SESAR vs MET

Bart Nicolai – CAeM ET-ISA Core Expert
Geneva, 23 May 2017

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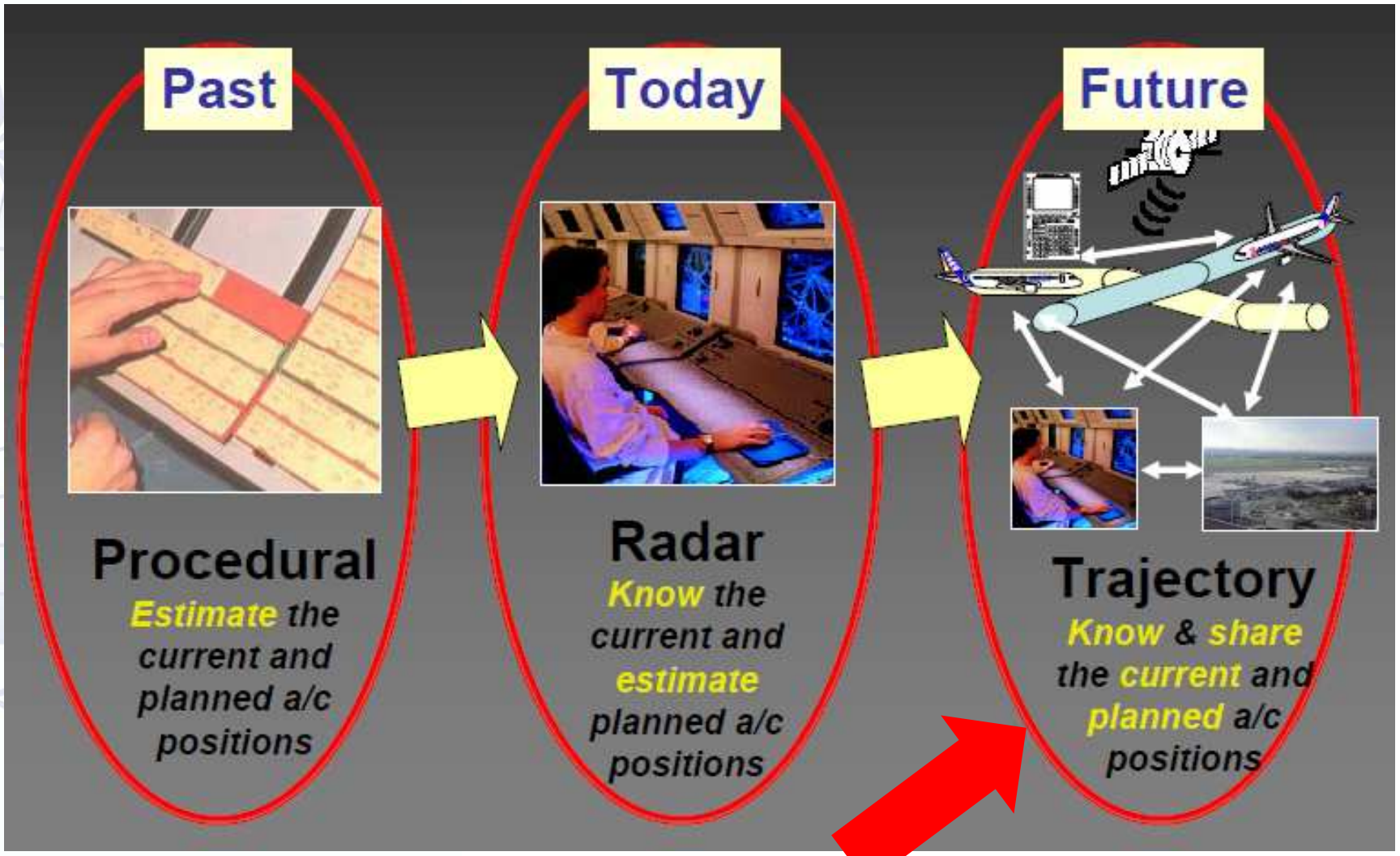
SESAR context

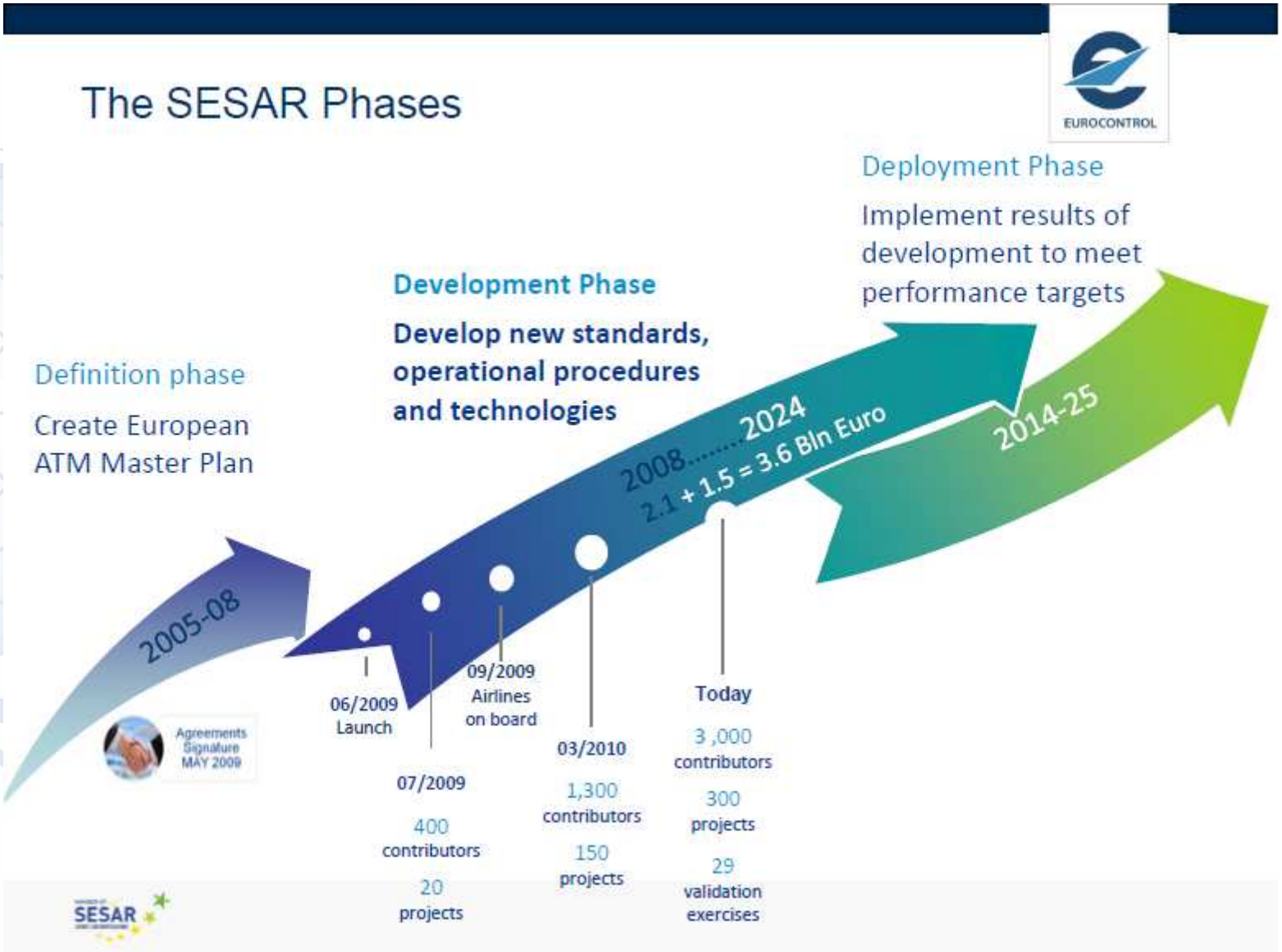
Source: European Commission

SESAR – ATM evolution



Planned position dependent on wind and influenced by (expected) location of adverse weather

SESAR phases



Source: Eurocontrol (Dennis Hart)

SESAR consortia

Definition phase

http://www.sesar-consortium.aero/

(no longer active)

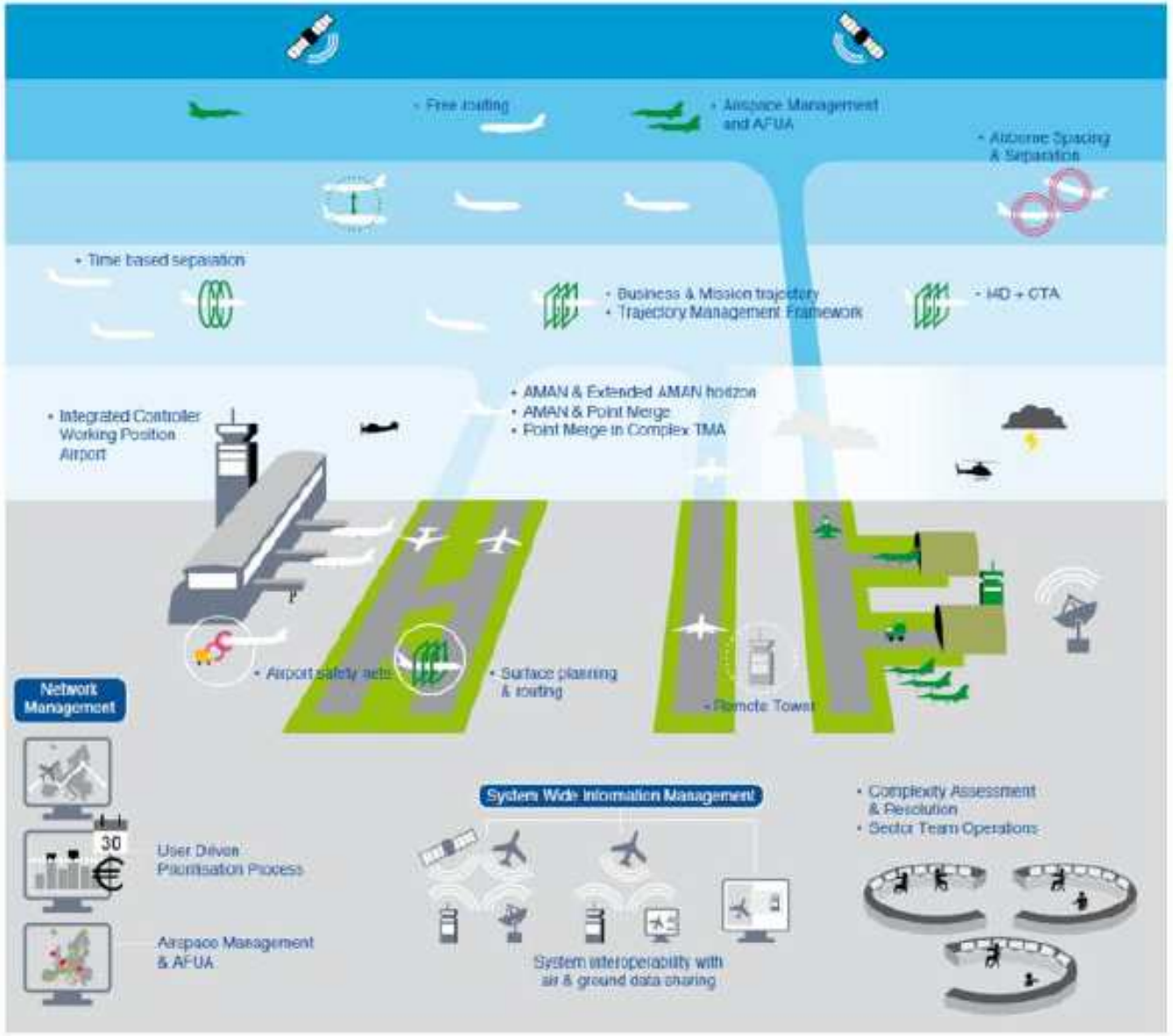
R&D phase

http://www.sesarju.eu/

Deployment phase

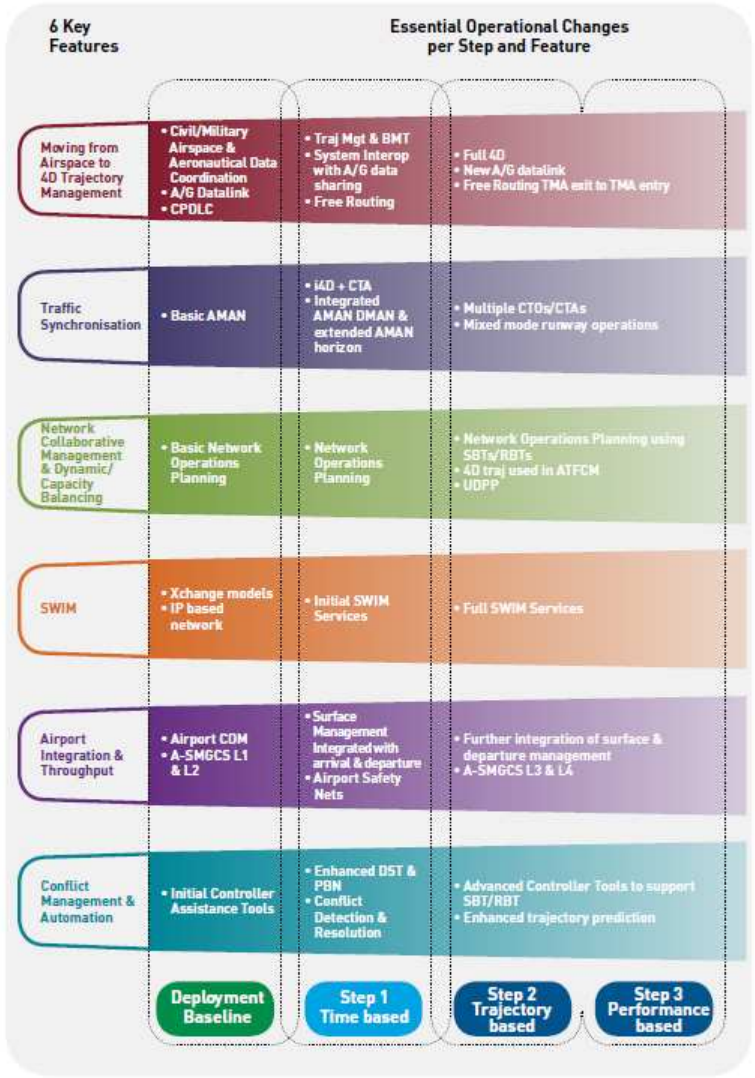
http://www.sesardeploymentmanager.eu/

SESAR 1 – Solutions

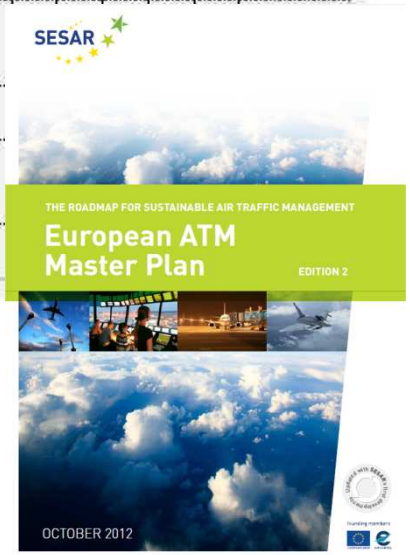


Source: SESAR JU

SESAR 1 – Mapping

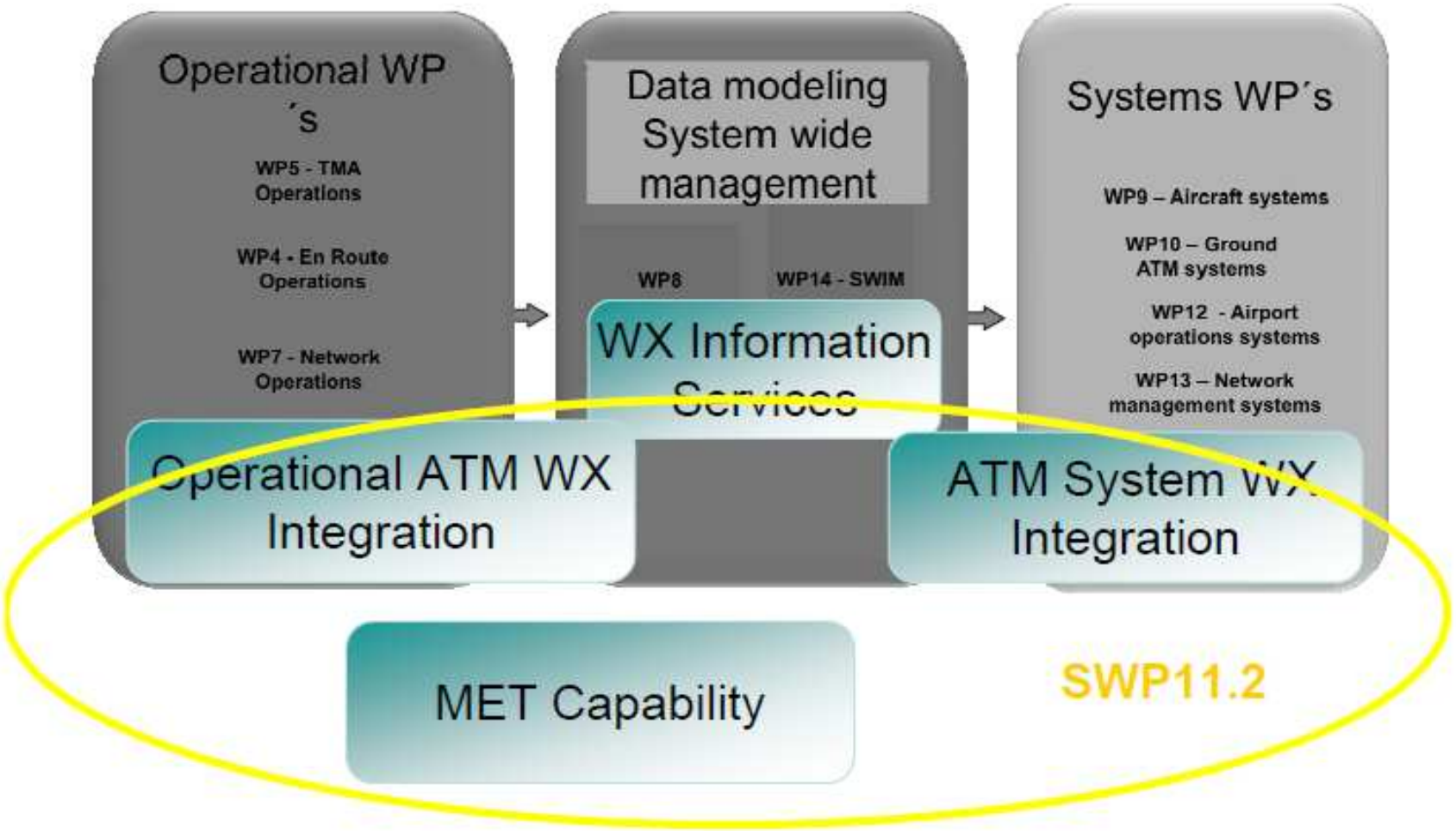


Essential Operational Changes	Airport				TMA				En-Route				Network
	LCn	MCn	HCn	VHCn	LCn	MCn	HCn	VHCn	LCn	MCn	HCn	VHCn	
Trajectory Management & Business/Mission Trajectory			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
System Interoperability with A/G Data Sharing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Free Routing									✓	✓	✓	✓	✓
i4D + CTA						✓	✓	✓		✓	✓	✓	✓
Integrated AMAN DMAN and extended AMAN Horizon						✓	✓	✓		✓	✓	✓	✓
Network Operations Planning	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SWIM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Surface Management integrated with Arrival & Departure			✓	✓									
Airport Safety Nets	✓	✓	✓	✓									
Enhanced Decision Support Tools & Performance Based Navigation						✓	✓						
Conflict Detection & Resolution							✓						



Source: ATM Masterplan (v2012)

SESAR 1 vs. MET

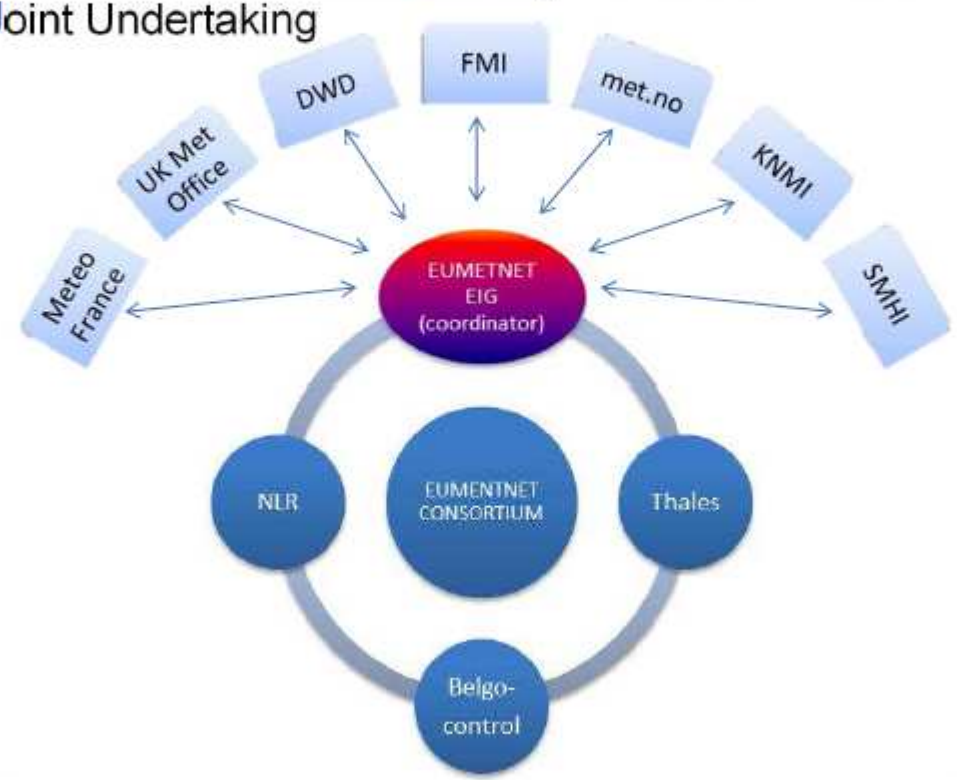


Source: Eurocontrol (Dennis hart)

SESAR 1 vs. MET

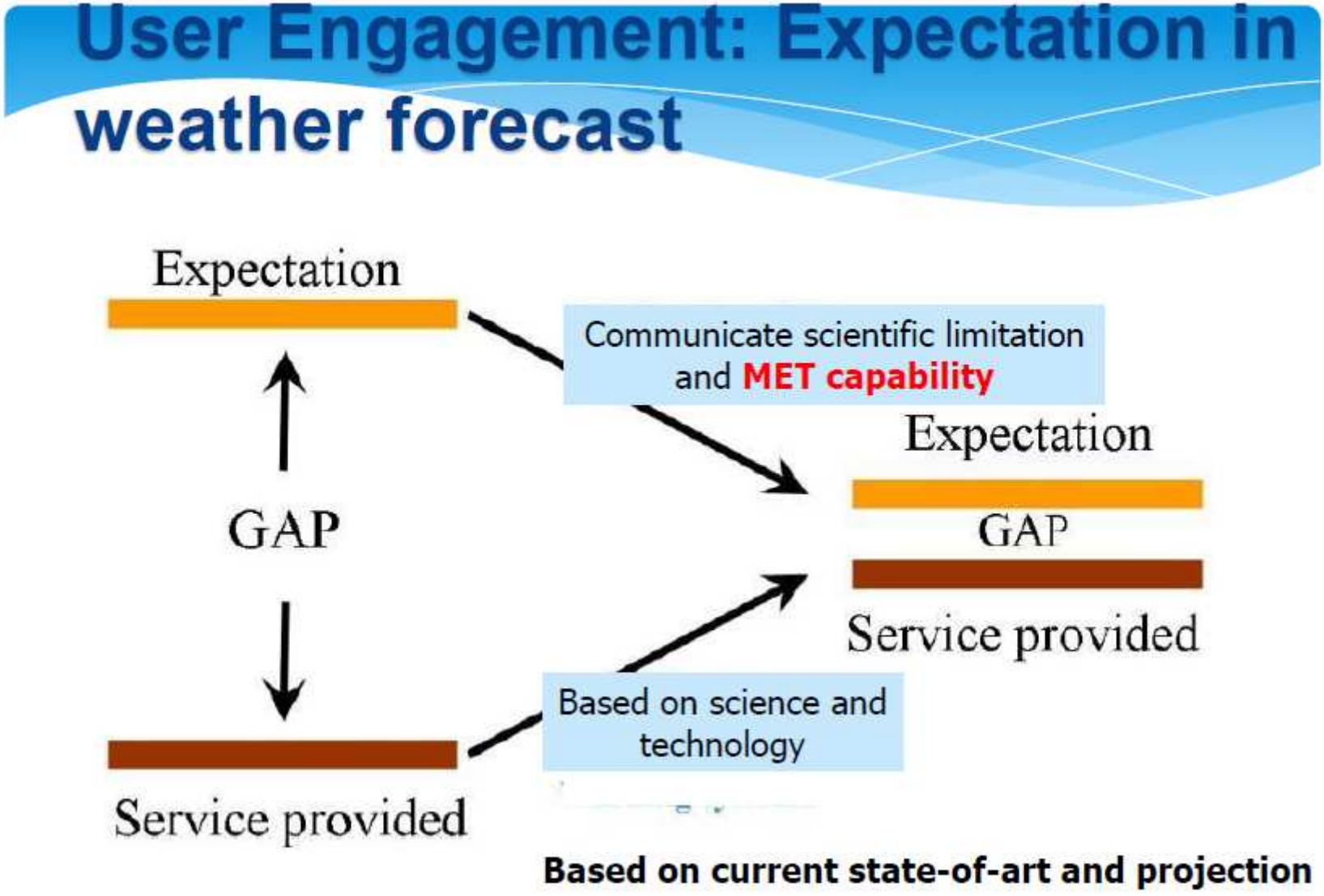
MET partner in SESAR

EUMETNET Consortium contracted by EUROCONTROL on behalf of SESAR Joint Undertaking

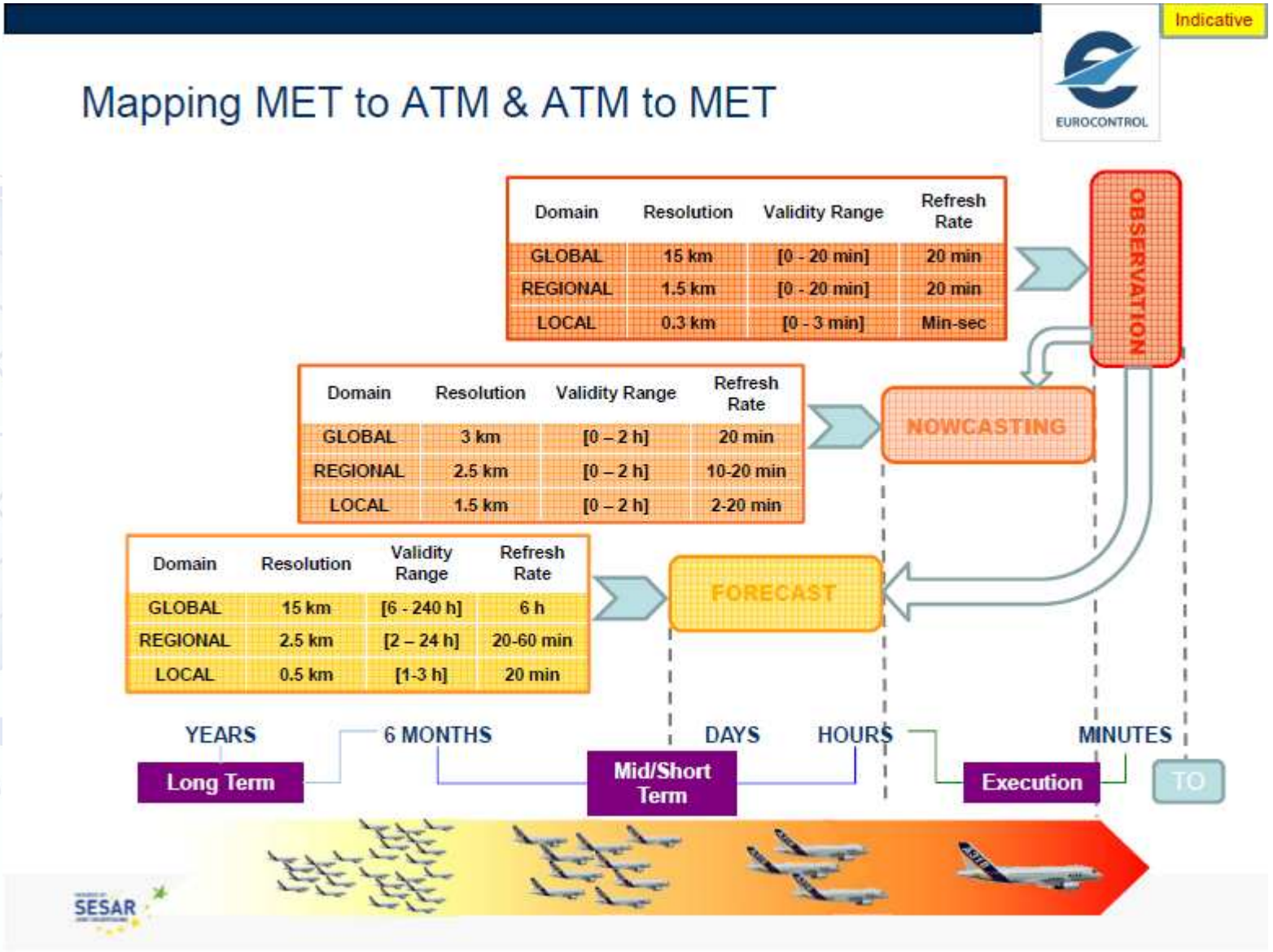


Source: Eurocontrol (Dennis hart)

SESAR 1 vs. MET – Raising awareness



MET vs. ATM timelines



Source: Eurocontrol (Dennis hart)

SESAR 1 vs. MET – Raising awareness

EUMETNET NLR THALES Belgocontrol

Raising Awareness – technical documents

SESAR JOINT UNDERTAKING

Meteorological Services: Real-time Weather Observations and ATM applications (including Nowcasting)

SESAR JOINT UNDERTAKING

Meteorological Services: Probability Forecasting and Aviation Applications.

SESAR JOINT UNDERTAKING

Meteorological Services: Prototype Development Preliminary Prioritisation

SESAR JOINT UNDERTAKING

Meteorological Services: Fundaments of Weather Forecasting.

SESAR JOINT UNDERTAKING

Meteorological Services: Convective Weather and Aviation Applications.

GIE/EIG EUMETNET

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SESAR 1 vs. MET – Future MET concept and Requirements

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Deliverables with MET concept & requirements

- MET-DOD (D18/D22/D26)
- MET-OSED (D9/D12/D19/D23) – 3 volumes
- MET-SPR (D10/D13/D20/D24) – 3 volumes

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SESAR 1 vs. MET – MET prototypes

WP11.02 prototypes – demonstrate high capabilities

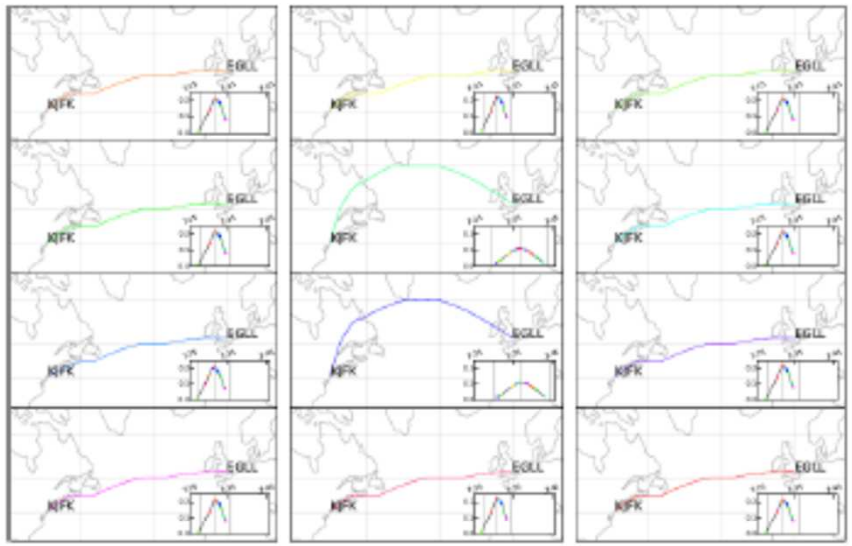
MET prototype		Related Validation EXE	Related Large Scale Demonstration (LSD)
X1.1	Radar Composite for 3D convection	VP811	TOPMET, TOPLINK, SWIM Master Class, SWIM Global Demo
X1.2	Nowcasting of Convection	VP811	TOPLINK, SWIM Master Class, SWIM Global Demo
X1.3	Super-Ensemble Mesoscale Forecast of Convection	N/A	
X1.4	Icing Forecast	VP700, VP811	TOPMET, TOPLINK, SWIM Master Class, SWIM Global Demo
X1.5	Clear Air Turbulence (CAT) Forecast	VP700, VP811	TOPMET, TOPLINK, SWIM Master Class, SWIM Global Demo
X1.6	Winter Conditions Forecast at Airports	VP513	TOPLINK
X1.7	MET support for Network capacity reductions due to weather across Europe	VP700	
X1.8	MET support to 4D trajectories	VP791(V2)	
X2.1	Mode-S EHS New Sensors	VP689 (partially)	
X2.2	E-AMDAR Humidity case studies	N/A	
N/A	4DWxCube - MET-GATE	VP700, VP811	TOPLINK, SWIM Master Class, SWIM Global Demo
N/A	Standard MET data (according ICAO Annex 3)	VP757	

http://www.sesarju.eu/sesar-solutions/enabling-aviation-infrastructure/met-information-exchange

Source: Eurocontrol (Dennis hart)

SESAR 1 vs. MET – Exploratory research - ensembles

Example
Probabilistic Trajectory Prediction SESAR WP11.1 / WP-E



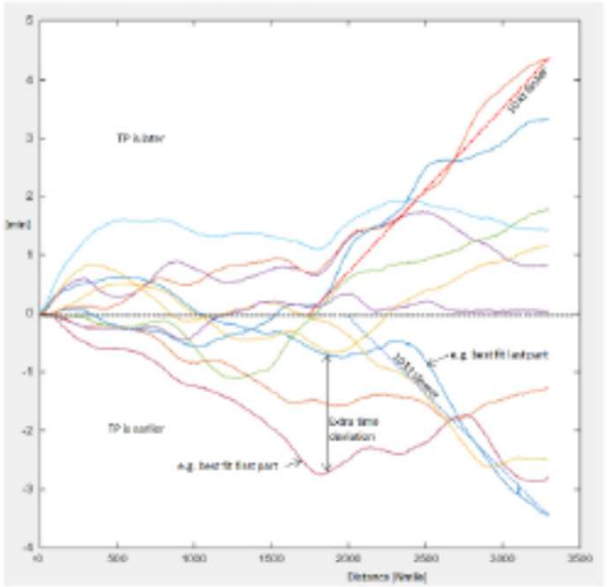


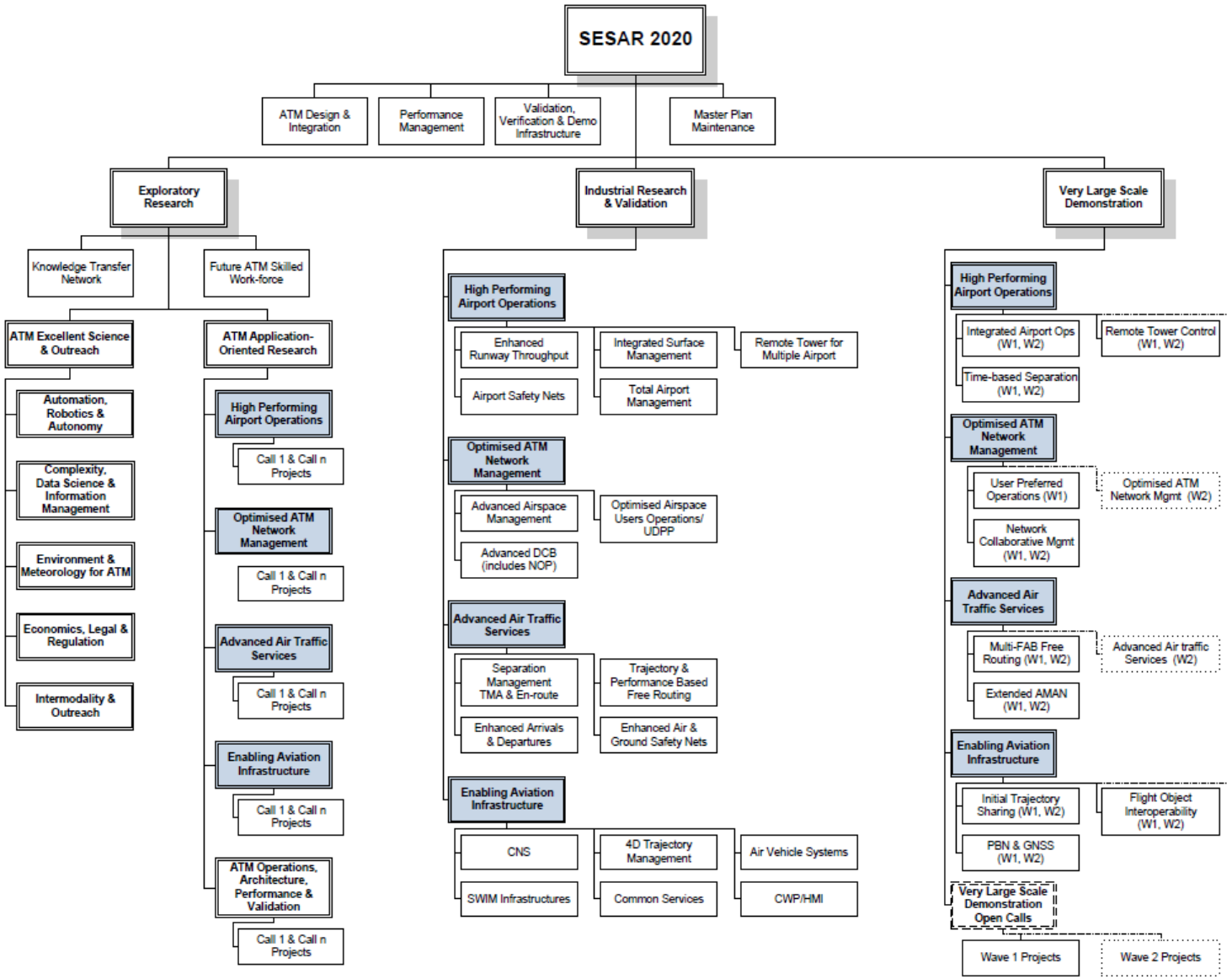
Figure 14: Flight time deviations from the deterministic member of the ensemble MET along route 8 (see Figure 3) and departing at 1427 (see Figure 4). Each line represents the TP result of a different member of the MET ensemble.

Enables improved knowledge based decision making, e.g.:

- Trajectory uncertainty (thus cost) is visible
- Cost index could use these (flight time) uncertainties
- Balancing flight time adherence vs total cost

Sources: SESAR WP E.02.40 Draft D2.2

SESAR 2020 – set up



Source: SESAR JU

Concept Maturity

SESAR 2020 vs. MET (ER)

Meteorology
Aviation is fundamentally affected by weather, and advances in the understanding and prediction of local and global meteorological effects will increase the efficiency and safety in the system. Enhanced meteorological information and capabilities made available system-wide have great potential as long as ATM is able to integrate the information fully into its decision making process.

Specific challenge: Research into enhanced meteorological capabilities and their integration into the ATM planning processes has great potential for improving ATM efficiency, e.g. through robust planning less vulnerable to unforeseen changes in weather; or through improved air-ground trajectory synchronisation. This requires understanding of the potential of different types of weather-related information in ATM operations taking into account the inherent uncertainty of meteorological information.

Scope: Research may investigate the vulnerability of the ATM system to local weather phenomena, with existing knowledge taken into account. Research may also investigate the levels of which weather uncertainty impacts 4D trajectories. Research to understand the impact of global and/or long-term phenomena such as climate change, global warming, changes in the frequency and severity of extreme weather or ash-cloud formation on ATM operations may also be considered.

Expected impact: This research will contribute significantly to enhancing ATM efficiency by integrating meteorological information. It will also lead to a better understanding of the resilience of the ATM system to local and global weather phenomena.

http://www.sesarju.eu/newsroom/all-news/first-call-launched-sesar-2020-exploratory-research-projects (call for proposals published on 19 March 2015)

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Source: SESAR JU & European Commission

SESAR 2020 vs. MET (IRV)

PJ.18-04: Management and sharing of data used in trajectory (AIM/METEO)	Solution PJ.18-04 will bring a coherent and consistent approach to how AIM and MET information required to support a gate-to-gate trajectory and the individual elements thereof will be managed from production to issuance. PJ.18-04 will collect and analyse the MET and AIM information requirements from the various other Solutions (including other Solutions defined by PJ.18) and define the required MET or AIM capability to meet these requirements as efficiently as possible. This includes a step to identify if there is a demonstrable benefit in providing the required MET or AIM information consistent and consolidated with other MET and AIM information or that a specific capability should be developed. The defined capabilities will be developed, prototyped and verified and the MET or AIM information will be made available as a SWIM service to the Solutions.
PJ.03a-09: Extended provision of Terminal information using datalink	This solution aims at providing the pilots current meteorological and operational flight information derived from ATIS and NOTAMs/SNOWTAMs, specifically relevant to the departure, approach and landing flight phases via datalink. D-OTIS can be seen as an evolution of the current ATIS services by including NOTAM information automatically, and making it accessible on demand for flight crew. In current ATIS, special operational information affecting the airport is often added manually in a few free text lines or broadcasted by voice. This information can also be provided electronically to the flight crew but only during pre-flight phases (via PIBs).

Source: SESAR JU & European Commission

SESAR 2020 vs. MET (IRV)

PJ.03b-07: Weather hazards detection and alerts	To improve safety, the objective will be – depending on the hazard – to identify which level of support and alerting function would be relevant for Air Traffic Controllers and develop this as a SESAR solution.
PJ.04-04: Pro-active management of MET impacts on the AOP	This SESAR solution addresses two key issues to support pro-active management, the translation of MET information in impacts and the quantification of their likelihood (predictability). Therefore The focus of the MET contribution will be on the integration of tailored MET information in the ATM and airport management processes, including information on MET forecast uncertainty. The first level of integration is already deployed at some CDM airports and consists in probabilistic MET information on a separate display. The next step in PJ04 will be to integrate MET information in impact assessment models to derive an ensemble prediction of the impacts and support DCB with probabilistic impact assessment. The last step in SESAR2020 will be to integrate MET impact assessment in decision support tools to derive optimal solutions in adverse weather conditions. The MET information covers from observation to 7 days forecast of nominal and significant weather, seamless in space and time, and with progressively finer time steps from 6 h for the 7 days horizon to 5 minutes for the forthcoming 2 hours. MET uncertainty will be quantitatively assessed using ensemble weather predictions that provide a probabilistic vision of the future.

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Source: SESAR JU & European Commission

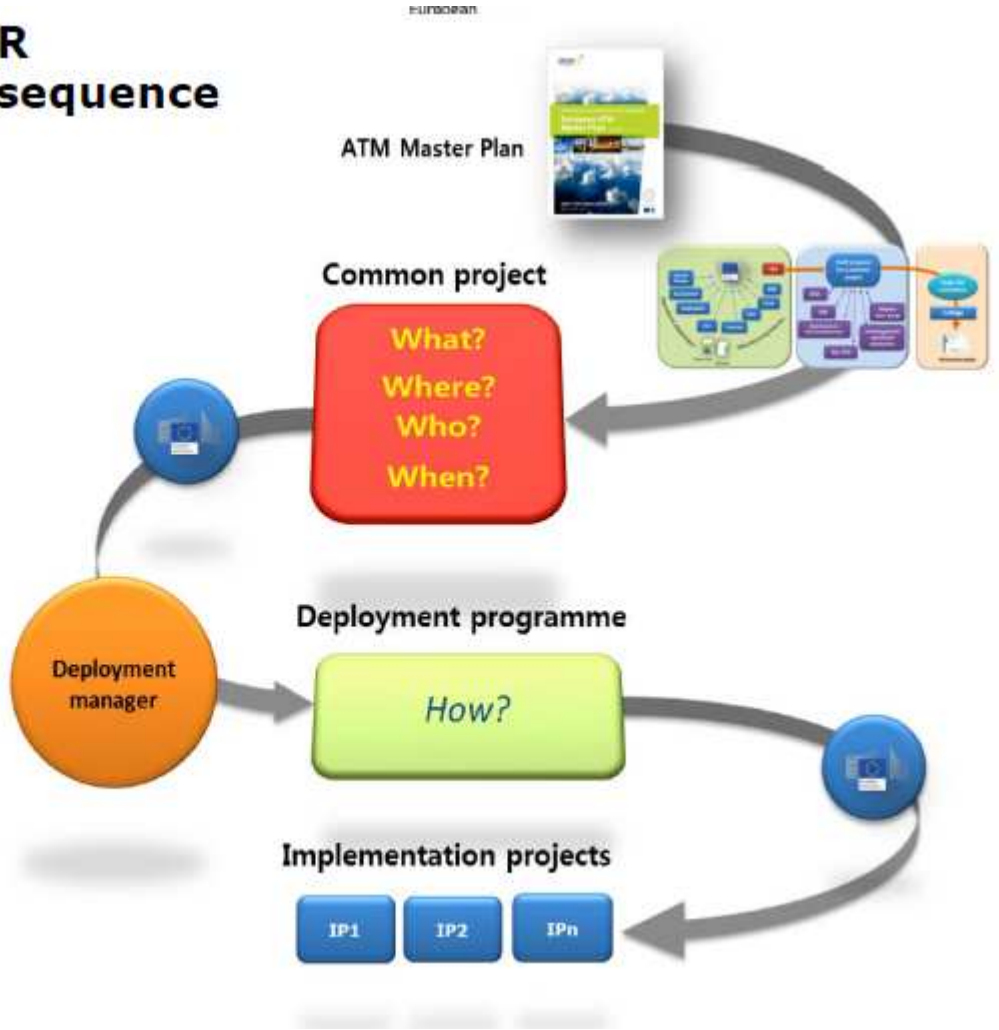
SESAR Deployment

Common Projects

"what, where, who & when"

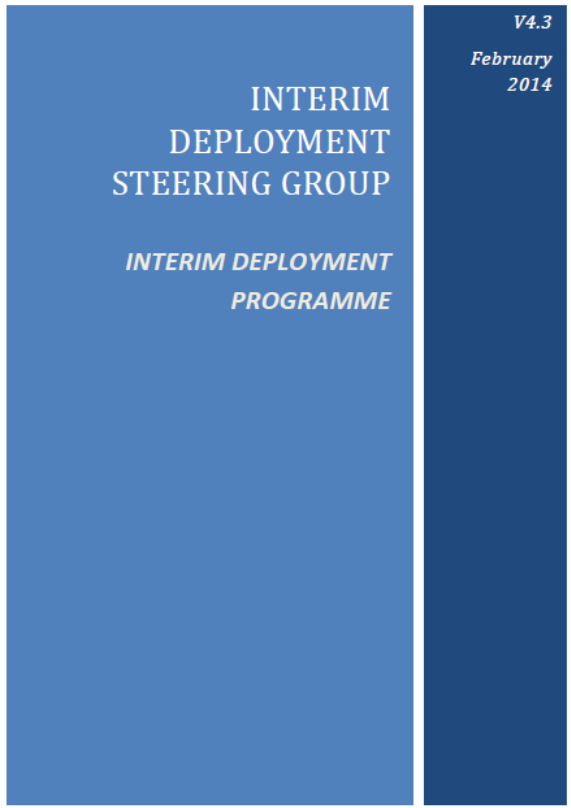
Identify & **enforce** deployment of ATM functionalities that:

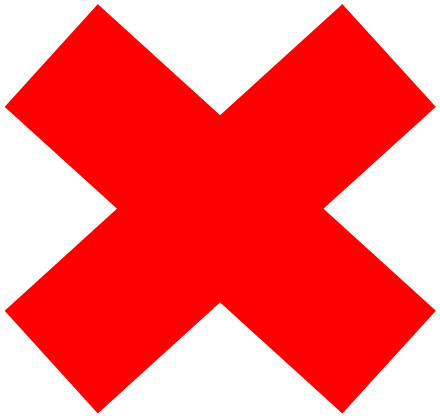
- Contribute to achieving the ATM Master plan **essential operational changes**
- Are **mature** enough for implementation
- Require a **synchronised** deployment



Source: European Commission

SESAR Deployment vs. MET





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SESAR Deployment vs. MET

COMMISSION IMPLEMENTING REGULATION (EU) No 716/2014

of 27 June 2014

on the establishment of the Pilot Common Project supporting the implementation of the European Air Traffic Management Master Plan

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EC) No 550/2004 of the European Parliament and of the Council of 10 March 2004 on the provision of air navigation services in the single European sky (1), and in particular Article 15a(3) thereof,

Whereas:

(1) The Single European Sky Air Traffic Management Research and Development (SESAR) project aims to modernise air traffic management (hereinafter: 'ATM') in Europe and represents the technological pillar of the Single European Sky. It aims to provide the Union by 2030 with a high performing air traffic management infrastructure that will enable the safe and environmentally friendly operation and development of air transport.

(2) Commission Implementing Regulation (EU) No 409/2013 (2) laid down the requirements related to the content of common projects, their setup, adoption, implementation and monitoring. It provides that common projects are required to be implemented on the basis of the deployment programme through implementation projects

Operational stakeholders and the Network Manager referred to in Point 5.2 shall provide and operate the iSWIM as of 1 January 2025.

CIR 716/2014

5.1.4. *Meteorological information exchange*

Operational stakeholders shall implement services which support the exchange of the following meteorological information using the yellow SWIM TI Profile:

— Meteorological prediction of the weather at the airport concerned, at a small interval in the future:

  — wind speed and direction

  — the air temperature

  — the altimeter pressure setting

  — the runway visual range (RVR)

  — Provide Volcanic Ash Mass Concentration

  — Specific MET info feature service

  — Winds aloft information service

  — Meteorological information supporting Aerodrome ATC & Airport Landside process or aids involving the relevant MET information, translation processes to derive constraints for weather and converting this information in an ATM impact; the system capability mainly targets a 'time to decision' horizon between 20 minutes and 7 days.

  — Meteorological information supporting En Route/Approach ATC process or aids involving the relevant MET information, translation processes to derive constraints for weather and converting this information in an ATM impact; the system capability mainly targets a 'time to decision' horizon between 20 minutes and 7 days

  — Meteorological information supporting Network Information Management process or aids involving the relevant MET information, translation processes to derive constraints for weather and converting this information in an ATM impact; the system capability mainly targets a 'time to decision' horizon between 20 minutes and 7 days

Service implementations shall be compliant with the applicable version of AIRM, the AIRM Foundation Material and the ISRM Foundation Material.

System requirements

— ATM systems shall be able to use the MET information exchange services

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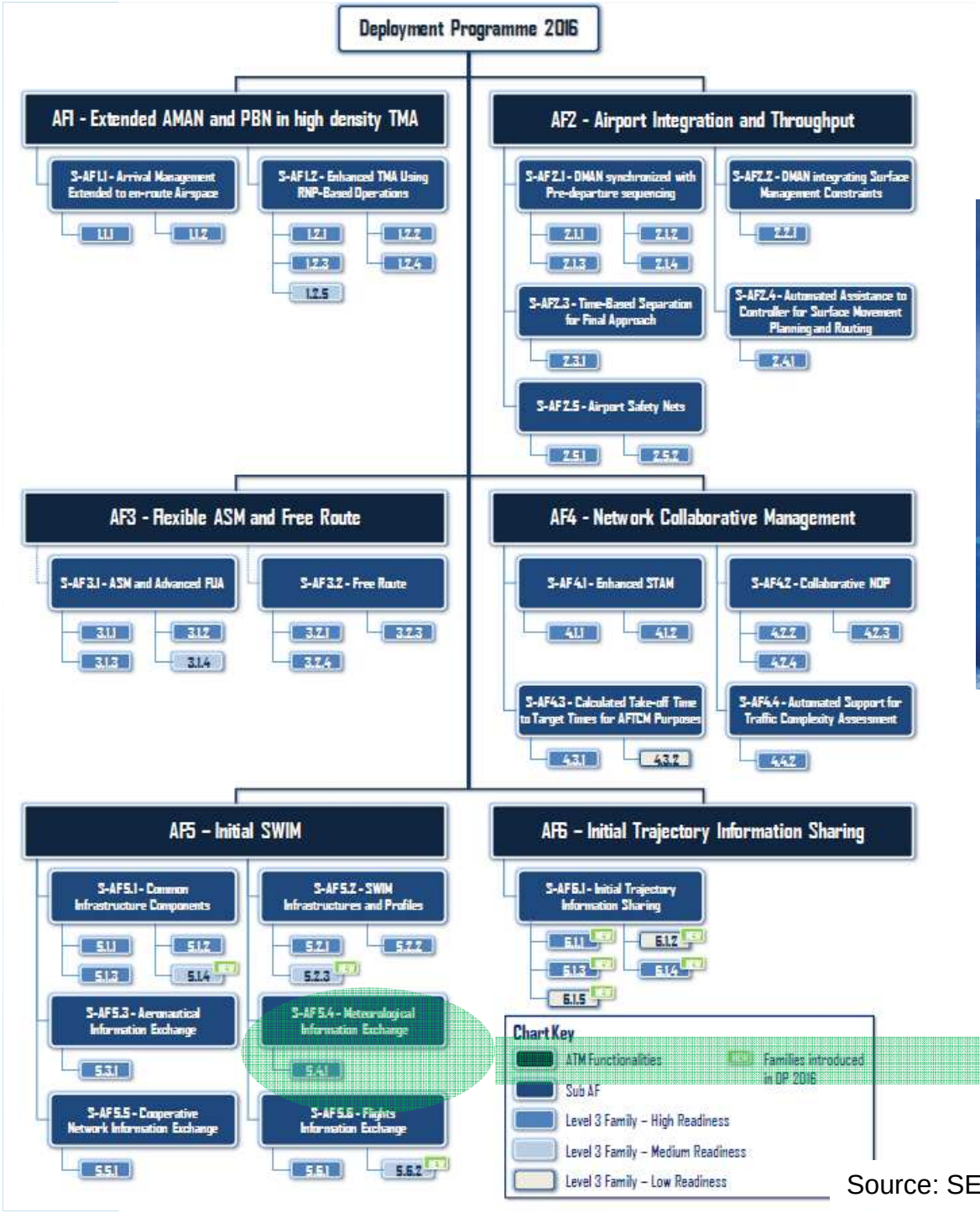
SESAR Deployment vs. MET



DP2016 - Family 5.4.1

- Volcanic Ash Mass Concentration
- Airport MET Observation
- Airport MET Forecast
- Airport MET Alert
- Airport MET Induced Capacity Reduction
- MET Hazard Enroute Observation
- MET Hazard Enroute Forecast
- MET Gridded Forecast

Source: SESAR Deployment Manager

Deployment Programme – MET outside 5.4.1

Families 1.1.1/1.1.2

- AMAN applications require high resolution wind information in approach/TMA area

Family 2.1.4

- (initial) AOP requires MET information as input to weather monitoring and adverse weather management activities

Family 2.3.1

- Time Based Separation requires high resolution wind information as input
- Ref. PCP: Actual glide slope wind conditions are required

Family 3.1.4

- To appropriately manage dynamic airspace configuration a good situational awareness of the weather conditions (both actual and pre-tactical) are required

Families 4.1.2/4.2.2

- Advanced STAM & NOP activities both require (network wide) MET information for situational awareness purposes and to trigger the required NM activities

Family 4.4.2

- Complexity management needs to take into account the weather situation to assess whether or not the proposed de-complexing traffic complexity solutions are feasible

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Deployment Programme – SWIM aspects

Family 5.1.2

- Making SWIM compliant MET Information Services available: via NewPENS network

Family 5.1.3

- Implementation of common SWIM infrastructure componenents: MET inforation services to be published in SWIM registry

Families 5.2.1, 5.2.2 & 5.2.3

- Implement Internet Protocol compliance, SWIM infrastructure components & SWIM PKI & cyber security

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MET Projects (ongoing)

Project Name	Project Coordinator	Project Contributors
Initial WXXM Implementation on Belgocontrol systems	Belgocontrol	N.A
SESAR PCP Meteorological Information Exchange by MET ANSP KNMI to support non-safety-critical and safety-critical aviation applications for Amsterdam Schiphol	KNMI	N.A
European Weather Radar Composite of Convection Information Service	EUMETNET EIG	Met Office (UK) DWD Météo-France EUROCONTROL
European Harmonised Forecasts of Adverse Weather (Icing, Turbulence, Convection and Winter weather)	EUMETNET EIG	Met Office (UK) DWD Météo-France FMI EUROCONTROL
European MET Information Exchange (MET-GATE)	EUMETNET EIG	Met Office (UK) DWD Météo-France EUROCONTROL DFS
European Meteorological Aircraft Derived Data Center (EMADDC)	KNMI	Met Office (UK)
Sub-regional SWIM MET deployment to support NEFRA	FMI	SMHI DMI EEA

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MET use projects (ongoing)

Project Name	Project Coordinator	Project Contributors
Amsterdam Schiphol AMAN 2.0 Including: Implementing high resolution meteo data to improve trajectory prediction	LVNL	N.A.
AF2_MET-Compliance-Program Including: • Recovering and improving loss of capacity due to bad weather conditions • Supporting automatic observer functions • Improve exchange of meteorological information	Austrocontrol	N.A.
Initial (I)WXXM implementation on CCIS Amsterdam ACC and Schiphol Including: • Implementation of the (I)WXXM model in the meteo gateway of LVNL, CCISv2 • Demonstration and verification of the operational deployment of iSWIM for MET information, in collaboration with the dutch MET office KNMI • Receiving and storing MET information coming from the dutch MET office KNMI, compliant with the iSWIM data formats and interfaces. • Simultaneously supporting legacy messaging exchanges	LVNL	N.A.

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THANK YOU !
ANY QUESTIONS?