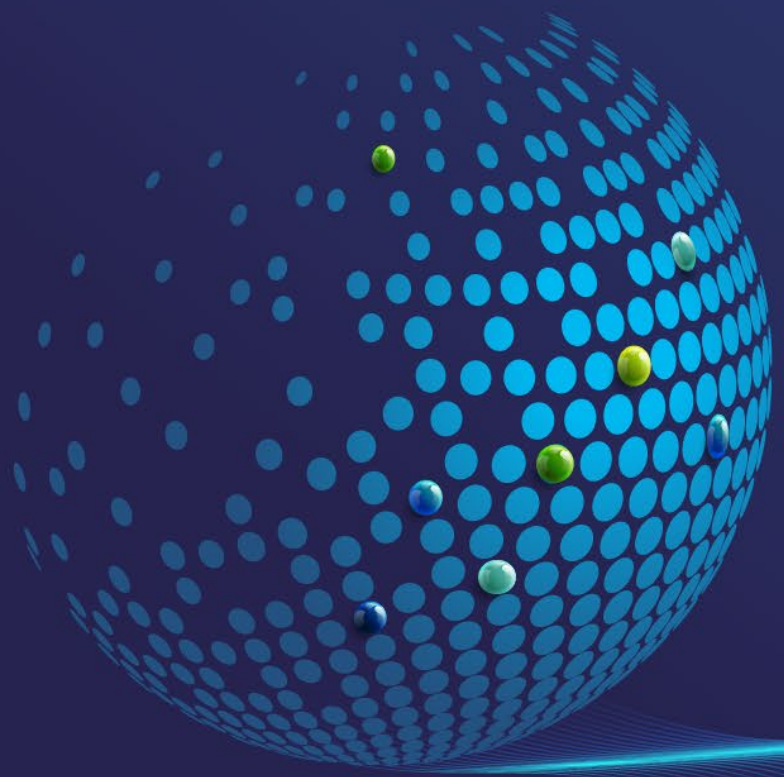

# I-CNSS towards secure and safe data Communication with LDACS&SWIM

SESAR 2020 SHOWCASE

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# SESAR PJ.14-W2-60 - LDACS

PJ.14 W2 I-CNSS

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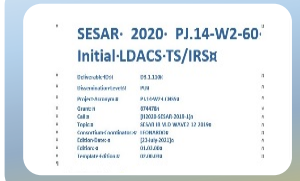
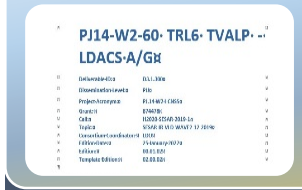
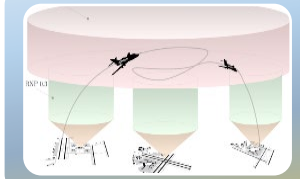
**The key areas are:**




Definition of LDACS functional and non functional requirements and coordination with standardization bodies

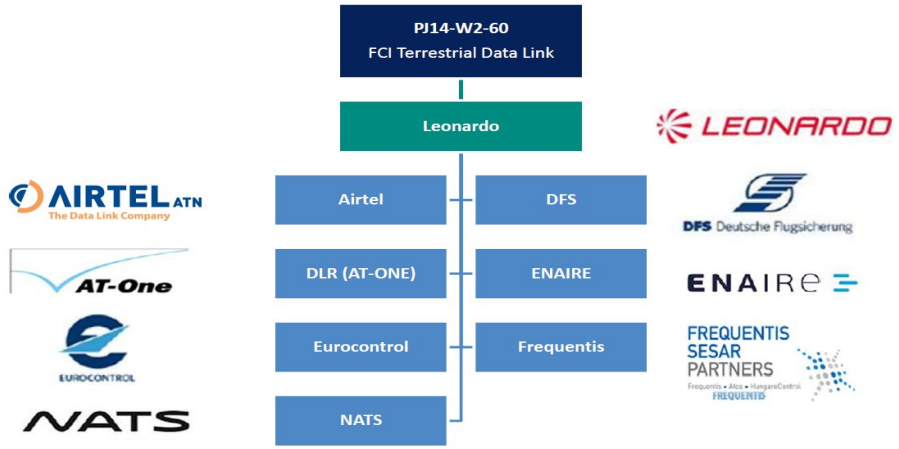



Develop and validate LDACS prototype in ATN-IPS infrastructure showing the interoperability of different manufacturers



Look at LDACS Navigation and LDACS Digital Voice Capabilities including the specific requirements

**The consortium is composed by:**

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# LDACS Architecture Principles

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Support the new FCI infrastructure.

Support digital voice communications, both for sector-oriented and flight-centric operations.

Support the deployment of LDACS technology, supporting legacy like ATN-OSI and ACARS.

The L-band digital aeronautical communications system providing a secure wide-band data link for data and voice services.

LDACS Architecture was defined and validated in SESAR Wave 1 (PJ.14-02-01) and during SEASR W2 Solution PJ.14-W2-60 continuous work on validation. The design work is also shared with ICAO PT-T Working Group

Overcome the current limitations of VHF Data Link Mode 2.

Potentially support new services like RPAS that could also be supported.

Support Navigation services (Alternative Navigation Position & Timing).

Support the current ATN-B1 and B2 services, as well as next SWIM Purple Profile.

# LDACS PJ.14-W2-60 Validation Exercises

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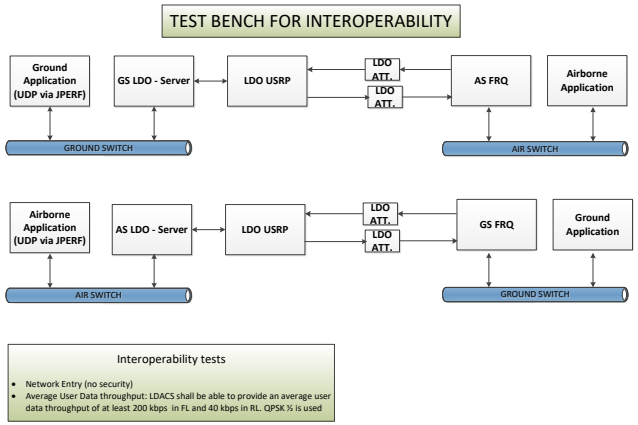
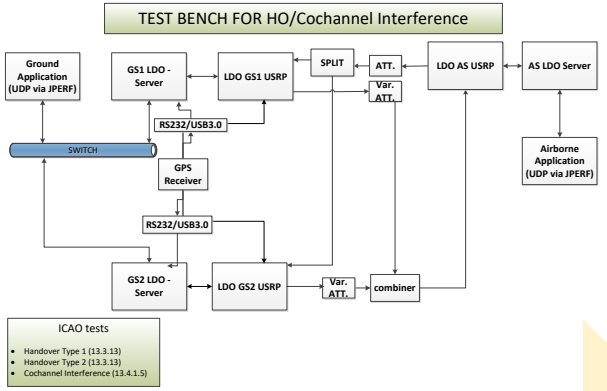
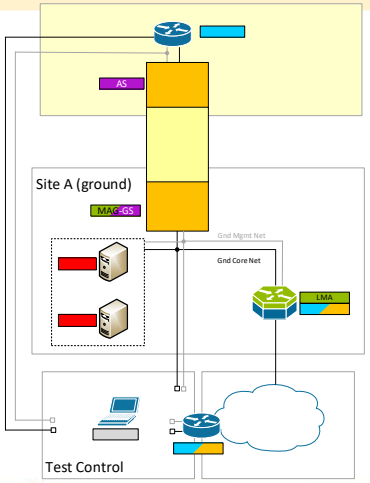
LDACS integrated on ATN-IPS

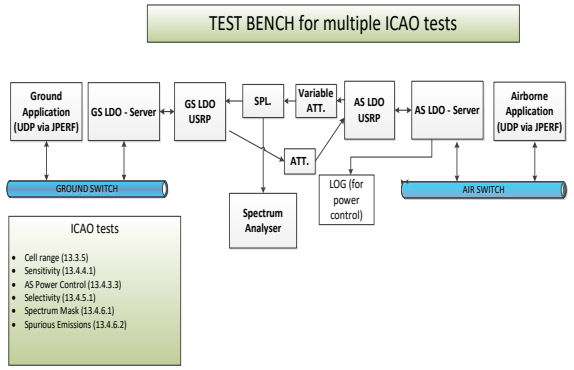



LDACS ICAO Requirements Validation




LDACS Functional Interoperability Testing




LDACS Handover Validation

# LDACS Flight Trial (PJ.33-W3-02)

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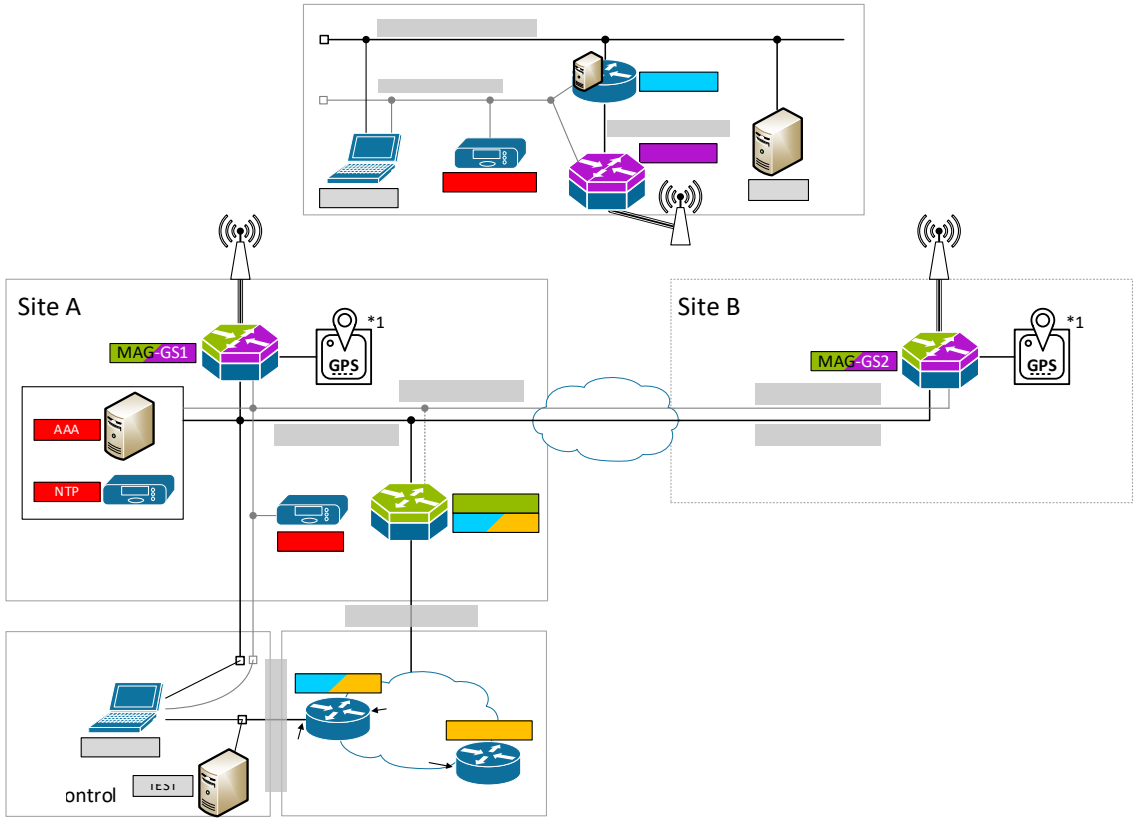

# LDACS Navigation Functionality (Pj.14-W2-81c)

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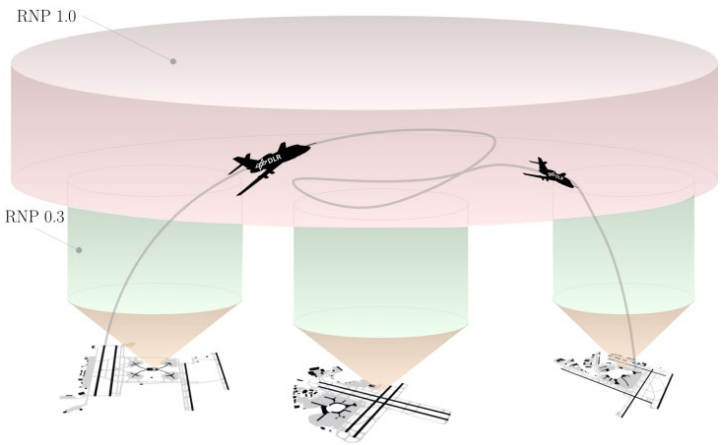
- The LDACS navigation functionality is foreseen as back-up to existing navigation means, e.g. to GNSS
  - LDACS as a complete APNT solution (APNT = Alternative Positioning, Navigation, and Timing)
  - LDACS as important part of modular APNT (DME, barometric height sensor, inertial sensors)




- Achievable accuracies with LDACS: RNP 1.0 up to RNP 0.3
- No changes to original LDACS signal required
- Only additional requirement for navigation functionality: precise synchronization of LDACS ground stations

# LDACS – Next STEPS

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STEP1 – FCDI & MIAR Project Execution Phase

STEP2 – LDACS COMM &NAV(Ground & Avionics Enabler) TRL6 Reached

STEP3 – Digital Sky Demonstrator & Pre-deployment Phase

LDACS DEPLOYMENT

# Air-Ground System Wide Information Management

PJ.14-W2-100 Solution

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"SWIM enabled Aircraft": fully connected information node enabling the aircraft to consume (uplink) and provide (downlink) SWIM information services promoting airborne participation in collaborative ATM through SWIM.

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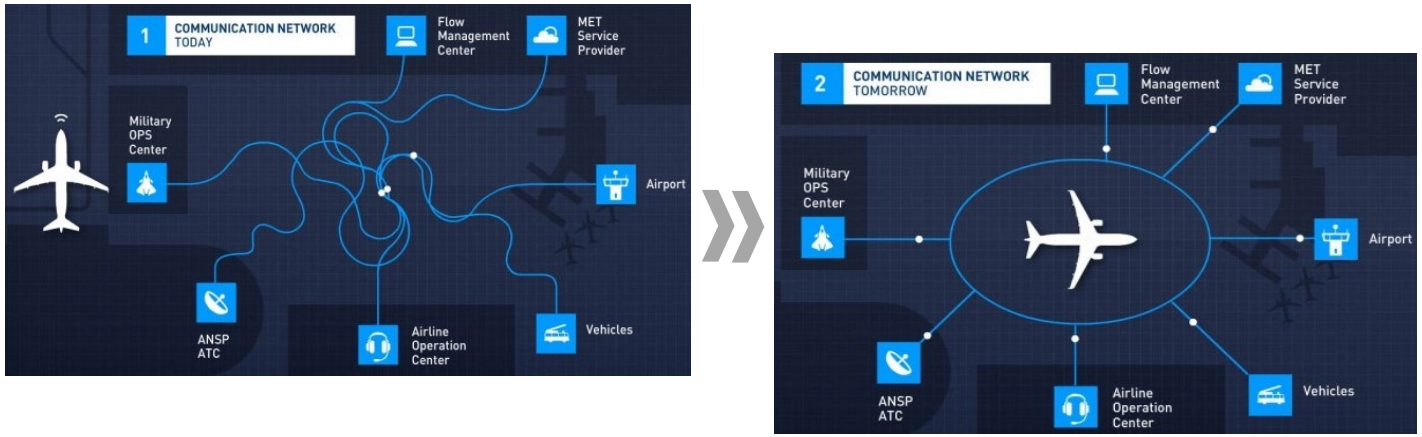
SWISS


TRL4 Achieved


SWIM principles and concepts applied to Air-Ground data communications enable safe, secure, reliable and cost-effective information sharing in support of increased levels of automation, digitalization and interoperability

# Air-Ground SWIM & “digital European sky”




- Trajectory-based operations (TBO)
- Digitalization and automation
- Cybersecurity
- Global interoperability
- Cost-efficiency
- …

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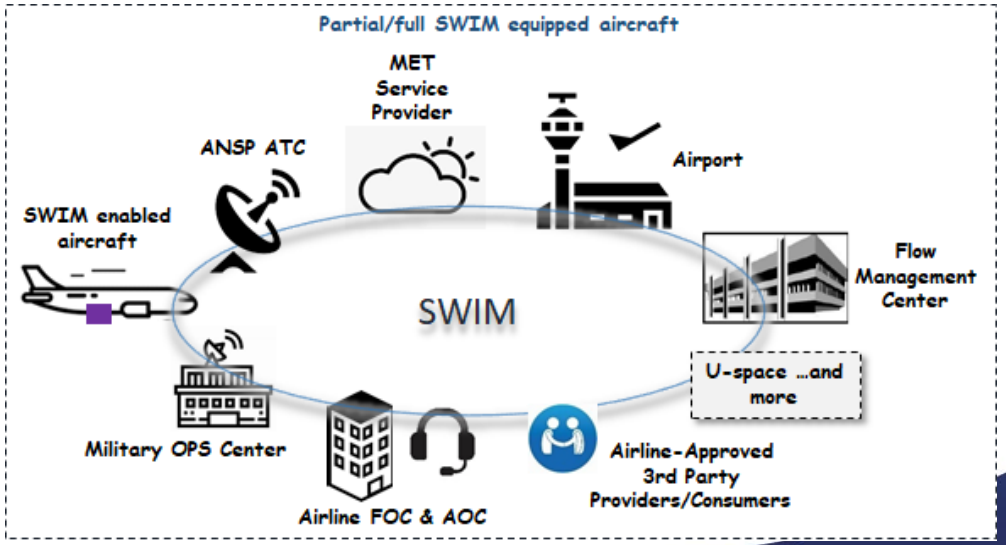
Yesterday, possible transition-phase solutions and the «tomorrow»: <u>end-to-end air-ground SWIM</u>

**Enabling airborne participation in collaborative ATM through SWIM**



# SWIM enabled AOC and ATS information sharing

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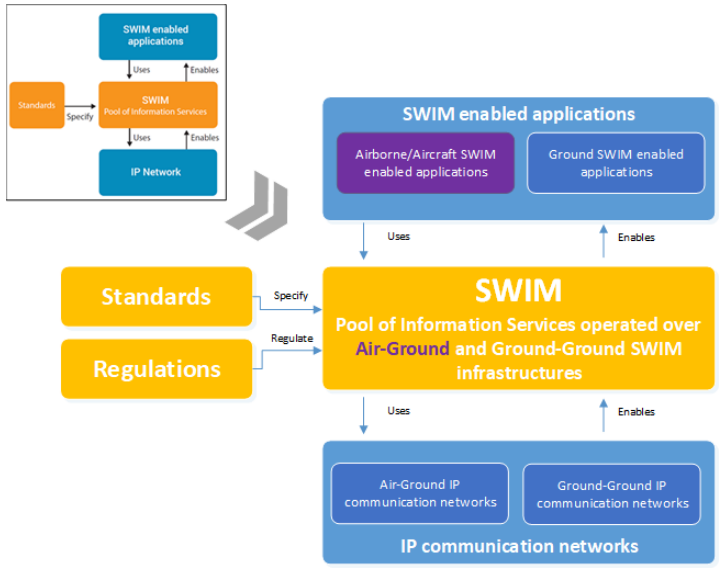
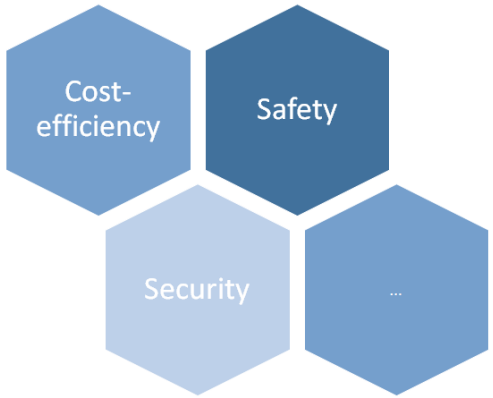
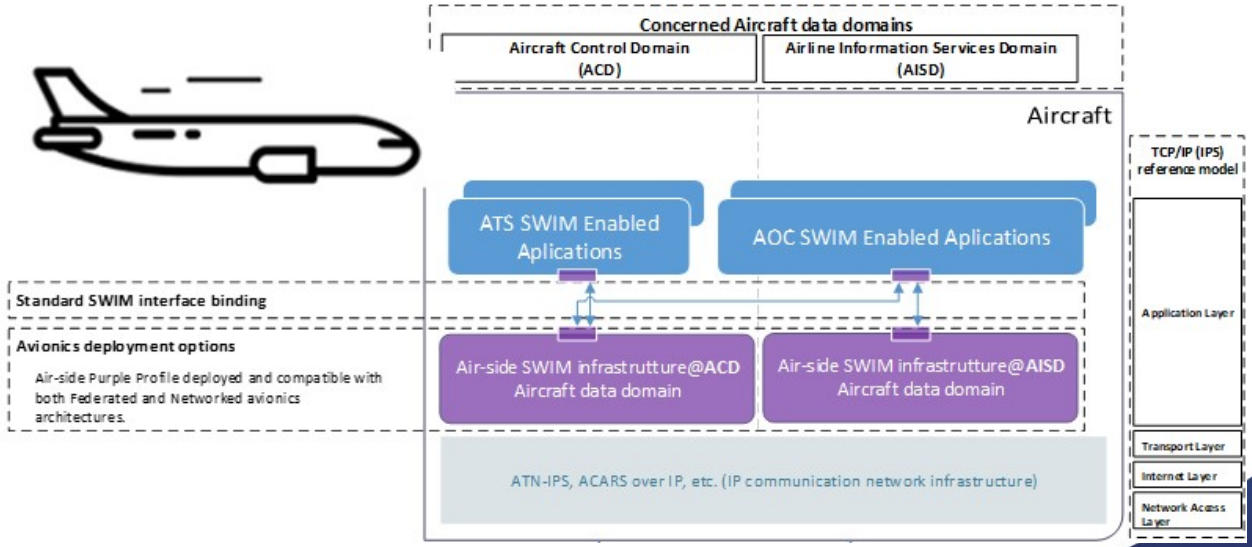



Flexible airborne SWIM infrastructure deployment enables to “SWIMize” current and future Air Traffic Services (ATS) and Aeronautical Operational Control (AOC) communication bringing benefits in terms of reliability, security, interoperability, agility and air-ground network resources usage.

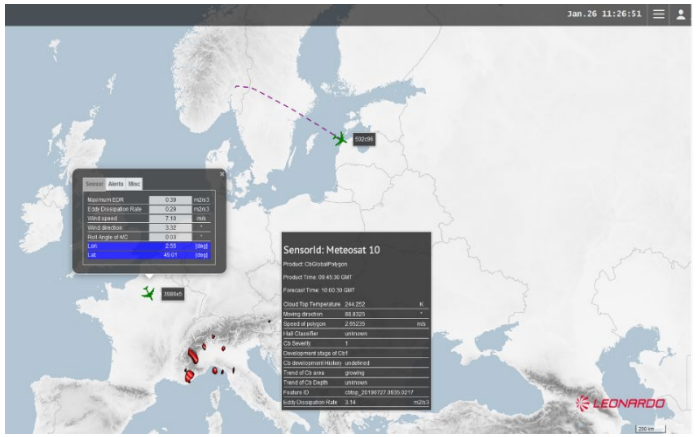


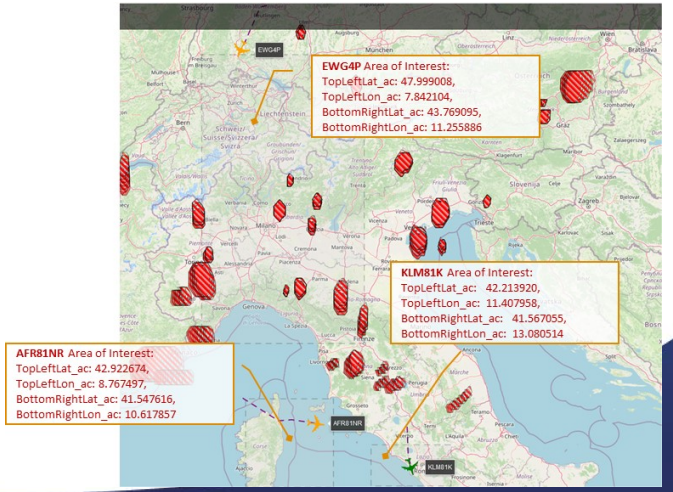



# Validation activities overview (1/2)

PJ.14-W2-100
EXE1a

- This exercise aimed to validate technical capabilities in support of the realization of the SWIM enabled aircraft concept.
- Several new end-2-end SWIM air/ground information sharing have been demonstrated including
  - Extended Projected Profiles (EPPs) distribution over end-to-end SWIM.
  - Uplink & Downlink of Weather data applying a rich set of ground-side filtering including 2D and 3D, flight phase, destination airport, etc.
  - End-to-end SWIM based interoperability between the aircraft and U-space:
    - Aircraft derived weather made available also to UTM
    - Conformance monitoring alerts from the UTM made available also to the Aircraft



# Validation activities overview (2/2)

PJ.14-W2-100 EXE1a

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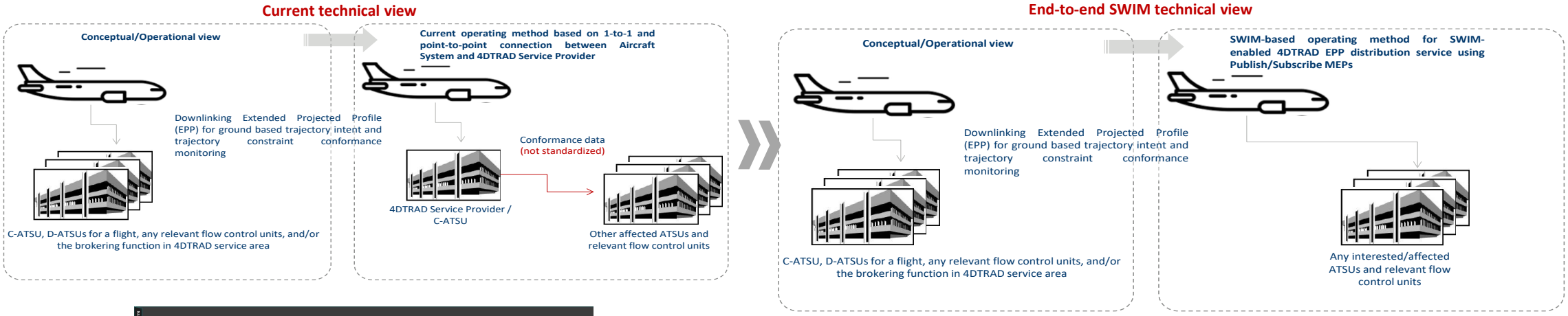
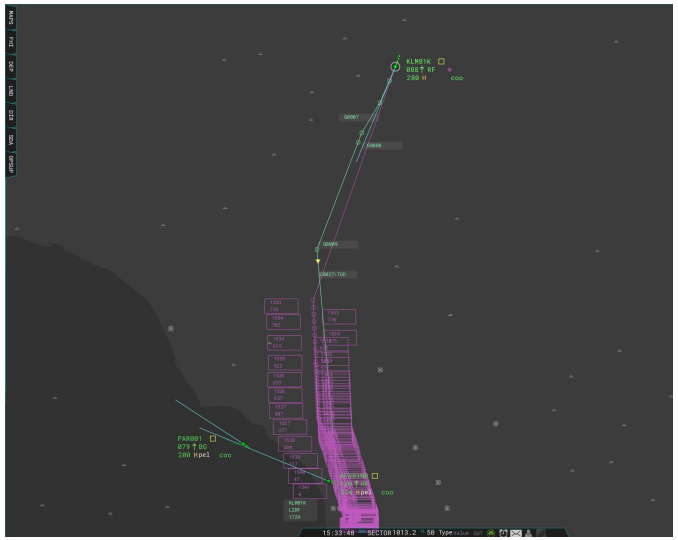
SWIM enabled EPPs distribution over end-2-end SWIM Publish/Subscribe



The Purple Profile enabled EPP distribution based on Publish/Subscribe MEP is characterized as follows:

- The service addresses end-to-end many-to-many EPP distribution.
- EPP messages are available to all interested and authorized ground systems.
- Decoupled technical and deployment views.
- Flexible operating methods.

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# What next?

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- Move from technological feasibility centric validation to performance-focused validation.

- More realistic validation platform in terms of network, representative avionics, etc. For instance, Flight trials with real datalinks and Purple Profile enabled ATS/AOC applications (shadow-mode/emulated) in support of operations like complex clearances

- Specify and validate performance efficiency validation objectives (time behavior, capacity, etc.) in a representative deployment. A first starting point would be validation scenarios with realistic bandwidth constraints on the air/ground link, preferably using a real subnetwork (e.g. LDACS).

- All these improvements (and more) will be part of SESAR3 MIAR project.