Supporting
European
Aviation

EUROCONTROL

PJ09-W2 Digital Network Management Services (DNMS)

Project Overview for SINTEF Open Day

29th Sep, 2022

Kris Delcourte, Project Coordinator

PJ09
DNMS

FOUNDING MEMBER
SESAR
JOINT UNDERTAKING

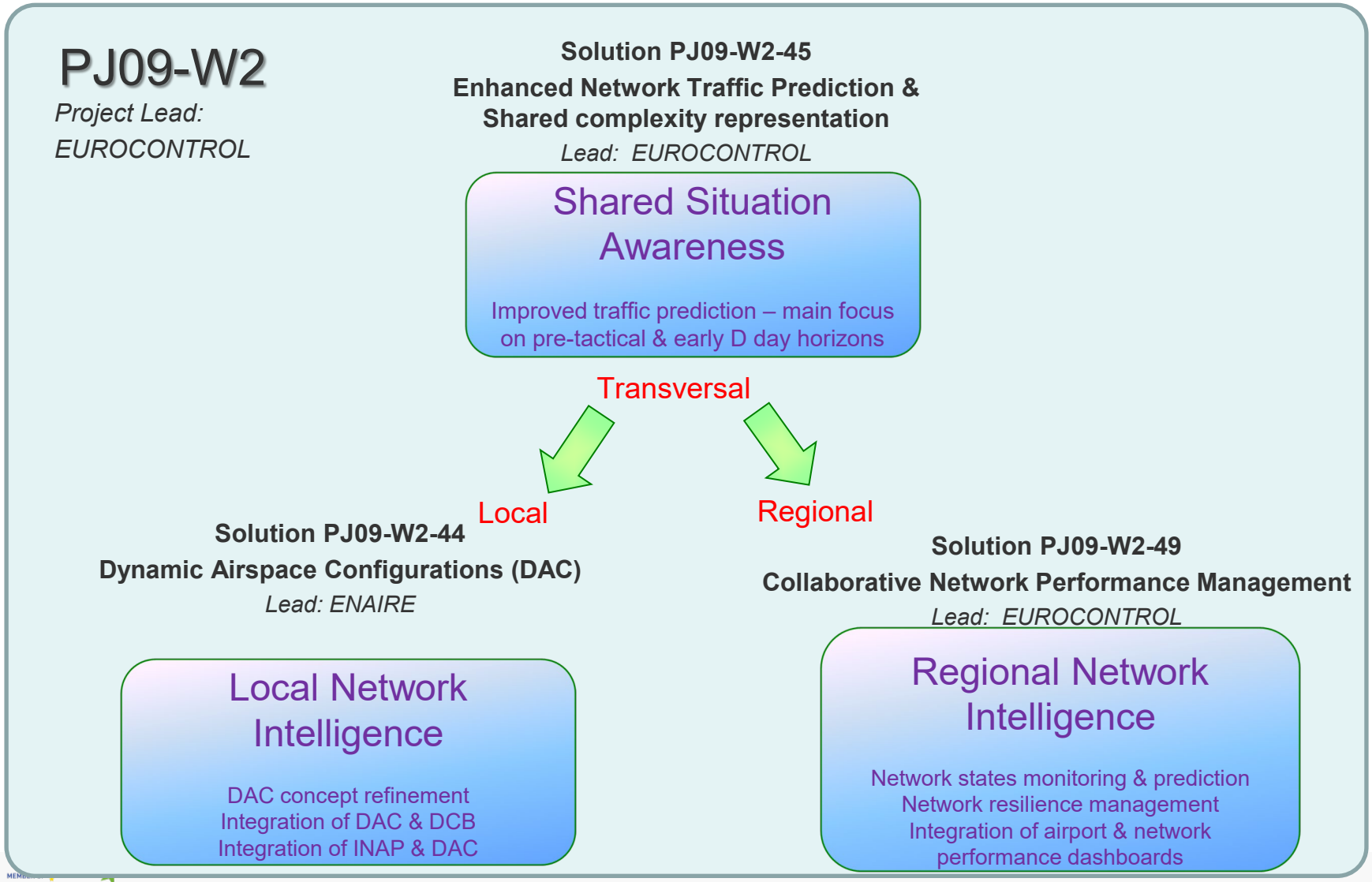
NETWORK MANAGER

Initial Problem statement

Key Points for Improvement :

- D and C not really integrated in DCB
- DAC algorithms to be further improved
- Demand Prediction is still not accurate enough
- Shareable complexity indicator not fully validated
- Performance Awareness and Decision Making
- Network resilience concept

PJ09-W2 DNMS – Overview



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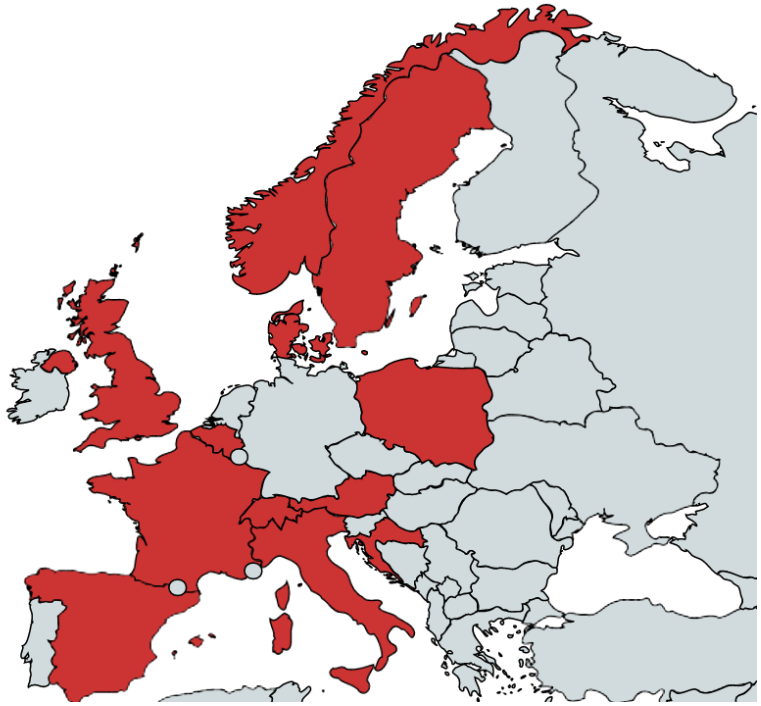
PJ09-W2 Partner Organisations

- ☑ PANSA (B4)
- ☑ ACG, CCL+FPZ, LFV, Naviair / COOPANS
- ☑ DSNA + ONERA
- ☑ ENAIRE + CRIDA + INECO
- ☑ ENAV + IDS AIRNAV + TECHNO SKY
- ☑ EUROCONTROL
- ☑ INDRA
- ☑ SINTEF (NATMIG)
- ☑ NATS
- ☑ SKYGUIDE
- ☑ THALES AIR SYS
  - ☑ Edisoft
- ☑ AIRBUS (in-kind)



15 Partners + their LTPs (7)

- ECTRL: Innovation Hub, CMC & Network Manager
- 10 ANSPs
- 6 Ground Industry
- 1 Airborne industry
- Universities & R&D centres

Involvement Airspace Users

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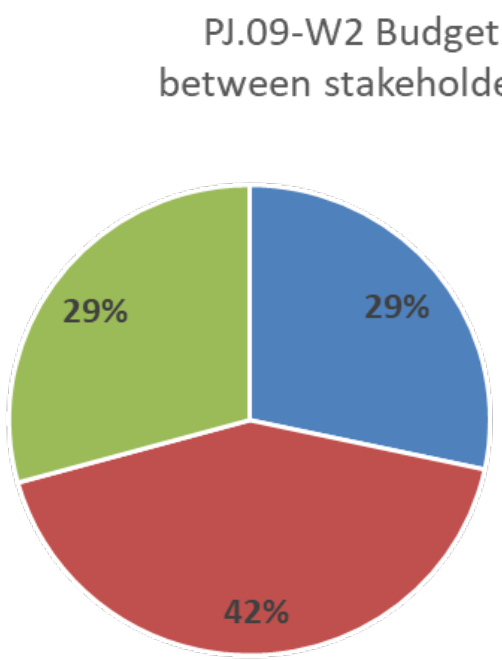
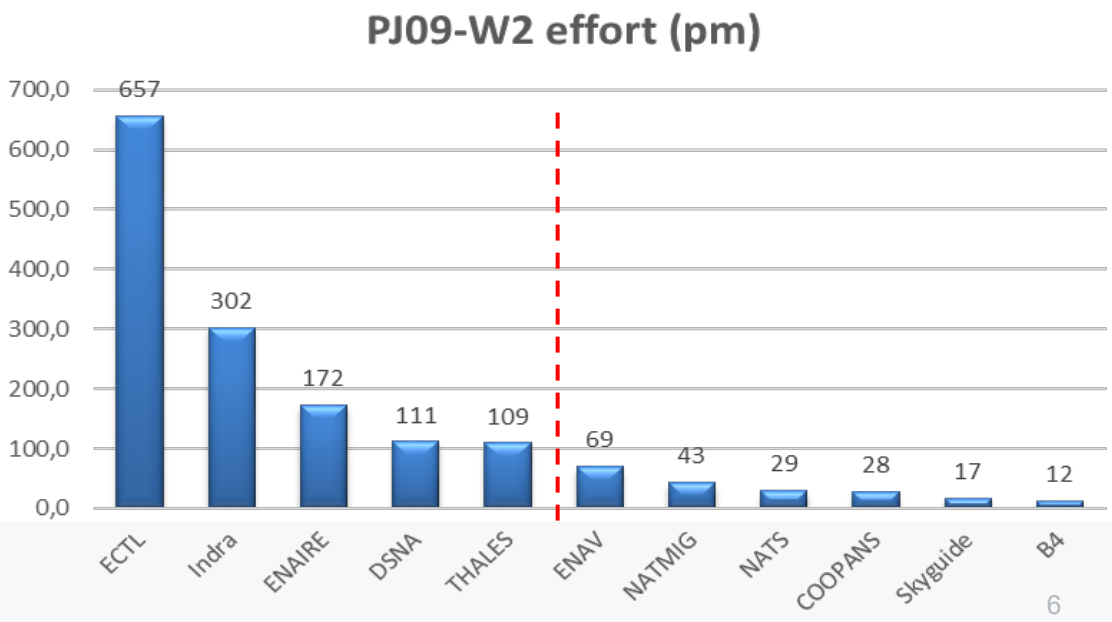
- **Via CFT contract established to acquire civil Airspace Users' expertise for execution tasks of SESAR projects**

- **Selected Airline Operators: Air Baltic, Air France, Ryanair, Lufthansa/Swiss, IATA, EBAA**

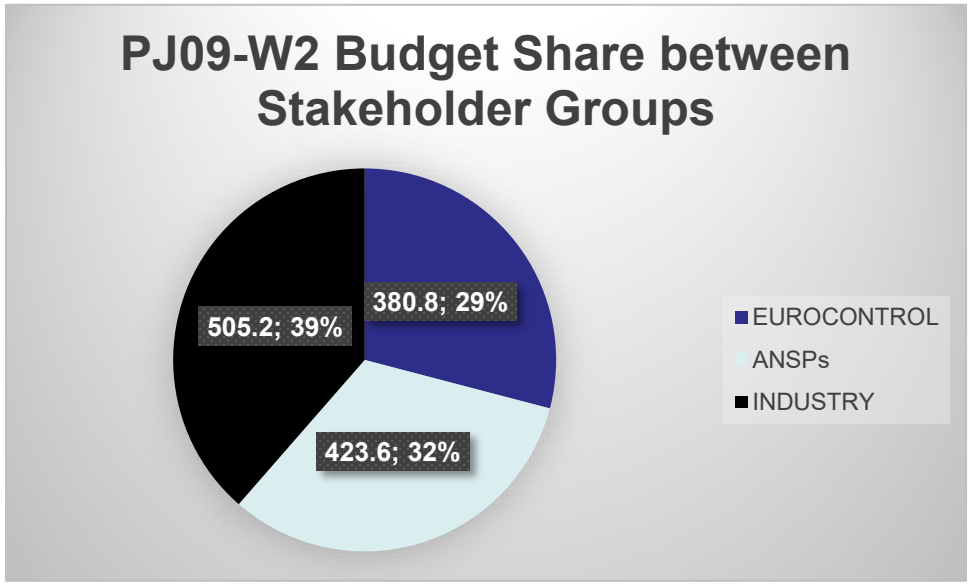
- **In 2021: participation to one OSED workshop Solution 44 to assess operational impact for Airline Operators**
  - **Air Baltic, Air France, Ryanair, Lufthansa**

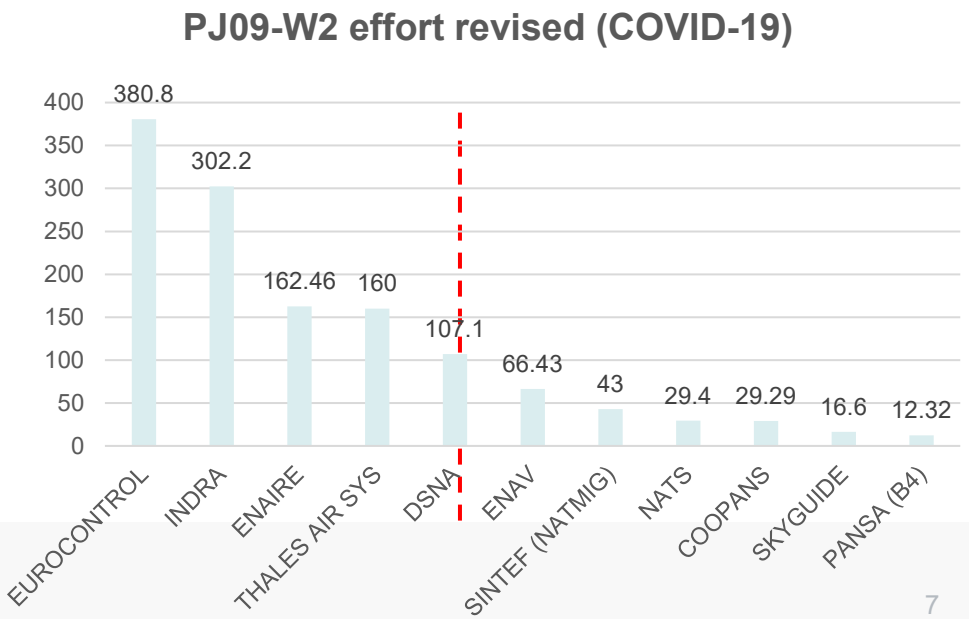
Partner Contributions (initial)





Partner Contributions revised (COVID-19)





Effort by solution: Initial

WP Number[9]	WP Title	Lead beneficiary[10]	Person-months[11]	Start month[12]	End month[13]
WP1	Project Management	1 - EUROCONTROL	93.10	1	37
WP2	Solution PJ.09-W2-44: Dynamic Airspace Configurations	8 - ENAIRE	899.37	1	37
WP3	Solution PJ.09-W2-45: Enhanced Network Traffic Prediction and Shared Complexity Representation	1 - EUROCONTROL	350.81	1	37
WP4	Solution PJ.09-W2-49: Collaborative Network Performance Management	1 - EUROCONTROL	207.73	1	37
		Total	1,551.01		

Effort by solution: revised (COVID-19)

WP Number	WP Title	Lead Beneficiary	Person Months	Start Month	End Month
WP1	Project Management	EUROCONTROL	50	1	40
WP2	Solution PJ.09-W2-44: Dynamic Airspace Configurations	ENAIRE	1088.1	1	40
WP3	Solution PJ.09-W2-45: Enhanced Network Traffic Prediction and Shared Complexity Representation	EUROCONTROL	95.76	1	13
WP4	Solution PJ.09-W2-49: Collaborative Network Performance Management	EUROCONTROL	75.73	1	13
		Total:	1309.59		

Solution PJ.09-W2-44 Dynamic Airspace Configurations (DAC)

CLOSING THE GAP BETWEEN CAPACITY PLANNING AND DELIVERY

AIRBUS SAS , ECTL, COOPANS, DSNA, ENAIRE, ENAV, INDRA, SINTEF, NATS, PANSA , SKYGUIDE, THALES AIR SYS

PJ09 DNMS

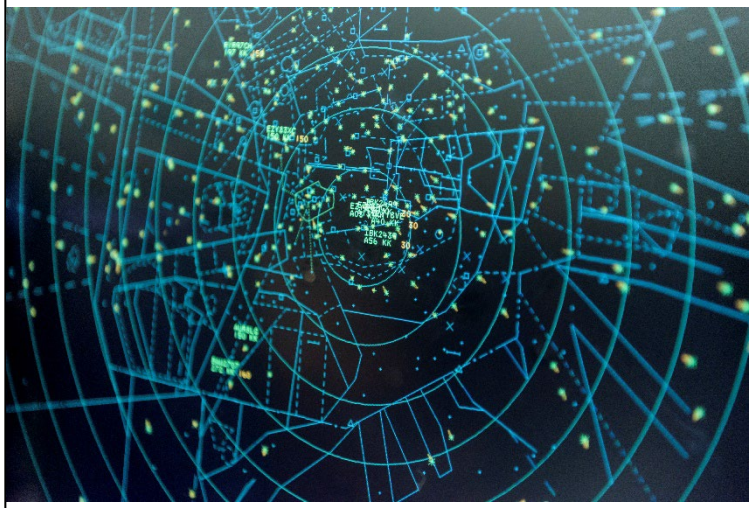
EUROCONTROL

V1 **V2** **V3**

Target Release **R12**

31-01-23

- Key Characteristics
  - Managing airspace dynamically to increase capacity, reduce delays & emissions
  - Harmonise airspace management, flow management, & ATC during planning
  - Deliver a seamless and dynamic process enabled (CDM) between civil and military stakeholders
- Dynamic Airspace Configurations (DAC)
  - Design sectors around predicted traffic flow
  - Organise, plan, & manage airspace configurations flexibly to traffic demand changes
  - Manage dynamically all capacity elements and constraints in seamless process
  - Ensure balance of performance targets and operational requirements
  - 4D trajectory forecasts, fixed & flexible routing, reserved / restricted airspace
- The solution builds upon
- Extended ATC planning functionalities
- Integrated network and ATC planning (INAP)
- Common view for situation analysis and decision support to implement optimized solutions



Intended Benefits

Dynamic Airspace Configuration allows improved ATM resource planning and better use of existing capacities leading to reduced ATC costs.

Dynamic Airspace Configuration should decrease Airspace Users fuel consumption and reduce flight time and optimized flight trajectories and profiles will result in reduced fuel burn and CO2 emissions.

Advanced Airspace Management allows a better use of available ATC capacity and a better balancing of ATC workload leading to reduced demand/capacity imbalance.

Enhanced Capacity, Increased Cost-Efficiency, Reduced Environmental Impact

Solution PJ.09-W2-45 Enhanced Network Traffic Prediction and shared complexity representation

AIRBUS, ECTL, INDRA, DSNA (incl. ENAC), ENAIRE (incl. CRIDA), ENAV, NATS

PJ09 DNMS Solution 45

EUROCONTROL

BIG DATA AND ML BRINGS BETTER NETWORK PLANNING

V1 | V2 | V3 — Target Release R12

31-01-23

- Demand Prediction could be improved with better route prediction for the predicted flights i.e. assigning trajectories or trajectory elements that are reasonably likely to correspond to the Airspace User response, taking into account the context and conditions. In Solution 45 the choice of these trajectories is made AI techniques where we assume that when the Airspace User is facing similar condition to the one in the past, his response will be similar, resulting in a similar route/ itinerary to be followed.
- The new model aims to improve the forecast of flight routes in the pre-tactical period, currently produced by the NM system PREDICT. The model will cover all flights in the IFPS zone including entering trans-oceanic traffic, it will include weather and progressively will incorporate other features like flight delays, route charges etc…

Solution cut off due to Wave 2 reconfiguration

AIRBUS, dgac DSNA, EUROCONTROL, Indra, NATS, ENAIRE, enav

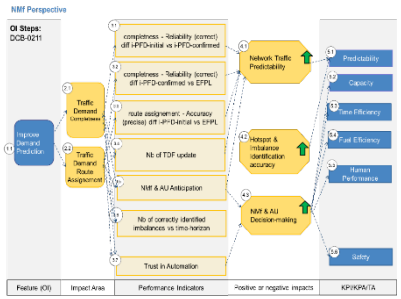
Intended Benefits

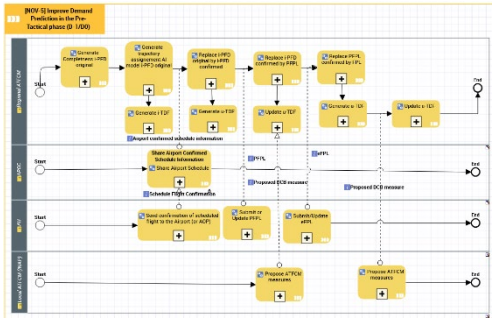
To improve the real time awareness of network performances at local and regional levels and to support a collaborative Network Management decision making.

Enhanced Capacity, Improved Predictability, Reduced Environmental Impact

Solution 45 - Achievements

- **V3 SPR-INTEROP/OSED**
  - ✓**Initial version**, approved November 2020.
- **V3 VALP Part I**
  - ✓**Initial version**, delivered December 2020
  - ✓**OIs & ENB adjusted & accepted in DS20**
  - ✓**Benefit Impact Mechanisms (BIMs)**
  - ✓**Validation Objectives**
  - ✓**EATMA Modelling done**
- **TS/IRS**
  - ✓**Initial version**, delivered December 2020





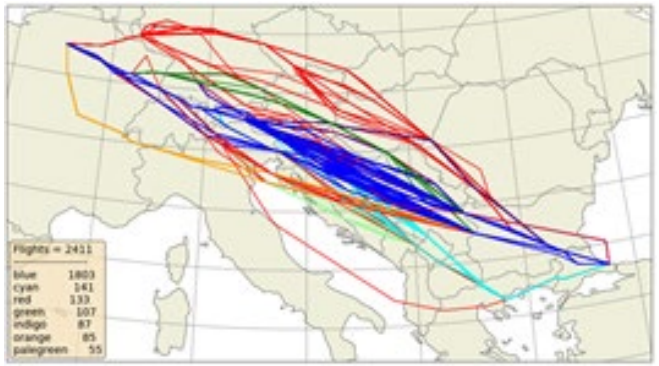
Follow-up (outside SESAR) - Achievements

- **Prototype using Artificial Intelligence to predict routes for pre-tactical demand: under development and evaluation**

- **Being continued and refined in the NM Lab.**

Communication and Dissemination

- **Presentation to MUAC**
  - ✓ **Done on 14th December 2020**
- **Presentation to OPS**
  - ✓ **Done on 22nd February 2021**
- **LinkedIn + Inno Newsletter**
  - ✓ **April 2021**

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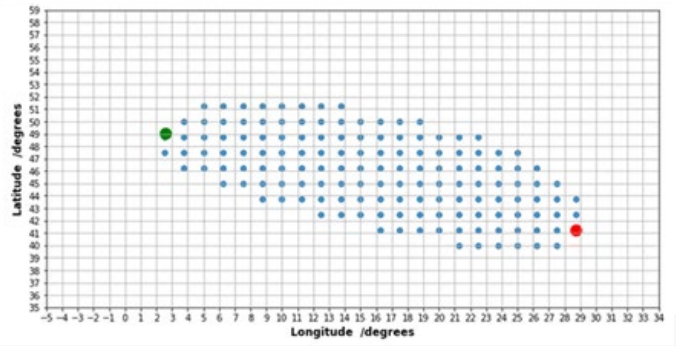


Solution PJ.09-W2-49 Collaborative Network Performance Management

PUTTING COMMON INTERESTS IN THE DRIVING SEAT

ECTL, ENAIRE

PJ09 DNMS

EUROCONTROL

V1 V2 V3

Target Release R12

31-10-22

- The ATM network is a complex system that involves the synchronisation of multiple operations and stakeholders. The Network Operations Plan (NOP) is a powerful tool that supports this process of demand-capacity balancing (DCB) by providing a common view of network performance indicators representative of the current and anticipated network situation. The NOP enables individual actors to design local solutions with minimal impact on network operations using upstream network performance indicators. To encourage the shift from local to regional management and improve DCB, SESAR is developing a network performance management dashboard tool (NPMD).
- The solution enables the pro-active management of network performance through the NPMD, increasing the network resilience through more efficient recovery plans to shorten the return to normal operations. The NPMD is designed to monitor the resilience of the network and anticipate, detect and monitor emerging disruptive operational situations across the system. The aim is to prevent an emerging degradation in one airport, or in one specific area in the en-route airspace, from having a cascading and potentially disastrous impacts on others.
- The solution enables the pro-active management of network performance through the NPMD, increasing the network resilience through more efficient recovery plans to shorten the return to normal operations.

The solution could be cut off due to Wave 2 reconfiguration

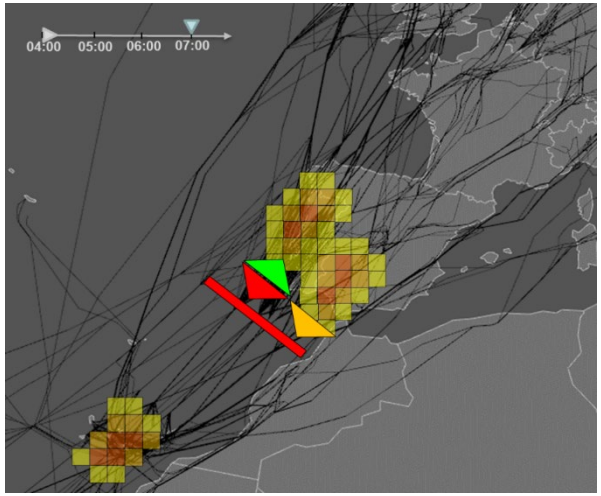
Intended Benefits

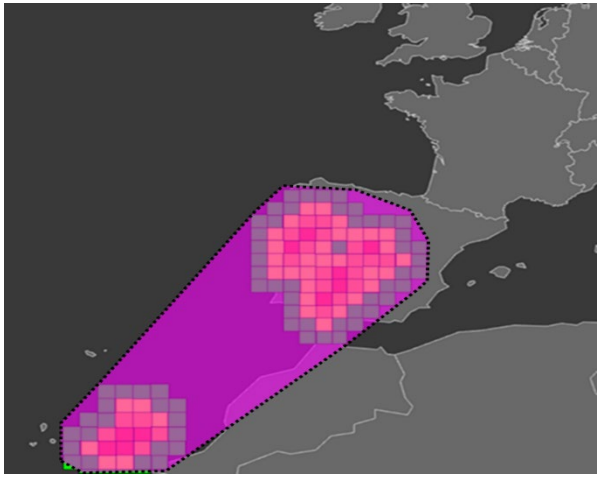
The local airspace and flow measures coordination and reconciliation in collaboration with the regional Network Management and integration with AU and AOP will considerably improve the Network predictability, capacity and efficiency of operations of all actors.

Enhanced Capacity, Improved Predictability, Reduced Environmental Impact

Solution 49 - Achievements

- **V3 SPR-INTEROP/OSED**
  - ✓ **Final version** focused on New Operating Methods, November 2020
- **V3 VALP Part I**
  - ✓ **Final version** ready December 2020
  - ✓ **OIs redefined & accepted in DS20**
    - DCB-0214 (**Digital Network Toolset for Problem Detection**)
    - DCB-0212 **(Resilience Transition Management)**
  - ✓ **Benefit Impact Mechanisms (BIMs)**
  - ✓ **Validation Objectives**
  - ✓ **VAL Exercises Plan description**
    - EXE-09.49.01 & EXE-09.49.02

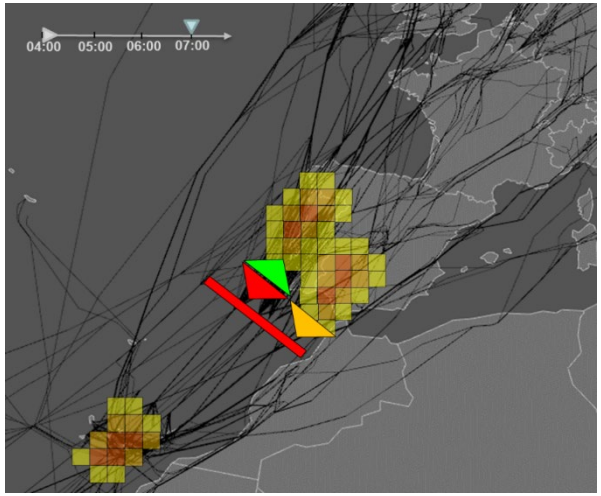


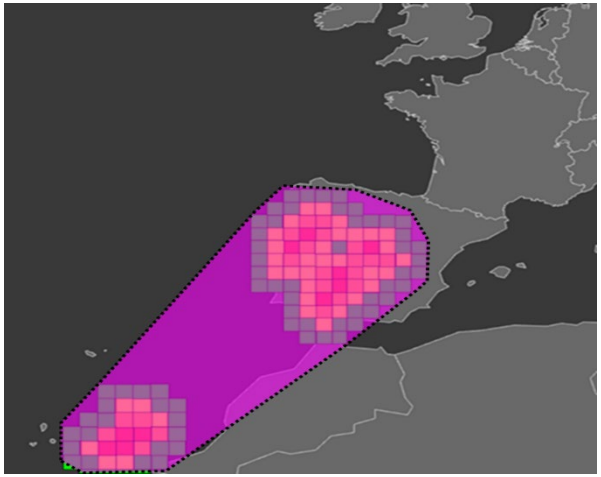


Solution 49 - Achievements

- **VALP Part II & Part IV**
  - ✓Scope & Change assessment workshop – November 2020
  - ✓**Safety Assessment Plan** (VALP-Part II) ready December 2020
  - ✓**HP Assessment Plan** (VALP-Part IV) ready December 2020

- **TS / IRS**
  - ✓**Initial TS IRS** ready December 2020





Follow-up (outside SESAR) - Achievements

- **Prototype Performance Dashboards**
  - ✓New HMI for NMOC
  - ✓Development AI model
  - ✓Presentations at various occasions
  - ✓Deployment related to iNM

Project Execution

- Project runs from 1-dec-2019 till 31-Mar-2023
- Current phase (2022): validation exercises are taking place (4 completed, 3 more to execute) + production final deliverables
- Final deliverables (data pack) by the end of 2022
- V3 Maturity Gate: 9-Feb-2023
- Dissemination of results

Communication activities

- Social media publications (linkedin), web publications
- Open days (ENAIRE/CRIDA, DSNA, SINTEF), EUROCONTROL (1-Dec)

- 2 publications:
  - SINTEF (NATMIG): scientific publication: “User Involvement in the Design of ML-Infused Systems”
  - CRIDA: publication SESAR Innovation days: “Optimal Dynamic Airspace Configuration (DAC) based on State-Task Networks (STN)”

- Presence at WAC: ANSPs, Industry, Research
- SESAR Innovation Days
- Close out meeting