Final Project Report

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Abstract

Project P07.06.01 addressed how the Collaborative NOP will support the DCB and dDCB concepts aimed at achieving SESAR Step 1 (Time Based) objectives. Network operations in Step1 were driven by enhanced stakeholders' participation in a rolling collaborative process by continuously sharing latest demand and capacity intentions, defining targeted measures in the network operations plan, realising the plan taking into account operational updates, evaluating operations against performance targets and updating the plan. This resulted in an optimised European ATM network

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This deliverable consists of SJU foreground.

Acronyms

Acronym	Definition
ATM	Air Traffic Management
ACC	Area Control Centre
ANSP	Air Navigation Service Provider
AOP	Airport Operations Plan
API	Arrival Planning Information
APOC	Airport Operations Centre
APT	Airport
ASM	Airspace Management
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATSU	Air Traffic Service Unit
AU	Airspace User
B2B	Business-to-Business
CDM	Collaborative Decision Making
CTOT	Calculated Take-Off Time
DS	Data Set
DCB	Demand Capacity Balancing
dDCB	Dynamic Demand Capacity Balancing
DPI	Departure Planning Information
E-OCVM	European Operational Concept Validation Methodology
FMP	Flow Management Position
FO	Flight Object
INAP	Integrated Network management & ATC Planning

KPA	Key Performance Area
KPI	Key Performance Indicator
NM	Network Manager
NMOC	Network Management Operational Cell
NOP	Network Operations Plan
NWP	Network Working Position
MET	Meteorological
OFA	Operational Focus Area
OI	Operational Improvement
OSED	Operational Service and Environment Definition
OTMV	Occupancy Traffic Monitoring Values
PCP	Pilot Common Projects
RTSA	Real Time Status of Airspace
SESAR	Single European Sky ATM Research
SJU	SESAR Joint Undertaking
STAM	Short-Term ATFCM Measures
SUUP	Special UUP
SWIM	System Wide Information Management
TRL	Technical Readiness Level
TTO/TTA	Target Time Over/ Target Time of Arrival
UUP	Updated Airspace Use Plan
WP	Work Package

1 Project Overview

The European ATM Collaborative Network Operations Plan (NOP) represents a view, at any moment in time, of the expected demand on the ATM Network on a particular day and the resources available across the network, together with a set of agreed actions to accommodate this demand, to mitigate known constraints and to optimise ATM Network performance.

The NOP has a dynamic and rolling lifecycle starting in the long-term planning phase and progressively updated up to and including the execution and post-flight phases. It supports and reflects the results of the collaborative ATM planning process.

The NOP facilitates and supports all ATM stakeholders to take informed decisions considering the network effect and supports the Network Manager, responsible for the overall coordination of individual decisions and actions needed to accommodate the demand and optimize network performance.

The NOP is the common view of the Network situation, knowing that the information the ATM Stakeholder has access to, depends on its role and associated access rights, adapted to its operational needs

The work undertaken by the project in Step 1 was to evolve the existing NOP and was centred on four main areas:

1 Comprehensive integration of AOP and NOP data.

2 Increased visibility of network performance

3 Initial integration of weather information

4 Improved collaboration via tool support

Work carried out in Step 2 was at a level of V1 and consisted of Identifying what, where and when to measure to monitor performances and to determine if the define KPIs are suitable to identify network problems

1.1 Project progress and contribution to the Master Plan

In Time Based Operations context SESAR Project 07.06.01 was focussed on one operational improvement :

:Collaborative NOP for Step 1 DCB-0103A / SESAR Solution #20 / OFA05.03.07

Step 1

The NOP was enhanced to:

- Improve predictability through better network situation awareness (richer, more relevant and up-to-date information), weather information and some standardisation in network responses;

- Facilitate dialogue amongst stakeholders engaged in decisions at network level;

- Facilitate continuous improvement by recording information useful for post-analysis and experience feedback.

The solution consisted of four areas for NOP improvement

1 Comprehensive integration of AOP and NOP data

Coming from the overall SESAR concept there was a strong need to integrate the airport and network operations The AOP-NOP Integration concept elaborated in SESAR is about a comprehensive integration of airports and network resulting in the relevant data exchange in a timely and automated manner. The concept supported a better Network and Airport planning, as means of better

predictability, cost reduction and less air-holding facilitated by better usage of existing Network capacity by allocating resources to accurate demand.

To be able to do this the NOP/AOP identified inconsistencies and ambiguities. e.g., when an arrival cannot be connected to a departure (or vice versa), and will inform through the NOP the relevant AOP(s) of these identified inconsistencies updating upstream information. The AOP also exchanged specific departure and arrival planning information per flight, named DPI and API respectively.

The API included time estimates and actual values at specific milestones of the flight: such as landing, taxing, in-block etc .

The DPI included time estimates and actual values at specific milestones of the flight: off-block, taxing, take-off etc. as well as out-bound flight statues such as BRD, RDY, TXO, DEP etc. and other information such as the SID/runway, de-icing and departure terminal.

2 Increased visibility of network performance

This provided increased visibility of the network performance to support the move to performance driven operations. This evolution was achieved with the availability for further operational use of a set of global performance indicators (delays, adherence, predictability…) to assist the network monitoring in the pre-tactical, tactical and post-ops phases.

The NOP provided the data needed in post-operations to analyse the performance of the network vs. performance targets on a daily/weekly/seasonal/yearly basis and determined stakeholders' contribution to network performance.

3 Initial integration of weather information

This integration provides support to improved NM supervision and monitoring role in scenarios where measures are created and significant weather forecast impact is detected. However local weather assessments were used to assess the potential impact of weather on operations. The process was based on the 4DWxCube information and other information available from MET Services Providers (incl. temperature and wind at defined FL, CBs, thunderstorms / convective activity, Clear Air Turbulence, icing and potentially others). This information was then used to estimate the existence of significant weather areas that may call for the application of STAM or other ATFCM measures on the day of operations.

4 Improved collaboration via tool support

The integration of the NOP with local and regional tool support was the implementation of STAM Measures via local tools and consists of the preparation, co-ordination, and execution of Short Term ATFM Measures (STAM) such as Ground Delay, Horizontal Rerouting, and Flight Level Capping. This used NM B2B Web Services and allowed local ANSP tools to connect with the NM Systems to exchange data and information in order to improve the efficiency and effectiveness of STAM. The performance improvements were enabled by allowing the ANSP to act on local intelligence about complexity, workload, procedures, and other local knowledge and therefore become more successful to select the right flights at the right time to restore the Demand Capacity Balance (DCB).

Typically the local system was able to determine a Hotspot based on occupancy counts that exceeded the defined OTMV thresholds (Occupancy Traffic Monitoring Values), declare it, and monitor its evolution. In the case there was a significant Capacity Demand Imbalance, the ANSP could decide to propose a measure (STAM) to be created to alleviate the imbalance, selecting those flights that are picked by the local system using decision criteria that are optimised to the local ANSP.

The objective was to co-ordinate STAM via NM B2B Web Services between adjacent ANSPs, (here NATS and MUAC), in both directions. An ANSP created and proposed a STAM measure based on actual traffic situations, then asked for co-ordination and approval of the measures, implement them and monitored their evolution.

STEP 2 - Network Performance Framweork

The elaboration of a network performance framework was a first stage towards the definition of an on-line network monitoring and assessment capability enabling the early detection of deviations from network performance targets and objectives. The capability was to facilitate stakeholders' decision making whenever the stability of the plan is at stake, so that corrective actions can be taken before the problem happens. New technological & Operational deployments, mainly SWIM deployment and Aircraft Trajectory Monitoring Capabilities, enabled the generation of an enhanced Network Operation Plan, based on increased accuracy and timeliness of continuously updated SBT/SMT/RBT/RMT information, shared by all stakeholders.

Full integration of AOPs within the 'SWIM enabled NOP' delivered the Network Manager a more accurate picture of traffic situation.

New prediction tools, based on a fully integrated Network were able to anticipate with much more precision traffic shifts in the Network and their impact on the Demand Capacity relationships throughout the Network, early alerting stakeholders on traffic deviations and allowing them to anticipate their mitigation decisions

The project was also part of Release 5 SE#3 (Solution 20). Which included the points above, mainly the comprehensive integration of AOP and NOP data (AOP-NOP Integration); Increased visibility of network performance (Network Performance KPIs); Initial integration of weather information (MET-NOP Integration); and improved collaboration via tool support. As part of Solution 20 a number of acceptable issues were raised and have been detailed in the VALR for step 1 [4]. However the project has been successfull and has achieved V3 status.

Operational Improvements and Enablers

The following lists the Operational Improvement steps and the Enablers that the project P07.06.01 has worked on.

The Operational Improvement steps and the Enablers used in this document are with reference to the Integrated Roadmap Data set DS-15.

Code	Name	Project contribution	Maturity at project start	Maturity at project end
DCB-0308	Advanced Short Term ATFCM	P07.06.01 assisted and helped validate (through exercises VP-314, VP-522, VP-700 and VP-632) and provided recommendations on the following concept features of this OI Step: • Hotspot detection, • Analysis and preparation of STAM, • STAM coordination, • STAM implementation, • NMOC supervision.	V2	V3 V3 V3 V3 V3
DCB-0208	DCB in a Trajectory Management Context	P07.06.01 assisted and helped validate (through exercises VP-632, VP-634, VP-723 and VP-749) and provided recommendations on the following concept features of this OI	V2	

		Step: • TTA dissemination • TTA Adherence • Local target time generation • Roles & Responsibilities (NM, FMP & Airport side)		V3 V3 V3 V3
DCB-0310	Improved Efficiency in the management of Airport and ATFCM Planning	P07.06.01 through its validation activities, including VP-632, VP-634 and VP-749 contributed to the V3 maturity level of this Solution. The last exercise VP-749 covers the Target Time Management and AOP-NOP Integration covering AOP/NOP Integration, and P06.03.01 (covering the AOP and airport DCB related aspects) of the following aspects • AOP-NOP harmonized interface and data synchronisation • Airport / AU / NM Interface for Airport Impact Assessment and TTA window improvement into ATFCM	V2	V3
DCB-0103-A	Collaborative NOP for Step 1	P07.06.01 contributed to this validation through a set of exercises: VP-522, VP-632, VP-700, VP-749 and VP-772. MassDiv: The level of maturity reached in the definition of the concept, the roles and responsibilities and the operational requirements allowed to start the preparation of the operational deployment and to perform the next validation via a Pilot Phase.	V2	V3 V4
DCB-0103-B	Collaborative NOP in Step 2	EXE-07.06.01-VP-779 can be considered a first step for further Step 2 Network Performance Monitoring and Assessment	V1	V1
METEO-06b	Generate and provide MET information relevant for Network related operations, Step 1		V2	V3
NIMS-13b	Enhanced short term ATFM measures (STAM)		V2	V3

NIMS-27	Network DCB sub-system enhanced with improved accuracy of processing real-time data		V2	V3
NIMS-43	Enhanced NM systems to process the Flight Object (FO) data related to the NM cluster including STAM, TTA and EFPL information		V2	V2
NIMS-38	Calculation and dissemination of the TTO & TTA		V2	V3
SWIM-APS-03a	Provision of ATFCM Information Services for Step 1		V3	V3
SWIM-APS-04a	Consumption of ATFCM Information Services for Step 1		V2	V3
SWIM-INFR-05a	General SWIM Services Infrastructure Support and Connectivity		V2	V2
SWIM-NET-01a	SWIM Network Point of Presence		V2	V2
SWIM-SUPT-01a	SWIM Supporting Registry Provisions		V2	V2
SWIM-SUPT-03a	SWIM Supporting Security Provisions		V2	V2
SWIM-SUPT-05a	SWIM Supporting IP Network Bridging Provisions		V2	V2

Data set 15 was used

1.2 Project achievements

Step 1

The work undertaken by the project was to evolve the existing NOP and was centred on four areas, these areas were validated by a number of validation exercises. These validation exercises were run by other WP7 projects but were used to validate the four areas of the NOP:

AOP/NOP Integration

Coming from the overall SESAR concept there was a strong need to integrate the Airport and Network operations The AOP-NOP Integration validation of the concept elaborated in SESAR achieved comprehensive integration of airports and network resulting in the relevant data exchange in a timely and automated manner. The concept supported a better Network and Airport planning, as means of better predictability, cost reduction and less air-holding facilitated by better usage of existing Network capacity by allocating resources to accurate demand.

To be able to do this the NOP identified inconsistencies and ambiguities in the Airport Schedule Information; e.g., when an arrival cannot be connected to a departure (or vice versa), and informed the relevant AOP(s) of these identified inconsistencies. The AOP also exchanged specific departure and arrival planning information per flight, named DPI and API respectively.

The API included time estimates and actual values at specific milestones of the flight: such as landing, taxing, in-block etc.

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-Increased visibility of network performance.

This was achieved by providing increased visibility of the Network performance to support the move to performance driven operations. This evolution was achieved with the availability for further operational use of a set of global performance indicators (delays, adherence, predictability…) to assist the network monitoring in the pre-tactical, tactical and post-ops phases.

The NOP provided the data needed in post-operations to analyse the performance of the network vs. performance targets on a daily/weekly/seasonal/yearly basis and determined stakeholders' contribution to network performance.

-Initial integration of weather information.

This integration provided support to improved NM supervision and monitoring role in scenarios where measures are created and significant weather forecast impact is detected. However local weather assessments were used to assess the potential impact of weather on operations. The process was based on the 4DWxCube information and other information available from MET Services Providers (incl. temperature and wind at defined FL, CBs, thunderstorms / convective activity, Clear Air Turbulence, icing and potentially others). This information was then used to estimate the existence of significant weather areas that may call for the application of STAM or other ATFCM measures on the day of operations.

-Improved collaboration via tool support.

The integration of the NOP with local and regional tool support was the implementation of STAM Measures via local tools and consisted of the preparation, co-ordination, and execution of Short Term ATFM Measures (STAM) such as Ground Delay, Horizontal Rerouting, and Flight Level Capping. This used NM B2B Web Services and allowed local ANSP tools to connect with the NM Systems to exchange data and information in order to improve the efficiency and effectiveness of STAM. The performance improvements were enabled by allowing the ANSP to act on local intelligence about complexity, workload, procedures, and other local knowledge and therefore become more successful to select the right flights at the right time to restore the Demand Capacity Balance (DCB).

Typically the local system was able to determine a Hotspot based on occupancy counts that exceeded the defined OTMV thresholds (Occupancy Traffic Monitoring Values), declare it, and monitor its evolution. In the case there was a significant Capacity Demand Imbalance, the ANSP could decide to propose a measure (STAM) to be created to alleviate the imbalance, selecting those flights that are picked by the local system using decision criteria that are optimised to the local ANSP.

One objective was to co-ordinate STAM via NM B2B Web Services between adjacent ANSPs in both directions. An ANSP created and proposed a STAM measure based on actual traffic situations, then asked for co-ordination and approval of the measures, implement them and monitored their evolution.

The NOP is viewed as a transversal project and the main benefit identified was found to be better predictability of information between all the stakeholders. This gave rise to the following specific benefits to better Collaborative Decision Making (CDM) between all actors due to:

-Integration of AOP and NOP which gives enhanced collaboration,

-Increase in predictability;

-Increase in common situation awareness with the introduction of some new elements (as weather or performance indicators).

It was noted that with better predictability came the benefit of increased punctuality. However it was difficult to relate this to an increase in capacity, reduction in fuel burn etc. These benefits need to be validated via further validations using multiple airports and Airspace Users.

Step 2

As part of examining Network performance in Step 2 a number of demonstration activities were run using data mining as the validation method and examining the data collected in the demonstration exercises..

This work was focused on the validation of the network performance monitoring framework through quantification of the current problems: identification on when, where, and how performance imbalances occur as well as who are impacted. Although the exercise was based on post-flight data sources analysis determination of potential use of performance deviation at planning phase and during flight execution was also addressed.

The data used was the data that is available today and any additional data that was needed for Step 2 Performance Assessment was emulated if it was not readily available The final indicators and metrics are summarized in the Step 2 VALR (D08)

It exercise showed that some imbalances can be detected during the planning phase with information which is already available which then leads to early problem detection

1.3 Project Deliverables

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

Reference	Title	Description
D05	Validation Report V3 Step 1	This document is the Validation Report addressing those NOP objectives related to the exercises where project P07.06.01 has actively contributed: P13.02.03 VP-749 “AOP/ NOP Integration” and VP-700 “DCB Local Tools” for KPIs for Network Monitoring and MET-NOP Integration topics. Objectives and results specified by OFA05.01.01 for VP-749 are also part of this report.
D08	Step 2 Validation Report	This document is the Validation Report for the validation activities developed by P07.06.01 ‘Collaborative NOP’ in Step2 V1, in VP-779, particularly focused in the Network

		Performance Monitoring and Assessment area.
D14	Step 2 OSED	This document describes the evolutions of the Collaborative Network Operations Plan (NOP) concept in supporting the European Network Management concepts. It includes the NOP integration in the ATM stakeholders' planning processes, the enhancement of AOP-NOP integration, improved flight intentions (civil and military), extended application of AU Preferences to execution and arrival phases, real time awareness of network performance, monitoring of the quality of information, enhanced usage of the NOP for post-ops reporting and NOP What If/Network impact analysis service to evaluate impact of any planned decision for SESAR Step 2. REF[6]
D32	Closure Report	This closure report, highlighting the contribution WP07.06.01 has made to SESAR 1 and identifying the final state of the deliverables as work package closure.
D36	Network Performance Monitoring & Management Report Step 1	This document provides an initial operational performance framework to prepare for the specification and validation of a network performance monitoring capability intended to drive and facilitate ATM stakeholders' collaborative network planning. REF[8]
D37	Step 2 Network Performance Monitoring & Management Report 2014	This document proposes an initial operational performance framework intended to be utilised in the operational performance monitoring of the European ATM Network, to support the assessment and monitoring of overall Network Performance for Step 2 of the SESAR Concept. REF[9]
D46	Step 1 OSED	This document describes the evolutions of the Collaborative Network Operations Plan (NOP), its Operational services and associated environment to support the Network Management concept, achieved in the step 1 of SESAR. These evolutions concern 4 domains : - Weather (MET) integration at planning phase, - Performance driven operations, - AOP-NOP integration, - Collaboration improvement (B2B services for data integration into local tools, user driven prioritisation process for increased awareness, 4D profiles and real time airspace reservation). REF[10]

1.4 Contribution to Standardisation

The project has not contributed to any standardisation activities.

P07.06.01 participated in the identification of relevant SWIM services for DCB Federation Service and SWIM services relevant to NOP services. The Service Design has been performed in the context of Service Activity SVA009 (entailing Federated Demand and Capacity Balancing) and SVA001 (entailing AOP-NOP Integration). In particular, it developed and assessed the following SWIM services:

- HotspotManagement: supports the Short-Term ATFCM Measures (STAM) concept by providing the concerned stakeholders with capabilities for managing Hotspot in support of network demand and capacity balancing.
- MCDM (Measure Collaborative Decision Making): manages and promotes the collaboration and coordination on the measures and messages exchanged.
- METHazardEnrouteForecast: defines an information service for exchanging Forecasts and Nowcasts of significant weather phenomena.
- METHazardEnrouteObservation: addresses the delivery of information on observed significant weather phenomena for air traffic.
- NMCapacityData: provides data and enable the update of capacity data (entry and occupancy) on traffic volumes
- NMFlightData: provides the list of flights per traffic volume, and detailed information about single flights.
- STAMMeasures: provides ways to manage Regulations, Reroutings, MCDMOnly measures and assess the impact of these measures by querying the ETFMS OpLog.
- TrafficVolumeInformation: provides detailed information on Traffic Volumes in AIXM format.
- AirportFlightPlanningInformation: supports the AOP-NOP integration concept by providing the concerned stakeholders with capabilities for exchanging extended departure and arrival planning information in support of network operations planning and airport operations to enhance predictability.

1.5 Project Conclusion and Recommendations

STEP 1

Comprehensive integration of AOP and NOP data.

Conclusions of this are:

Predictability provided by the exercise is better than that obtained with flight plan data, in days where the traffic is heavy, the gain in predictability is higher and that this predictability is clearly explained by the rolling exchange of DPIs contained within the AOP information.

Generally the results confirmed that by using the information contained within the AOP then there is a reduction in the overall delay

One other main conclusion is that a closer link between the AOP and NOP could lower the number of flights affected by any knock on effect should lead to a lower delay than if a CASA regulation was in place. This could lead onto the development of local algorithms that would be an alternate to the CASA regulations. However this has not been sufficiently developed within the NOP.

Recommendations can be made that the NOP/AOP link and integration of the AOP data into the NOP does make a major contribution to the overall performance to the Network

However it should be noted that a live trial to measure delays and traffic count predictability within the NOP is required to further confirm the results of the validation exercise

2 Increased visibility of network performance

Conclusions - The set of KPIs proposed and validated during the validation exercise assists the Network manager in on-line monitoring by identifying deviations from the plan, imbalance situations as well as supporting their analysis and investigation.

Assistance to the network manager was also supporting the analysis of traffic counts specially in terms of variability and its flight comparison, according to the different views (e.g. a/c status changes, flights ahead of or behind schedule compared to the plan etc.) available for sectors and airports. Other conclusions were that he performance graphics provided the very recent past delay calculation without needing to wait for post OPS analysis, the trend representation was considered useful to support both past analysis and future predictions in a single graph. The tool was highly appreciated by the NM participants in the trial, both by the information it delivered and by its user friendliness.

Recommendations: The set of Network KPI validated were considered positive for deployment although further action is required.

It is suggested that the operators better understand the algorithm used in the performance calculations and that there should be a proposal to the user the trade-off performance indicators to support the decision making process.

3 Initial integration of weather information

Conclusions - The tool that was provided allowed stakeholders to view METEO forecasts together with ATFCM measures (regulations and STAM) and showed significant weather phenomena and the forecast evolution. It also had the ability to identify and mark the areas that required monitoring. This supported the NMOC and local units to have more knowledge to support an informed decision making

This, in turn, allowed all stakeholders to identify and mark the areas that required monitoring and then allow the traffic that are directly affected by the weather to be diverted.

Recommendations : As part of this work it is recommended that other phenomena such as Jet Streams should be included and for future work, DAC could consider weather as a parameter for the combination of the building blocks to create Dynamic Airspace Configuration

In conclusion MET-NOP integration supports the monitoring activity of NMOC

4 Improved collaboration via tool support

Conclusions - The technical systems were able to communicate efficiently via B2B services between ANSPs and NM as well as between ANSPs. This allowed the local ANSP to act on local intelligence and then co-ordinate between ANSPs and the NM for a proposed STAM measure if required.

Recommendations - The role of NMOC in assessing network impact of STAM and monitoring the resolution have not yet been defined. This needs to be clarified for future concept.

Also that due to the limitations of the current NMVP platform, the end of V3 maturity level could not be fully assessed in term of tools during this exercise. Specific recommendations for System -Central Airspace Data Function operators have been stated:

It needs to be stressed that the overall recommendations from this project need to also include the requirement for further validations to include better participation with the Airspace Users and that all the validations need to have a valid CBA prior to deployment

STEP 2

Conclusions

The scenarios consisted in two main blocks: scenarios with degraded conditions at airports and scenarios with degraded conditions at route sectors (and its corresponding nominal days).

It was shown that in general the monitoring the metrics analysed, provided a better situational awareness in both execution and post operational phase.

Analysis of the results showed that if an airport with degraded condition is the origin one of the flight the metrics did not detect or predict the problem, however if the airport with degraded conditions was the destination one of the flight then metrics did detect the problem and could then be used to support the decision making process

Focusing attention on route scenarios the monitoring of entry count and occupancy metrics is able to identify in advance the existence of demand/capacity imbalances for entry counts and periods of high occupancy for execution phase. In post operations phase these two metrics can be used to corroborate the presence of any disruption.

However some of the results were limited in their accuracy due to the fact that Network data was not available.

Recommendations

Certain additional data such as SLDT, SIBT and EIBT has been identified as a requirement for further work. Also, it has been observed that will be useful to have the target times, in order to analyze it adherence to the scheduled and actual times.

Regarding scenarios and indicators, it is recommended for a future validation to analyze the relation between them, for some scenarios in particular many indicators do not provide significant information and that could be due to the characteristic of the problem.

Taking into account the information sources, the following data sources need to be taken into account in future validations for the project.

i) network information, which has flight plan actualizations

ii) radar data, in order to compare the geometric route extension with the calculated temporal route extension,

iii) airlines information, with the operational flight plans information and the estimated fuel consumption, in order to analyze the final temporal and environmental deviations.

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] WP 07.06.01 NOP, Validation Report V3 Step 1, D05, Edition 00.02.03, Date: 22/09/2016

[5] WP 07.06.01 NOP, Step 2 Validation Report, D08, Edition 00.01.01, Date: 30/11/2015

[6] WP 07.06.01 NOP, Step 2 OSED, D14, Edition 00.02.05, Date: 30/09/2016

[7] WP 07.06.01 NOP, Closure Report, D32, Edition 00.00.01 Date:

[8] WP 07.06.01 NOP, Network Performance Monitoring & Management Report Step 1, D36, 00.01.00, Date: 17/10/2013

[9] WP 07.06.01 NOP, Step 2 Network Performance Monitoring & Management Report 2014, D37, Edition 00.01.00, Date: 23/09/2014

[10] WP 07.06.01 NOP, Step 1 OSED, D46, Edition 00.04.02, Date

[11] WP 07.06.01 NOP, Step 1 Validation Plan, D48, Edition 00.01.00, Date: 28/06/2016

[12] WP 07.06.01 NOP, Step 2 Validation Plan, D17, Edition 00.01.01, Date: 18/03/20157

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