SESAR ENV Assessment Process 3 (ERM methodology update) Ed 02.00.01, dated 29th January 2015
- [7] SESAR Human Performance Reference Material - Guidance Ed 00.01.00, dated 15th December 2010
- [8] Guidance on Scenarios & Assumptions for Primary Project Validation Exercises for Step 1 Ed 00.01.01, dated 15 December 2011
- [9] SESAR P06.02 Delivery of VALP EXE 669 ENAV proposition, Ed 00.01.00, dated 18th march 2015
- [10] SESAR P06.05.04 OFA 05.01.01 Operational Service and Environment Definition Part 1, dated March 31st 2015, Ed 00.03.01
- [11] P06.05.04 OFA 05.01.01 OSED; D08; Ed 00.02.02; October 9, 2013
- [12] SESAR P06.05.04 OFA 05.01.01 Preliminary Safety and Performance Requirements Document, Ed 00.02.01, dated July 7th 2015
- [13] P06.05.04 D16 – OFA 05.01.01 Consolidated OSED Ed 3 , dated 24th December 2014
- [14] Airport CDM Implementation Manual Ed 4, dated April 2012
- [15] Latest P06.05.05 project approved baseline, 25th November 2014
- [16] D04 - Technical Description Ed 00.01.00, dated 10th October 2011
- [17] D05 - Validation Report First Paper Validation Ed 00.00.02, dated 21st February 2012
- [18] D06 - Delivery Note Project 06.05.05 Ed 00.01.00, dated 6th May 2013
- [19] D07 - Delivery Note Project 06.05.05 Ed 01.00.00, dated 12th March 2013
- [20] D08 - Delivery Note Project 06.05.05 Contribution to INTEROP Ed 00.01.00, dated 3rd September 2013
- [21] D09-01 - Delivery Note Project 06.05.05 Contribution to INTEROP Ed 00.00.04, dated 28th April 2014
- [22] D09-02 - V2 Validation Report (VALR) Ed 00.00.08, dated 9th September 2014
- [23] D10 - Delivery Note Project 06.05.05 Ed 00.01.00, dated 15th December 2014

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