FROM INNOVATION TO SOLUTION

THE SESAR PROGRAMME

Patrick KY,

Executive Director

SESAR WORKSHOP, 25 June 2013, Washington DC

SESAR JOINT UNDERTAKING

founding members

EUROPEAN UNION

EUROCONTROL

Change in Air Traffic Management infrastructure is inevitable

What is changing with SESAR

Partnership

- *3000 persons, 110 companies, Airspace users, military, staff,…*

Pragmatism

- *Technologies validated in a real life operational environment*
- *Demonstration flights (e.g. Green flights)*

Business cases

- *Involvement of suppliers, integrators and buyers*
- *Direct link to standardisation and regulation*

CHALLENGES FOR BUILDING ATM CAPACITY

1. Bringing ATM to the Internet Age
2. Sustainability push
3. Regulatory alignment

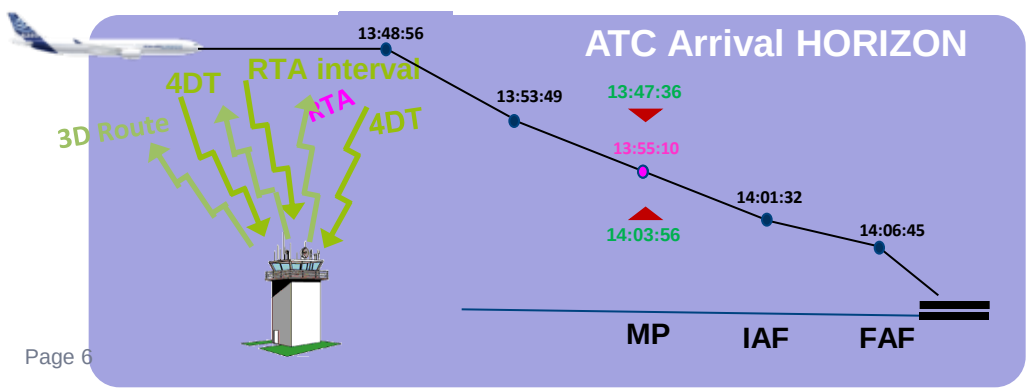
Technological Revolution in ATM

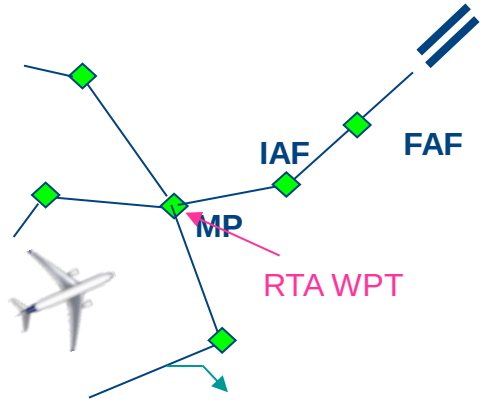
- **Replace VHF radio by digital communication**
- **Integrate the aircraft/flight and the airport in the ATM System**
- **Automate**

4D Trajectories Operations

- *Once the A/C enters the ATC arrival horizon, at least 40' before landing*:

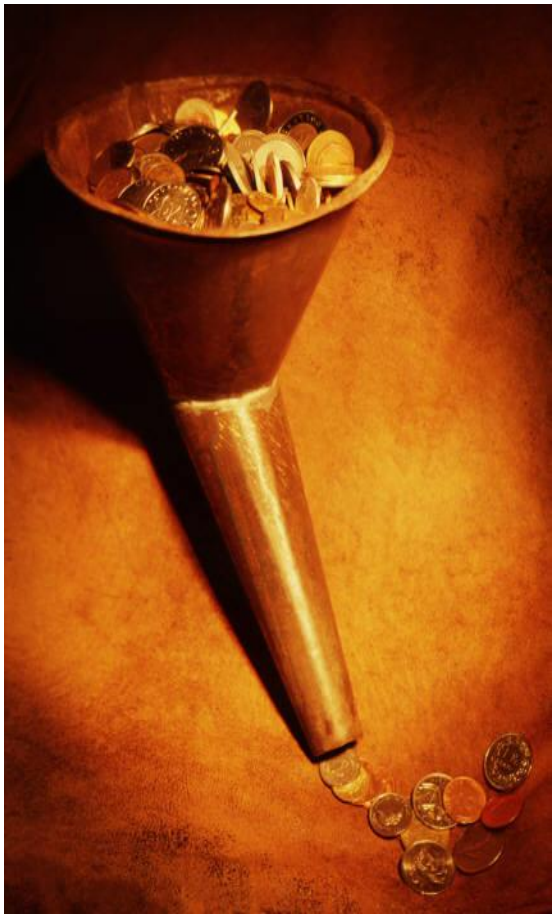
1. ATC uplinks to A/C the route clearance to follow down to runway - (via CPDLC).
2. Crew loads the route clearance into the FMS and updates FMS winds and temperatures data (via AOC datalink function). A/C downlink of 4D predicted trajectory (ADS-C).
3. ATC requests Reliable RTA interval for merge point (via ADS-C). A/C downlinks Reliable RTA interval (via ADS-C).
4. ATC uplinks feasible RTA.
5. Crew inserts RTA in FMS as active data. A/C downlinks A/C 4D predicted trajectory (via ADS-C).
6. 4D trajectory agreed by crew and ATC➔ Descent can be flown in full managed.





Sustainability push

- ATM business models will change (un-bundling, PPP, Airlines-Airports-ATM joint ventures,…)
- New capacity will be created and owned by heterogeneous stakeholders
- Off-the-shelf non ATM products will provide the basic infrastructure



Regulatory Alignment

- **No compromise on Safety**
- **Business models are linked to economies of scale**
- **International standards**
- **Regulatory drum-beat enforces necessary changes even if the business case is not positive**

Single European Sky builds on five pillars

Performance

Performance scheme
Performance Review Body
Functional Airspace Blocks
Network Manager
National Supervisory Authorities

Safety

EASA: ATM Competence
Crisis coordination cell

Technology

SESAR

ATM Master plan
SESAR Joint Undertaking
Common projects

Airports

Airport observatory

Human factor

Specific sectorial dialogue Committee
Consultative expert group on social dimension of the SES

THE EUROPEAN ANSWER

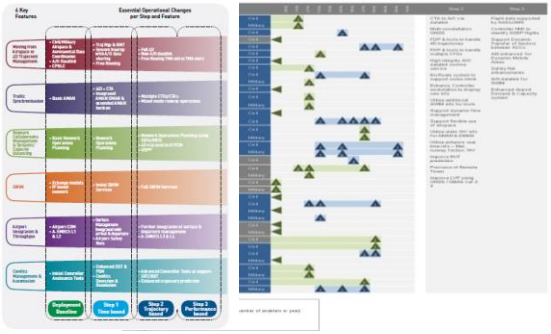
- The Governments of the 27 European States all signed up for the Single European Sky policy
- The Single European Sky ATM Research programme is the technological pillar of the Single European Sky
- Managed by a Public Private Partnership (SESAR Joint Undertaking), the programme is aiming at developing and validating in 8 years the technologies and procedures of the future ATM System

SESAR
JOINT UNDERTAKING

SESAR DEVELOPMENT

MASTER PLAN

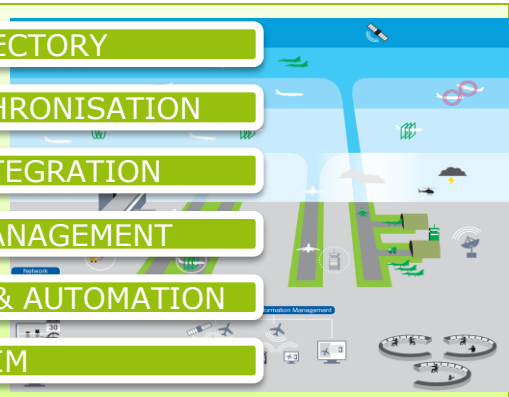
PERFORMANCE NEEDS
OPERATIONAL IMPROVEMENTS & ENABLERS
HIGH LEVEL DEPLOYMENT & DEVELOPMENT TIMELINE



PROGRAMME

PERFORMANCE VALIDATION TARGETS
CONCEPT & ARCHITECTURE
OPERATIONAL & TECHNOLOGY SOLUTIONS
CASES
STANDARDISATION & REGULATION PREP.

- 4D TRAJECTORY
- TRAFFIC SYNCHRONISATION
- AIRPORT INTEGRATION
- NETWORK MANAGEMENT
- CONFLICT MGT. & AUTOMATION
- SWIM



R&D PROJECTS

OPERATIONAL REQUIREMENTS
SYSTEM PROTOTYPES
VALIDATION ACTIVITIES & RESULTS

SESAR DELIVERY

MASTER PLAN

2010 | 2011 | 2012 | 2013 | 2014

Performance 2020+

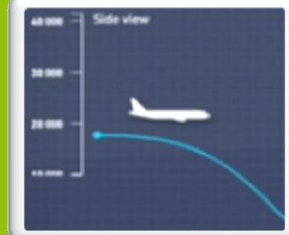
Trajectory Based Operations 2017

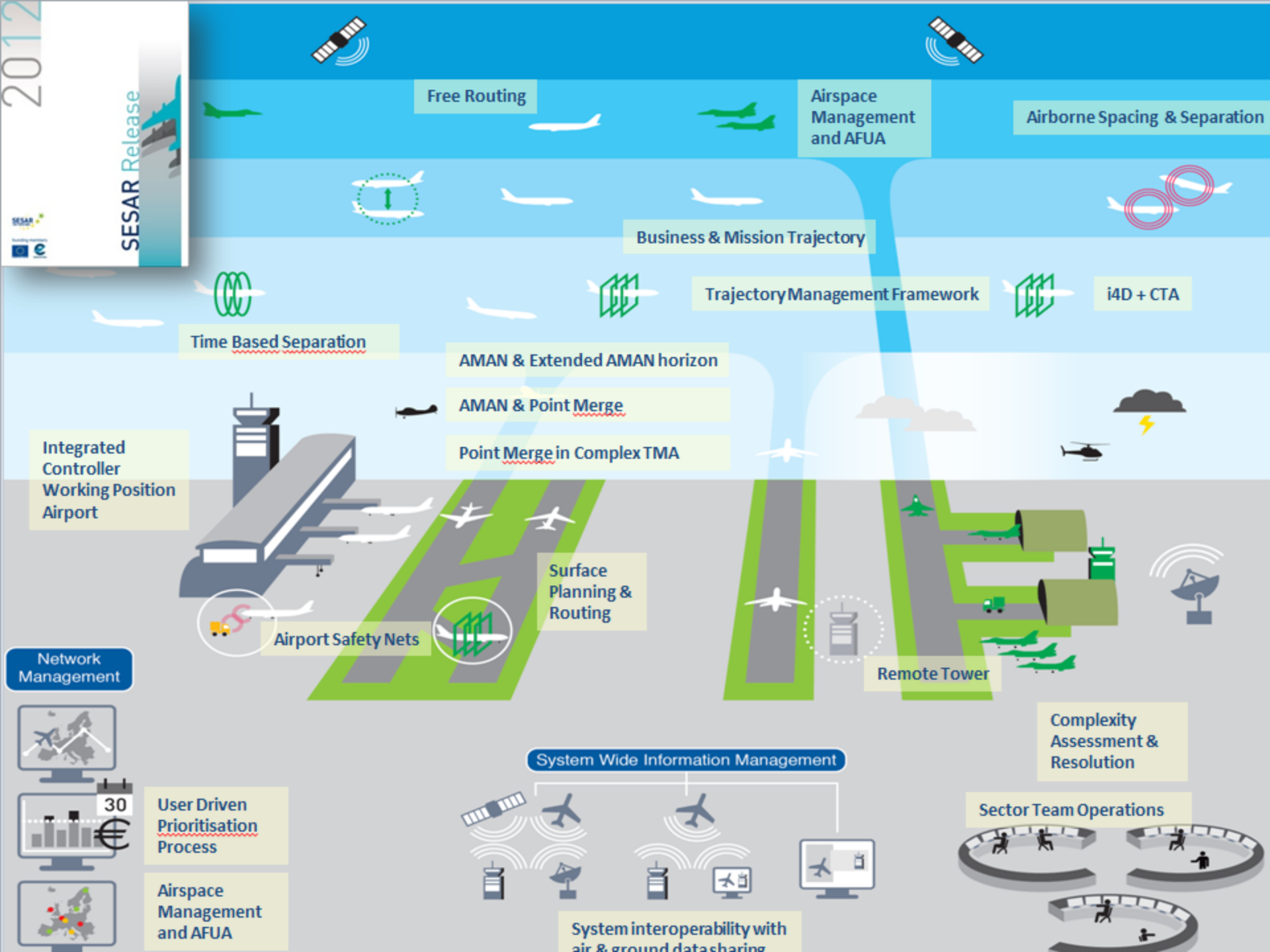
Time Based Operations 2014

PROGRAMME

R&D PROJECTS

MATURITY
- Concept
- Requirements
- Prototype
- Validation
- Safety and Business Cases

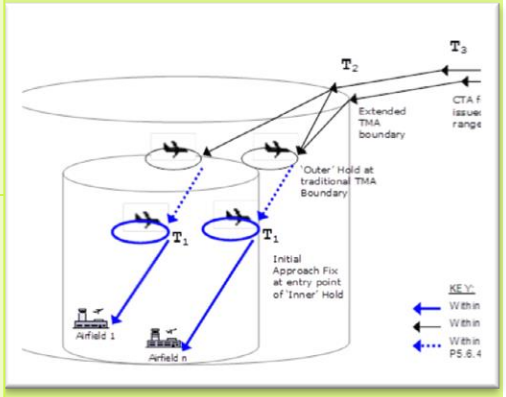



2012
SESAR Release
Free Routing
Airspace Management and AFUA
Airborne Spacing & Separation
Business & Mission Trajectory
Trajectory Management Framework
i4D + CTA
Time Based Separation
AMAN & Extended AMAN horizon
AMAN & Point Merge
Point Merge in Complex TMA
Integrated Controller Working Position Airport
Surface Planning & Routing
Airport Safety Nets
Remote Tower
Network Management
30
User Driven Prioritisation Process
Airspace Management and AFUA
System Wide Information Management
System interoperability with air & ground data sharing
Complexity Assessment & Resolution
Sector Team Operations

FUEL EFFICIENCY

KEY SESAR SOLUTIONS RELEASE 2

AMAN and Extended AMAN horizon



AMAN AND EXTENDED AMAN HORIZON

Validation of the operational aspects related to the use of Extended AMAN as supporting tool and application of P-RNAV procedures in complex TMA

Supporting tool enabling arrival traffic sequencing up to the en-route phase

AENA & NATS - Madrid & London TMA

RESULTS

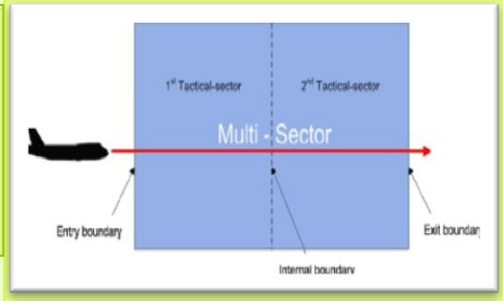
- Changes in trajectory allows for the in-cruise absorption of **flight delays**
- Optimization of arrival sequence allows reduction of holding (average reduction of 4.8min/aircraft) and optimized runway throughput. Aircraft **stack holding time** in London was reduced by between 78% and 87%
- **Fuel Burn** per Flight reduced by ~10% (average of 942kg/flight)
- Improvements in **cost efficiency** by reducing fuel burn
- Includes validation of **non-nominal scenario** that combines thunderstorms over en-route sectors
- Sharing the same information by all En-Route and TMA controllers increases the situation awareness in all CWPs improving safety and quality of service.

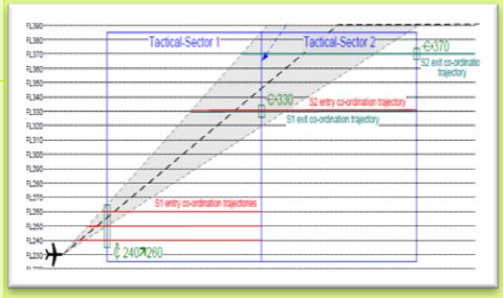
COST-EFFECTIVENESS

COST -EFFICIENCY

KEY SESAR SOLUTIONS RELEASE 2

CDM & Sector Team Ops





CDM & SECTOR TEAM OPS

Validation of the benefits of a Multi-Sector Planner concept in a complex operating environment, including roles and responsibilities

NATS En-Route Airspace

RESULTS

- Improvement of **situational awareness** and **task sharing** thanks to new support tools
- Increase of controller's **productivity** through automatic calculation of optimal arrival sequences and coordination support
- Flexibility in resourcing and deployment of ATCOs resulting in improvements in **cost-efficiency**; improvement in ability to resource to demand, providing significant reduction in costs associated with staff overheads
- Flight **efficiency** gains through improved profiles

EN-ROUTE CAPACITY

EN-ROUTE CAPA.

KEY SESAR SOLUTIONS RELEASE 2

Complexity assessment and resolution

COMPLEXITY ASSESSMENT AND RESOLUTION

Assess the capability of the Traffic Complexity Management tool to perform prediction of airspace complexity issues with an increased anticipation

EUROCONTROL MUAC

RESULTS

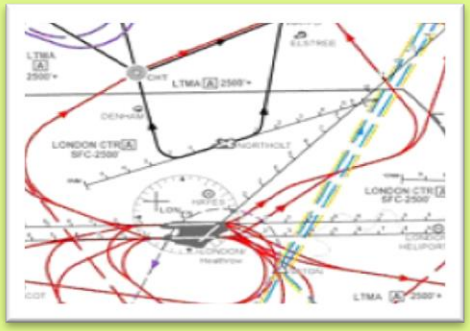
- Ability to manage more traffic with no increase to ATCO **workload**
- Benefits to ATCO **productivity**
- Traffic Complexity Management Tool is validated in an integrated environment adapted to the data accuracy expected from IOP and i4D improvements
- Allows the **prediction** of airspace complexity issues with an increased **anticipation** (**up to 120 min** before the congestion occurs)

AIRPORT CAPACITY

AIRPORT CAPA.

KEY SESAR SOLUTIONS RELEASE 2

Time Based Separation



TIME BASED SEPARATION

Validation of the use of Time Based Separation minima by Tower Air Operations Controllers, in particular the use of new controller practices and procedures in combination with controller support tools, conducted

NATS - Heathrow Airport

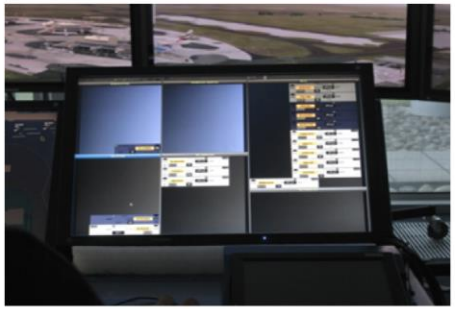
RESULTS

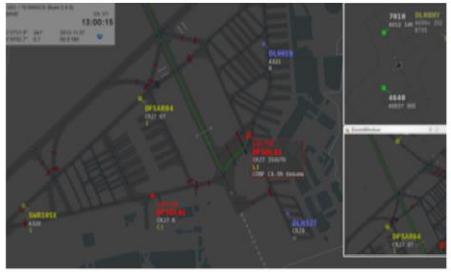
- Significant improvements and benefits for airport operations with TBS in terms of:
- **Increased aircraft landing rates,** including in stronger wind conditions, with up to **5 additional aircraft per hour were landed** with TBS compared to DBS, with a mean of 2 additional aircraft per hour
- **Reduction of holding times** (mean reduction of 0.9 min with a max. reduction of 9.4 min) and **stack entry to touchdown times** (mean reduction of 1.4 min, with a max. reduction of 9.3 min)
- The TBS Method of Operations is now considered to be **achievable and ready for deployment**

SAFETY

KEY SESAR SOLUTIONS RELEASE 2

Airport Safety Nets





AIRPORT SAFETY NETS

Validation through Shadow Mode live trials of the usability of a tool for detection of Conflicting ATC Clearances for the controller and the generated alert Messages on the HMI

DFS - Hamburg Airport

RESULTS

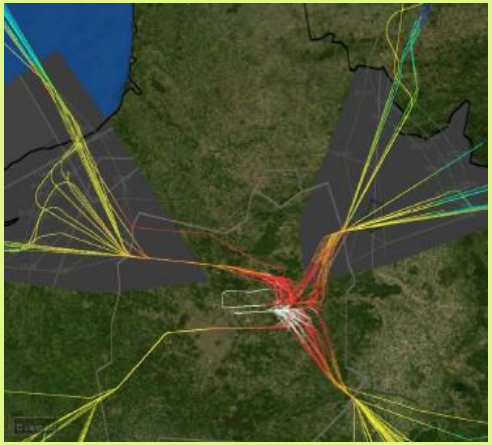
- The **overall** results indicate a **useable** system
- **Reduced** number of Runway conflict by **5 %** when ATC is supported by the Conflicting ATC Clearance Tool
- **Safety** improvements at airports through better **situational awareness** and conflicting alert systems while increasing **capacity**
- ATCOs most positive about the predictive conflict indication
- Nearly no nuisance alerts generated by the new safety net

PREDICTABILITY

PREDICTABILITY

KEY SESAR QUICK WIN RELEASE 2

AMAN + Point Merge



AMAN + POINT MERGE

Validation of a Point Merge System in Extended TMA (E-TMA) coupled with the used of an AMAN, with the objective of replacing radar vectoring by a more efficient traffic synchronization mechanism.

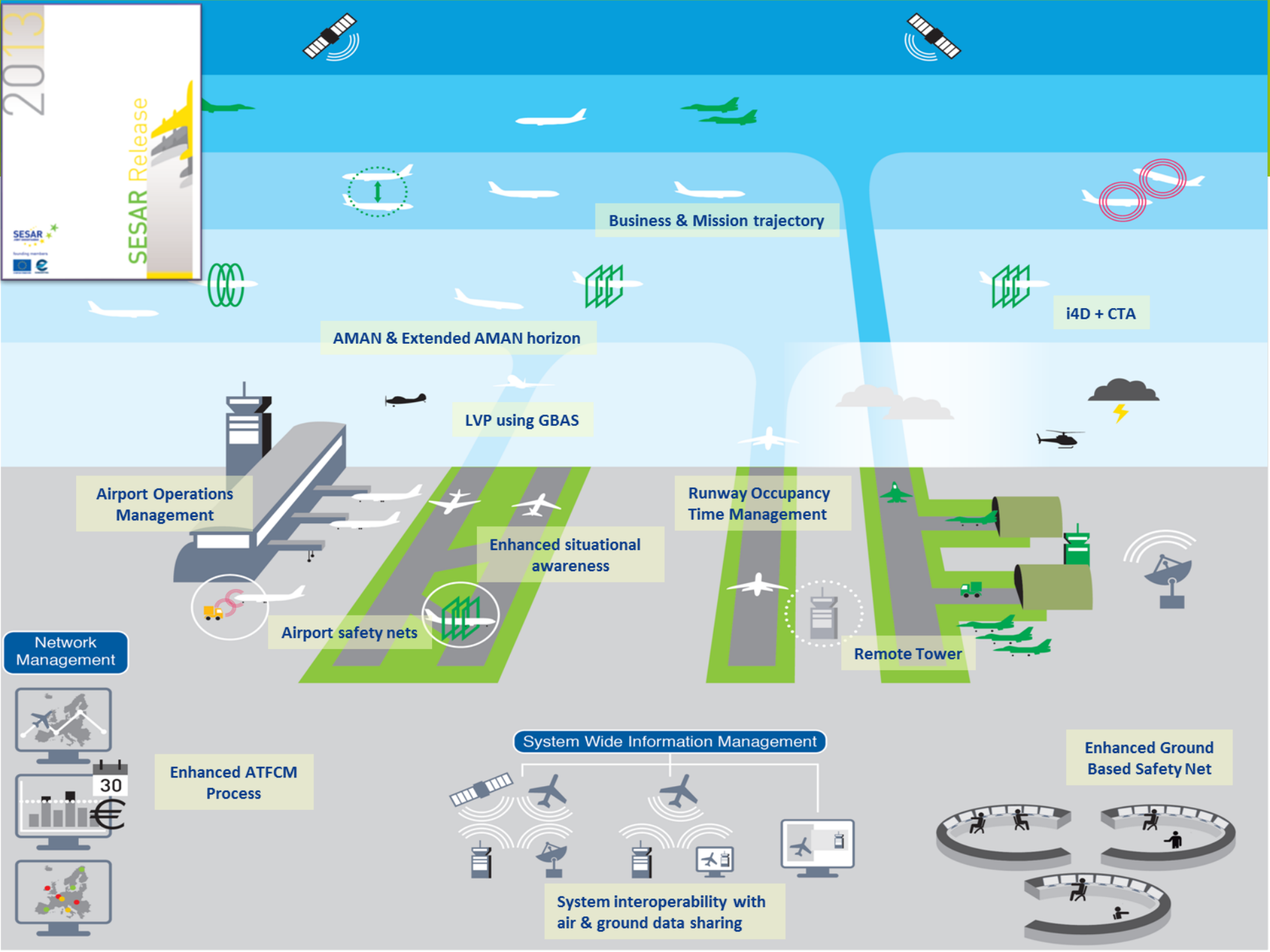
Live trials in **Paris ACC** between June and December 2012, involving DSNA, MUAC and Belgocontrol.

RESULTS

Implementation of AMAN + Point Merge leads to **benefits** in terms of:

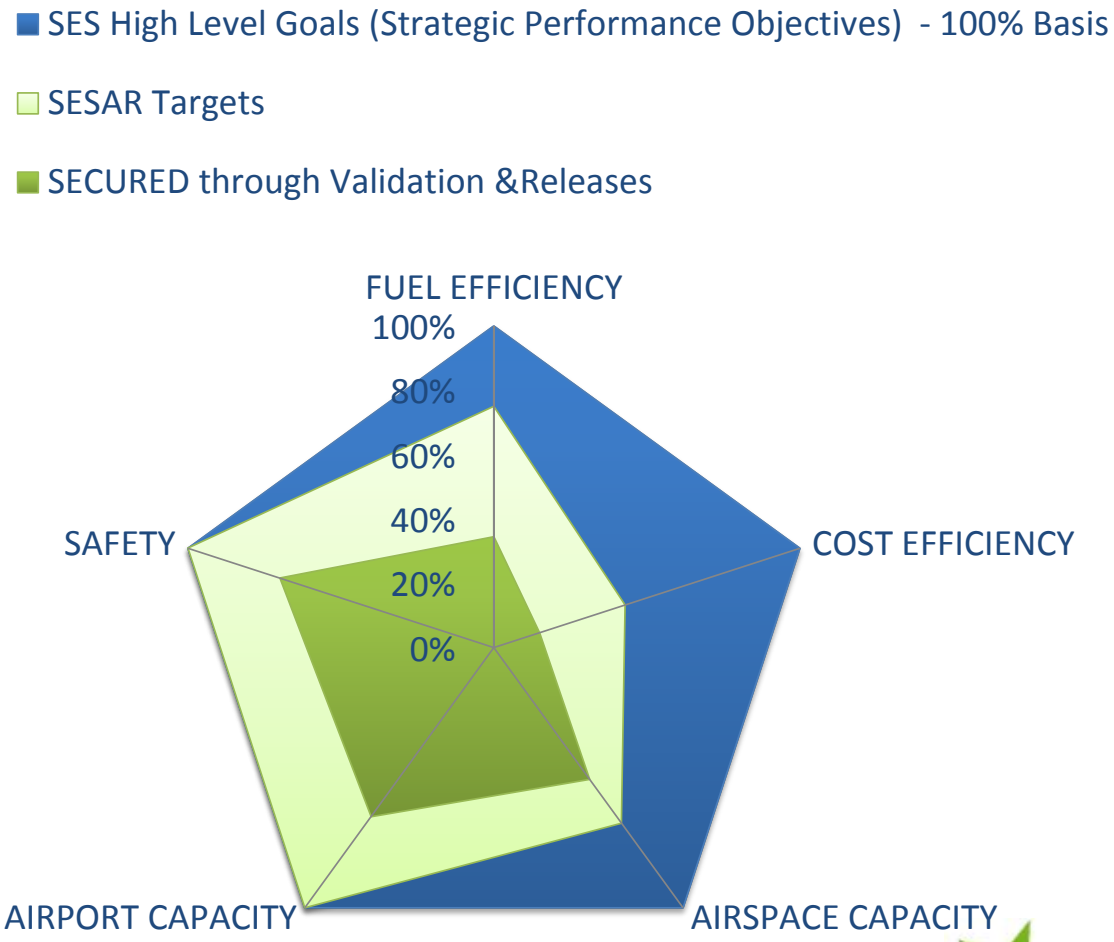
- Increased in **safety** resulting from a more structured airspace, with positive impacts in terms of controller and pilot **situational awareness**;
- Reduced controller **workload**, due to the reduction in frequency usage, that could allow to increase **capacity;**
- Positive impacts on **predictability** due to a standardization of ATCO methodology as well as improved trajectory prediction and reduction in the number of open loops.

Available documents: VALR, VALP, SPR, OSED (+ Safety Assessment Report)


2013
SESAR Release
SESAR
Business & Mission trajectory
i4D + CTA
AMAN & Extended AMAN horizon
LVP using GBAS
Airport Operations Management
Runway Occupancy Time Management
Enhanced situational awareness
Airport safety nets
Remote Tower
Network Management
30
Enhanced ATFCM Process
System Wide Information Management
System interoperability with air & ground data sharing
Enhanced Ground Based Safety Net

SESAR CONTRIBUTION TO PERFORMANCE

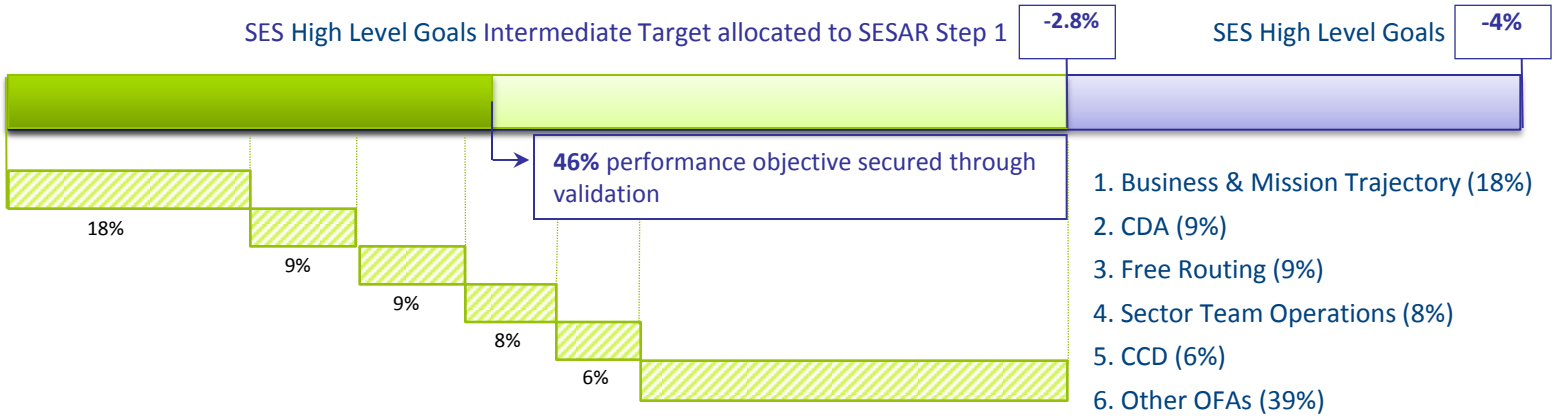
- Part of SES High Level Goals is apportioned to SESAR in Master Plan 2012
- Performance targets are set for each project
- Performance achievement is measured through validation



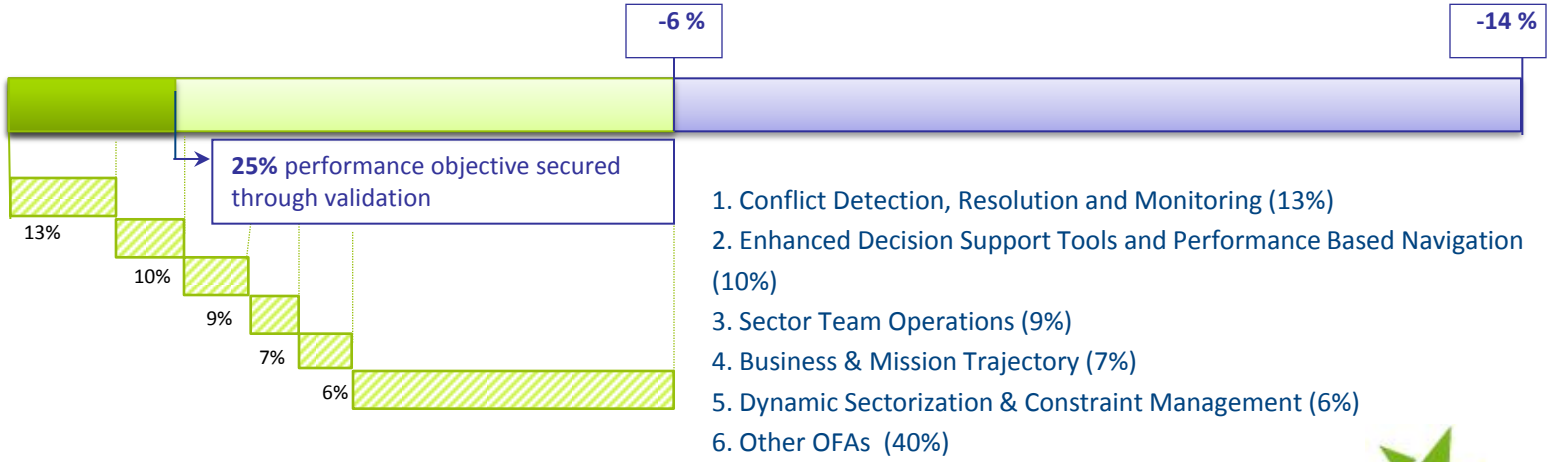
SESAR STEP 1 CONTRIBUTION TO PERFORMANCE PER KPA

KPA

Fuel Efficiency



Cost-Efficiency



SESAR STEP 1 CONTRIBUTION TO PERFORMANCE PER KPA

KPA

Airspace Capacity

SES High Level Goals Intermediate Target allocated to SESAR Step 1 **+27%**

SES High Level Goals **+40%**

20% En-Route Performance objective secured through validation

75% TMA Performance objective secured through validation

TMA

1. Conflict Detection, Resolution and Monitoring (11%)
2. Business & Mission Trajectory (10%)
3. Enhanced Decision Support Tools and PBN (8%)
4. i4D + CTA (8%)
5. Integrated AMAN DMAN (7%)

11%

10%

8%

8%

7%

Other OFAs

En-Route

1. Business & Mission Trajectory (10%)
2. Sector Team Operations (10%)
3. Conflict Detection, Resolution and Monitoring (8%)
4. Dynamic Sectorisation & Constraint Management (8%)
5. Free Routing (7%)

10%

10%

8%

8%

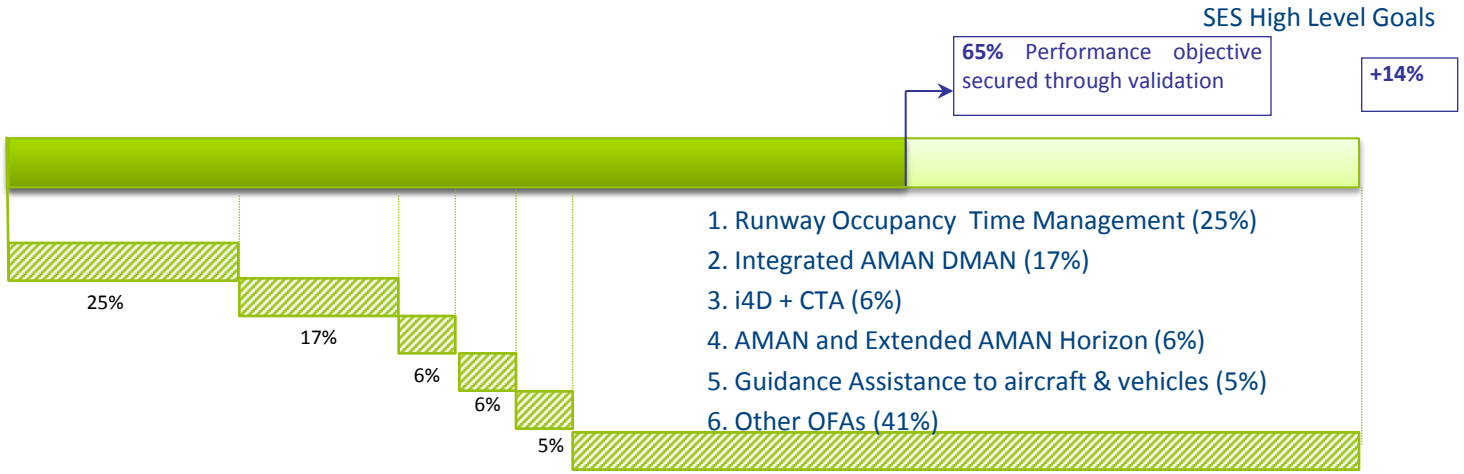
7%

Other OFAs

SESAR STEP 1 CONTRIBUTION TO PERFORMANCE PER KPA

KPA

Airport Capacity

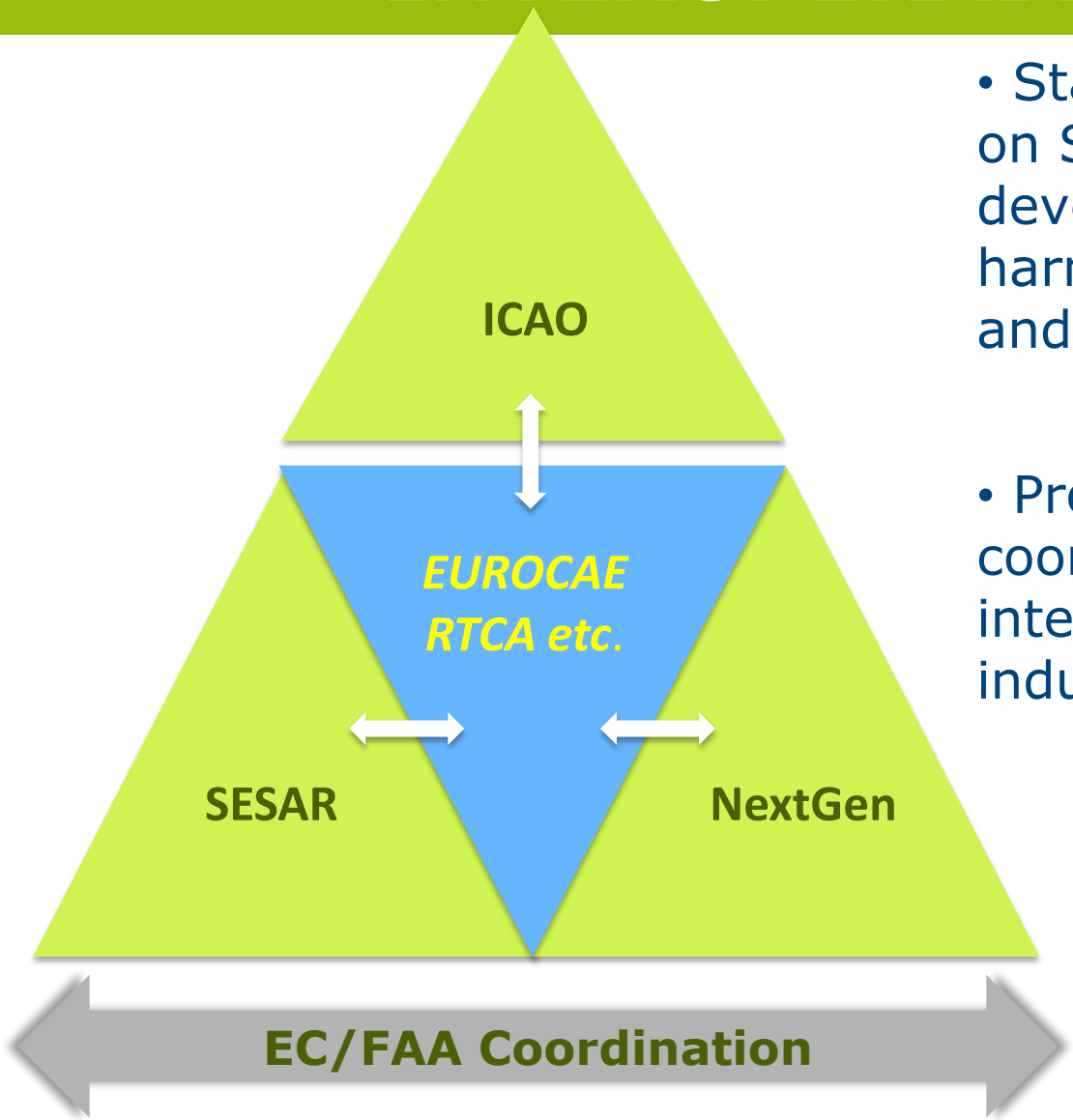


Safety

Safety requires a different approach and the performance assessment is mainly a **qualitative** one at this stage
Top contributing solutions are distributed across several influence factors:

1. Airport Safety Nets (4.8% Rinc)
2. Enhanced STCA (1.4% MAC-ER, 1.6% MAC-TMA, 2.8% CFIT)
3. Approach Procedure Vertical Guidance (2.4% CFIT)
4. Enhanced Situational Awareness (1.6% Rinc)
5. iCWP Airport (0.9% Rinc)

GLOBAL COOPERATION & INTEROPERABILITY



- Standards built on SESAR and NextGen developments will support harmonised Implementation and Regulation

- Programme level coordination enhanced by interoperability and wider industry buy-in.

Complete alignment with ICAO ASBU Modules

ICAO Module	SESAR Operational Changes	
BLOCK 1		
B1-65 Optimised Airport Accessibility	Improved Vertical Profiles	Approach Procedures with Vertical Guidance
	Weather Resilience	LVPs using GBAS
B1-70 Increased Runway Throughput through Dynamic Wake Turbulence Separation	Enhanced Runway Throughput	Time Based Separation
		Dynamic Vortex Separation
B1-75 Enhanced Safety and Efficiency of Surface Operations (ATSA-SURF)	Airport Safety	Enhanced situational awareness
		Airport safety nets
	Weather Resilience	Pilot Enhanced Vision
	Integrated Surface Management	Surface Planning & Routing
		Guidance assistance to aircraft & vehicles
B1-80 Optimised Airport Operations through Airport-CDM	Demand & Capacity Balancing Airports	Airport Operations Planning & CDM
B1-81 Remote Operated Aerodrome Control Tower	Remote Tower with AFIS	Remote Tower
B1-15 Improved Airport operations through Departure, Surface & Arrival Management	Traffic Synchronisation	AMAN and Extended AMAN horizon
		DMAN Multiple Airports
		i4D + CTA
	Integrated Surface Management	Integrated AMAN DMAN
		Surface Mgt Integrated with Arrival and Departure Mgt
B1-25 Increased Interoperability, Efficiency and Capacity though FF-ICE/1 application before Departure	SWIM	SWIM
	4D Trajectory Management	Trajectory Management Framework
		Business & Mission Trajectory
		System Interoperability with A/G Data Sharing
B1-30 Service Improvement through Integration of all Digital ATM Information	SWIM	SWIM
B1-31 Performance Improvement through the application of System Wide Information Management (SWIM)	SWIM	SWIM
B1-10 Improved Operations through Free Routing	Enhanced Route Structures	Optimised RNP Structures
	4D Trajectory Management	Free Routing
		Enhanced DST & PBN
	Conflict Management & Support Tools	Airspace Management & AFUA
	Demand & Capacity Balancing En-Route	Dynamic Sectorisation & Constraint Management
B1-35 Enhanced Flow Performance through Network Operational Planning	Complexity Management	Complexity Assessment & Resolution
	Demand & Capacity Balancing En-Route	Airspace Management & AFUA
		Dynamic Sectorisation & Constraint Management
		Enhanced ATFCM Processes
		UDPP
		Network Operations Planning
B1-85 Increased Capacity and Flexibility through Interval Management	Airborne Spacing & Separation	ASPA S&M
	CNS	Surveillance
B1-105 Better Operational Decisions through Integrated Weather Information (Strategic > 40 Min.)	SWIM	SWIM
		AIM/MET
B1-102 Advanced ground-based safety nets	Air Safety Nets	Enhanced STCA
B1-05 Improved Flexibility and Efficiency in Descent Profiles (OPDs)	Improved Vertical Profiles	Approach Procedures with Vertical Guidance
		CDA
B1-40 Improved Traffic Synchronisation and Initial Trajectory-Based Operation.	Traffic Synchronization	i4D + CTA
	4D Trajectory Management	Trajectory Management Framework
		System Interoperability with A/G Data Sharing
	Integrated Surface Management	Surface Planning & Routing
		Guidance assistance to Aircraft & Vehicles
B1-90 Initial Integration of Remotely Piloted Aircraft (RPA) Systems into non-segregated airspace	N/A	N/A

EU- US /SESAR NextGen coordination

- Identifying interoperability issues that needs to be harmonised.

- Strong coordination with the FAA/NextGen and other regional modernisation programmes is essential for standardisation activities in ICAO and EUROCAE and RTCA.

- The need for global interoperability and standards requires support at the ICAO level and a concerted approach is essential

TO CONCLUDE

- **Change is inevitable** and it will have in-depth consequences for our industry
- Sustainable solutions are developed in partnership with a **performance-driven approach,** to make a smooth transition to industrialisation and subsequent deployment
- The EU – US (SESAR-NextGen) MoC is **the important mechanism** of collaboration and to progress interoperability standards on key capabilities.
- **Harmonized positions** are essential for global interoperability and the business of aviation.

FROM INNOVATION TO SOLUTION

INITIAL 4D CONCEPT AND DEMONSTRATION FLIGHT

Pierre BACHELIER, Head of ATM Program

AIRBUS

SESAR workshop

Washington DC, 25th June 2013

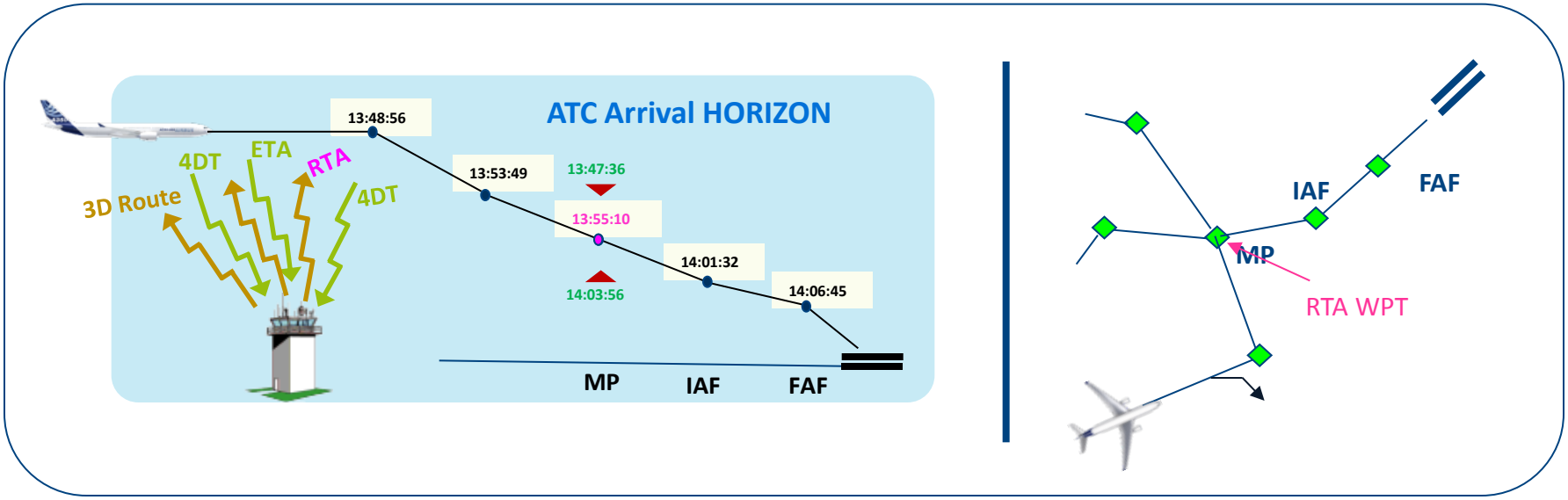
SESAR JOINT UNDERTAKING

founding members

EUROPEAN UNION EUROCONTROL

Initial 4D: The Operation

- Share and synchronize airborne and ground trajectory.
- "Flying to Time constraints" to optimize sequences as defined by ATC.



4D trajectory = computed 3D trajectory + times estimates considering route, altitude and time constraints (RTA)

Initial 4D: Expected benefits

Expected benefits

- **Better flight efficiency:**
  - Flight profile and fuel burn optimization.
  - Avoiding penalizing vectoring instructions (path stretching, holding patterns, etc.).

- **Better planning:**
  - Increased predictability of the real trajectory and arrival time.
  - Early agreement with the flight crew on the trajectory to be flown.

- **Improved safety:**
  - Through enhanced anticipation of traffic situation by ATC.

Initial 4D: Cockpit Integration

EIS

Electronic Information System (Displays)

ATSU

Air Traffic Service Unit (Communication)

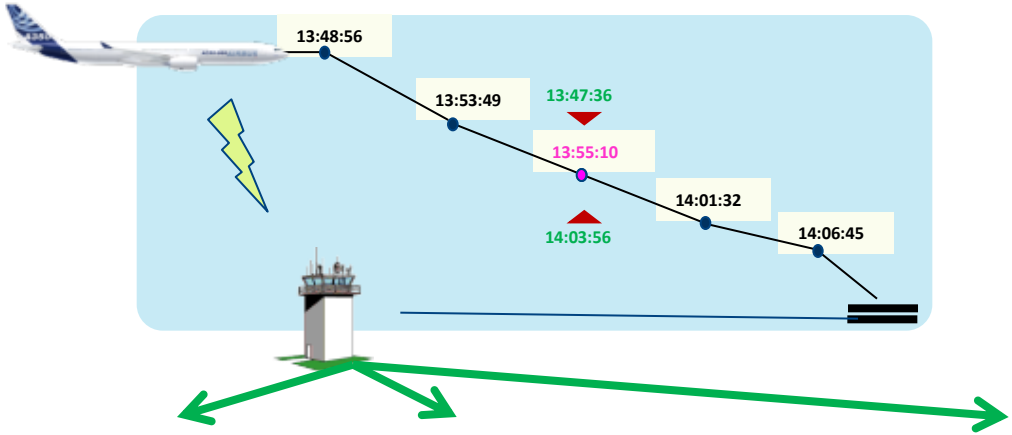
Avionics A429 link

FMS

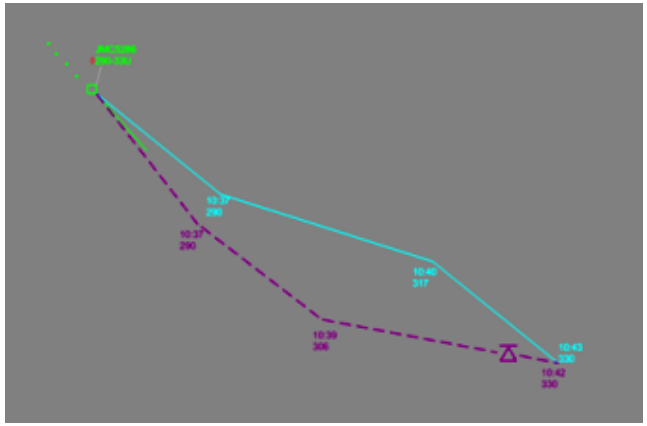
Flight Management System (Navigation and Guidance)

Initial 4D: Ground Services

The 4D Trajectory is a basis for a multitude of services (separation, situation awareness, enhanced prediction, flow and capacity management….)



(*)Courtesy of MUAC and NORACON



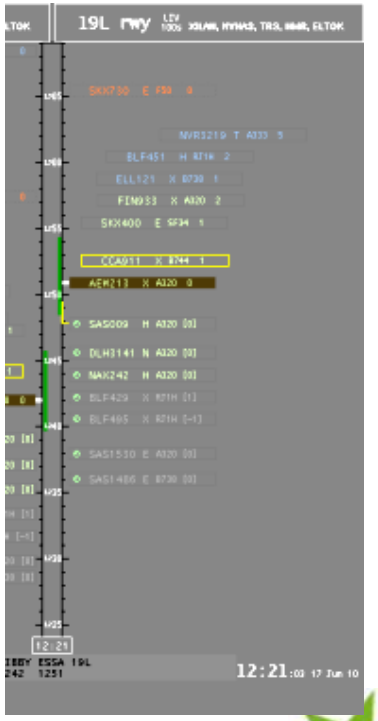
FDP Graphical display*

TRA5992 EPP

POINTS	FL	ETA	SPEED	FL	RTA	SPEED
MASEK	320	08:12:11	M.78			
EDEGA	320	08:15:59	M.78			
MAPOX	320	08:17:14	M.78			
HMM	320	08:25:09	M.78			
EKTOT	320	08:27:45	M.78			
SUVOX	320	08:28:55	M.78			
SOBTU	320	08:32:23	M.78		08:33	
ROTEK	320	08:34:39	M.78			

AGE: 08:10 REFRESH CUR/PRED GS: N0454 / ----- UPLINK

FDP Tabular display*

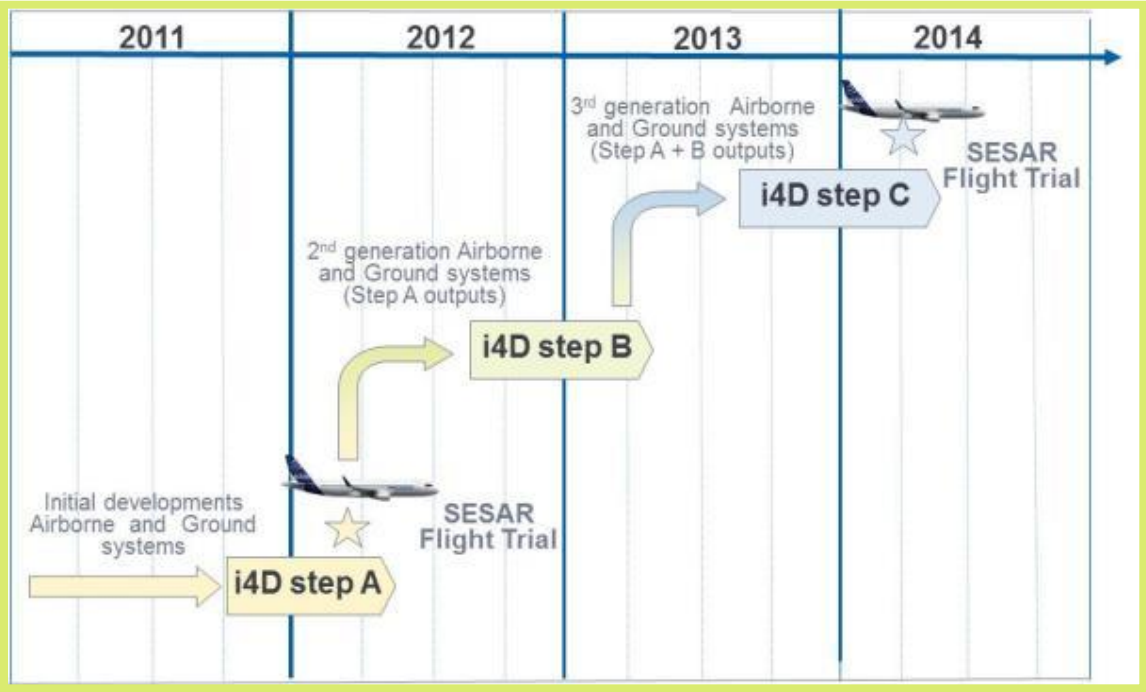


Arrival Manager (AMAN)*

Initial 4D challenges and achievements

SESAR validation campaign is ensuring the maturity

- Closely coordinated Airborne and Ground developments
- Stepped and integrated Air/Ground validation



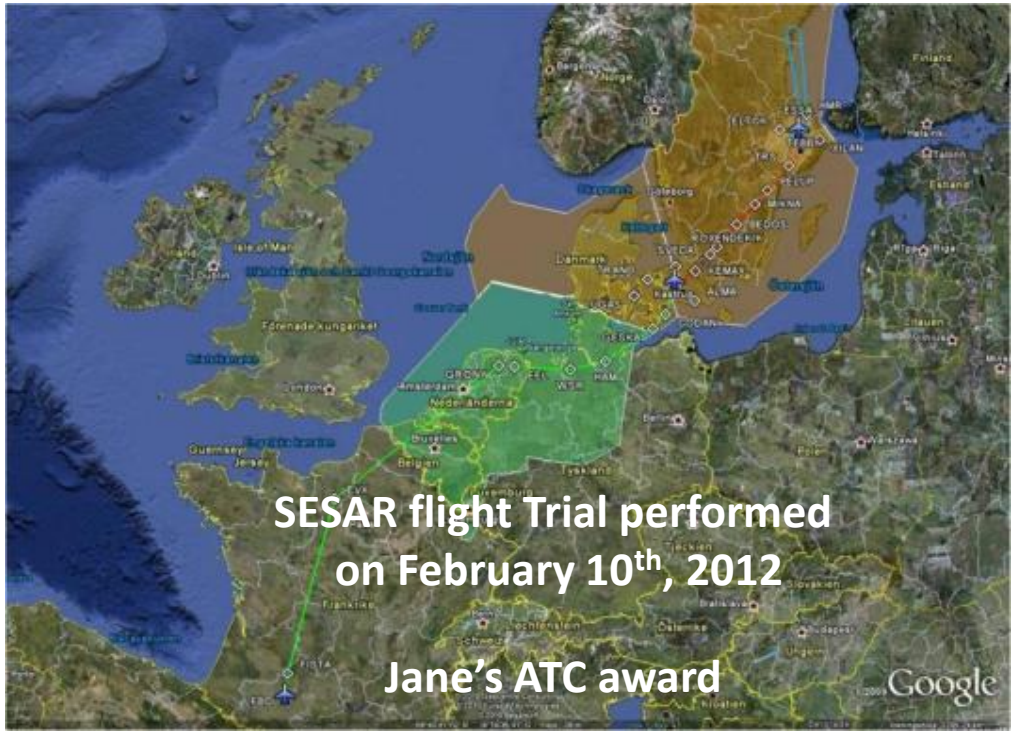
CONCLUSION

- Initial 4D **technical feasibility** is demonstrated. Technical enablers validated: ATC system, ADS-C, CPDLC, FMS
- **Benefits**: Flight efficiency, better predictability

- **Next steps**
  - More validation activities on-going (2013-2014)
  - **Large Scale Demonstrations** (2017-2018)
  - **Start of deployment** in Europe planned in 2018 (Pilot Common Project)
    - Full **coordination** is needed between airborne and ground developments to enable future operations with the performance expected by the users at the target date
    - Business: Airbus and industry partners push to ensure **return on investment** for users

Thank You and See the Video

AIRBUS



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THANK YOU !

Pierre BACHELIER

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EXTENDED ARRIVAL MANAGEMENT

Adrian Clark, 25 June 2013

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Extended Arrival Management

AGENDA

1	SESAR project - En Route & Descent Phase Delay Absorption at London Heathrow
2	Operational Trial of SESAR concept
3	Arrival Management using Better Trajectory Data
4	Taking Delay at the Departure Airport
5	Linking the Arrival Manager with the Departure Manager

Benefits of Extended Arrival Management

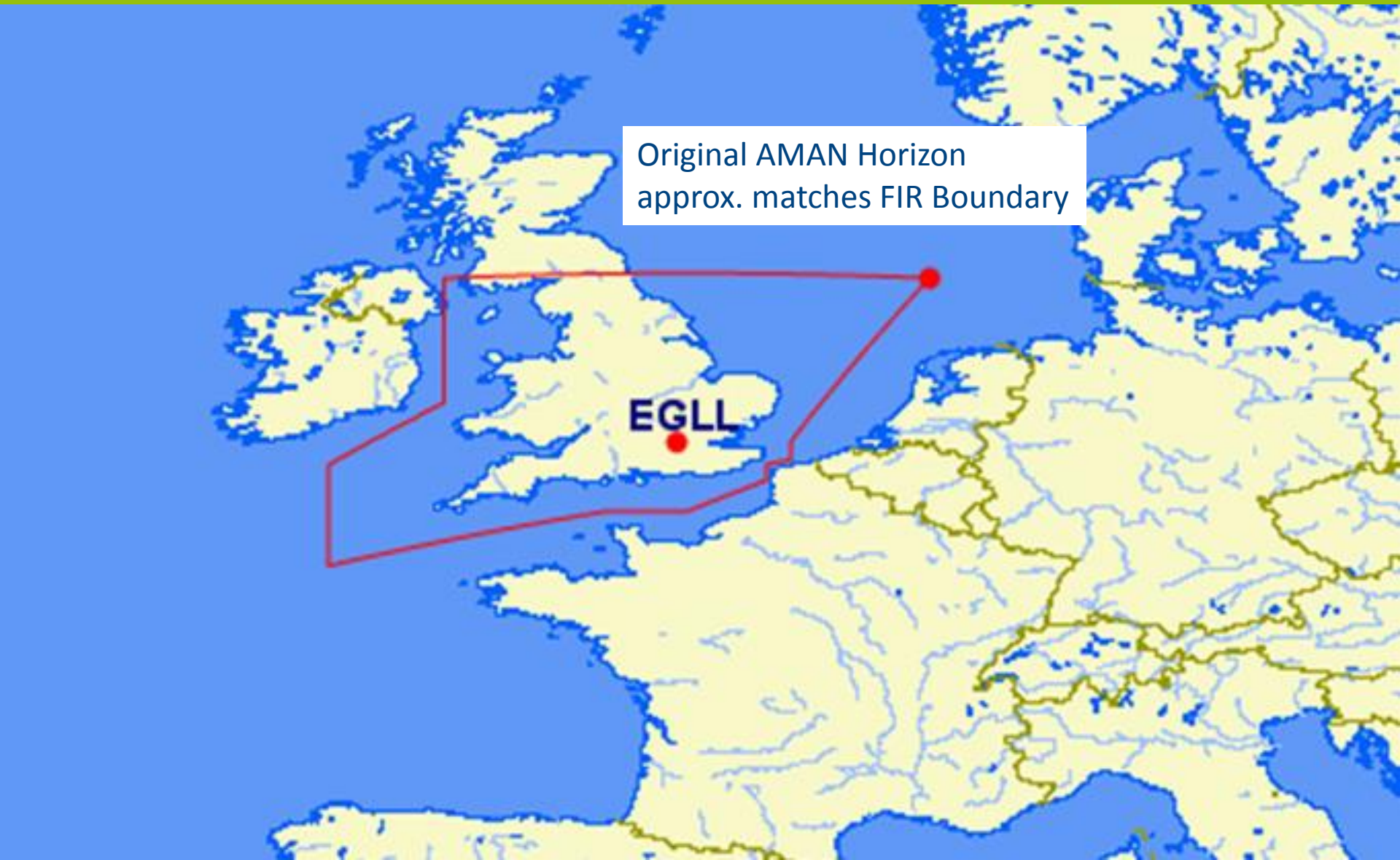
NOW

- Reduce holding in the TMA
  - enhance safety
  - reduce fuel and emissions
  - enable better departure profiles

NEXT

- Smooth delivery of arrivals
  - Improve en route capacity, i.e. steady stream of aircraft and reduced number of bunches
- Depart in response to arrival constraints
  - Further fuel/emissions reductions

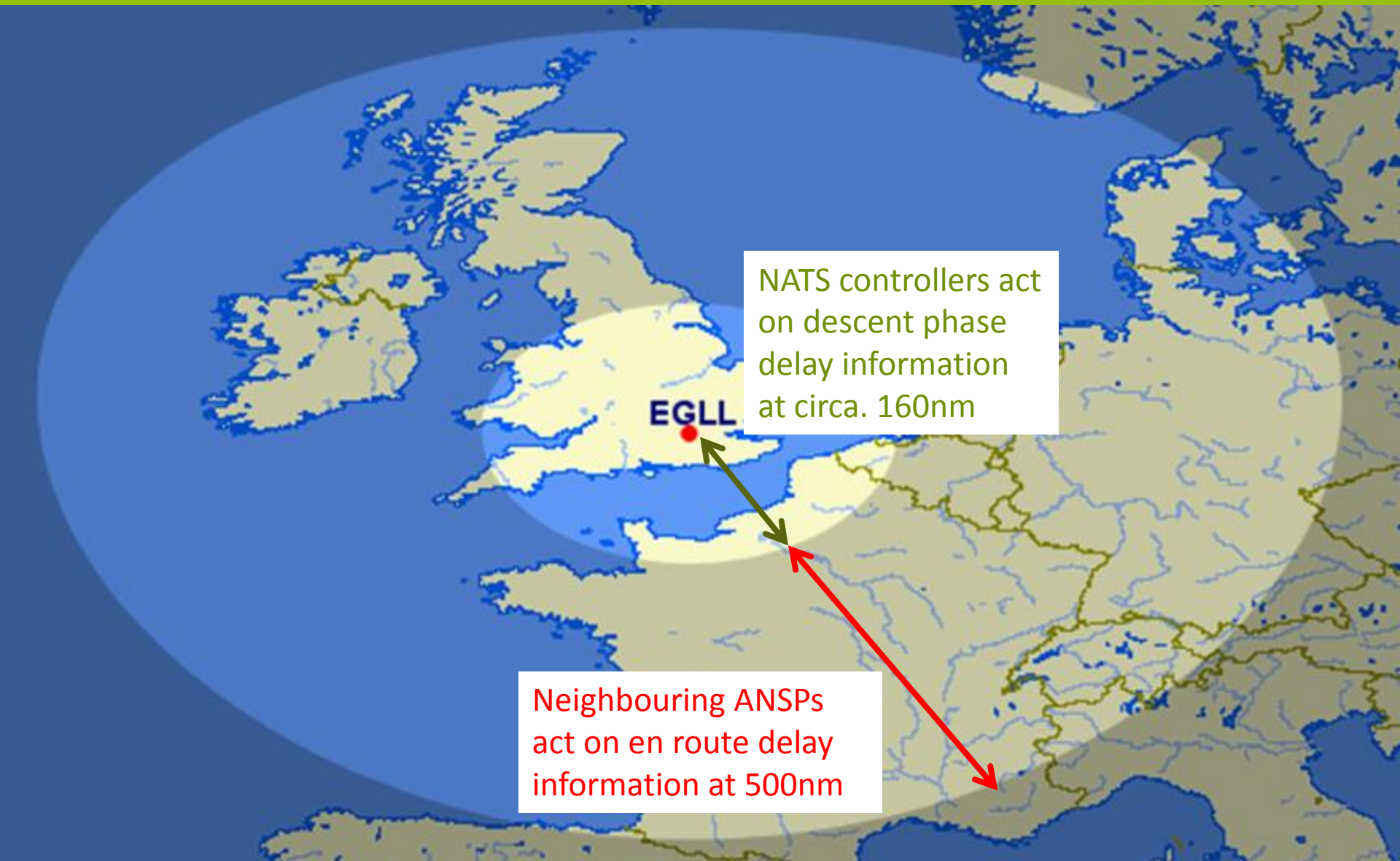
Near Term SESAR Extended AMAN Horizon project: London Heathrow



Near Term SESAR Extended AMAN Horizon project: London Heathrow

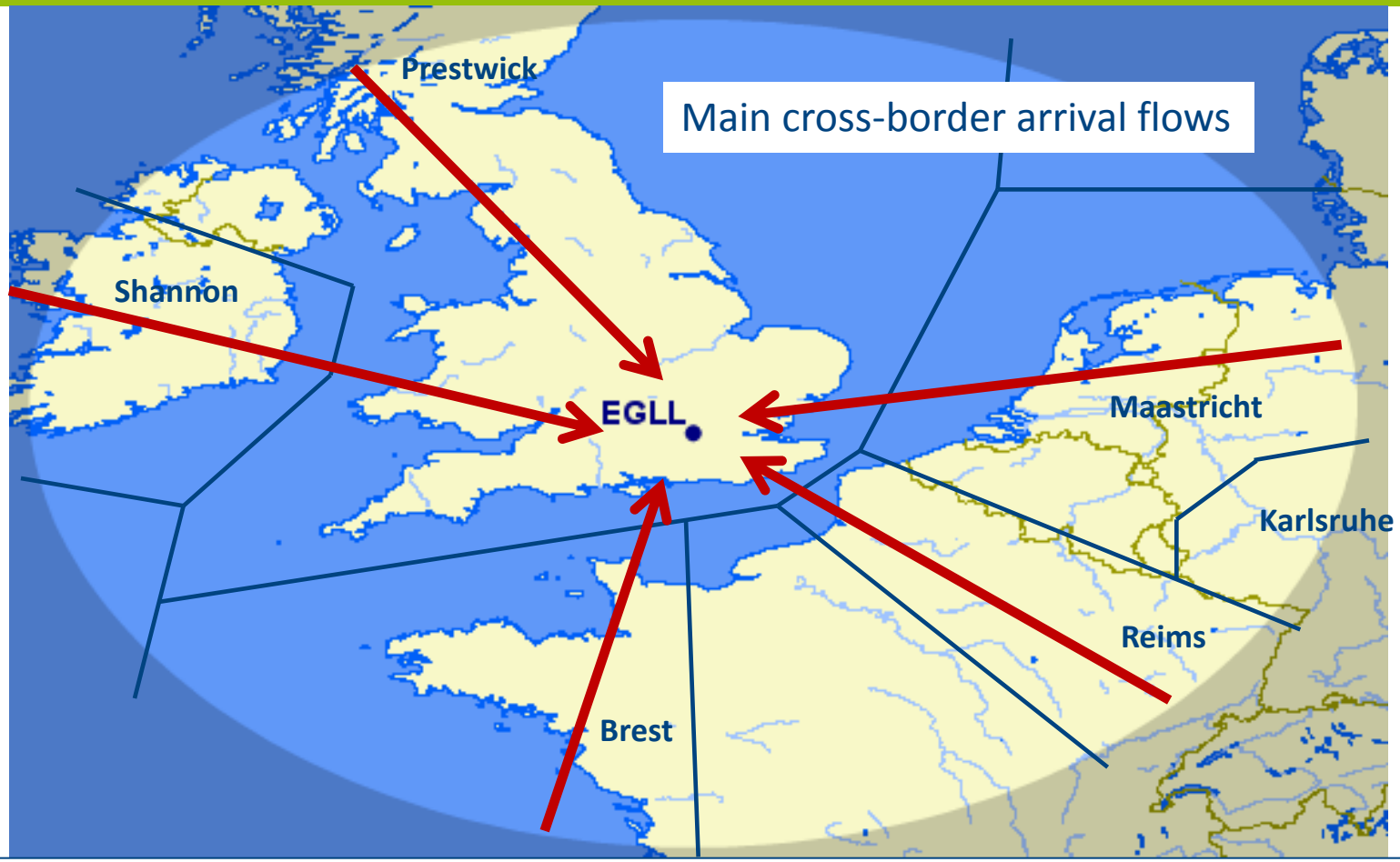
AMAN horizon extended to 550nm using European Flight Data (ETFMS)

Near Term SESAR Extended AMAN Horizon concept: London Heathrow



Operational Trials: En Route Delay Absorption: Heathrow 350NM

(Functional Airspace Block Europe Central XMAN & Atlantic Interoperability Initiative to Reduce Emissions 3)

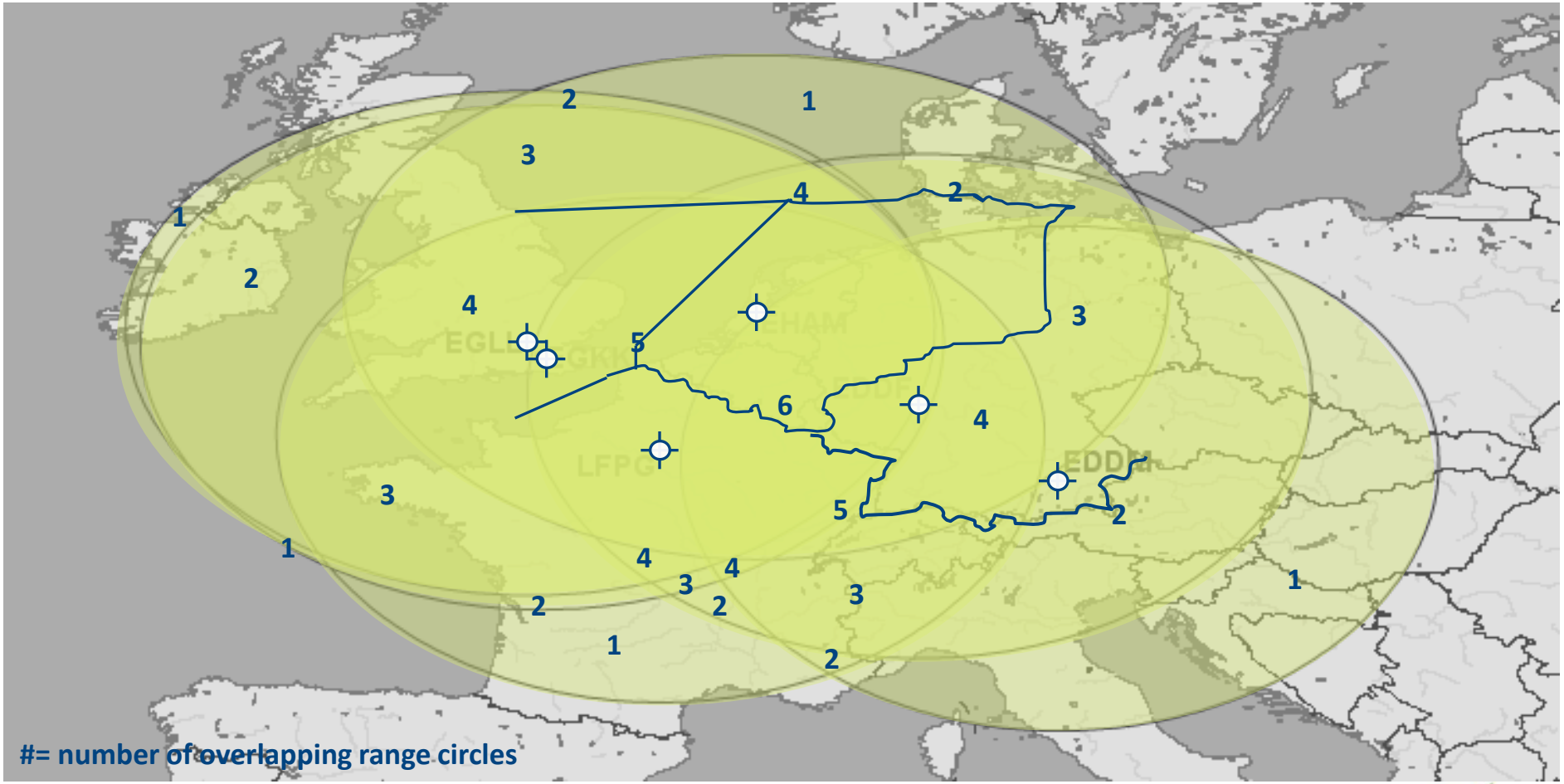


Employ various delay mechanisms (control techniques), as appropriate to traffic situation and airspace:

- Time to lose/gain
- Relative speed advisory
- Controlled Time of Arrival

→ pass delay information in a single format

Future FABEC XMAN Extended AMAN Horizon: Overlapping 350nm Horizons: EHAM, EDDF,EDDM, LFPG, EGLL, EGKK



Note: 350nm is horizon for FABEX XMAN local trial

Arrival Management using Better Trajectories

- Needs accurate aircraft ETA
  - now: centralised network management service (ETFMS) and individual AMAN calculations
  - future: common trajectory service held in flight object servers
  - initially based on ground-calculations (validation exercise planned for 2014-15) but evolving to include shared aircraft trajectory
- Pilots will manage flight to respect arrival (and other) constraints
- Controllers' tools will show aircraft trajectories enabling all parties to work to a common plan

Next Steps in Delay Absorption

- If delay greater than can be absorbed in the air, take delay on the ground
  - Currently work on this for small feeder airports in Swedish airspace
- Concept under discussion:
  - destination airport AMAN sends Target Time of Arrival to European Network Manager for check against other constraints (e.g. en route congestion)
  - resulting constraint sent to departure airport Airport-Collaborative Decision Making system
- Later stage goal to permit negotiation to give operators some flexibility in how they respect constraints

AMAN Interaction with Airport DMAN

NATS is running a SESAR coupled AMAN-DMAN exercise with London Gatwick Airport:

- Gatwick achieves 53 movements per hour on a single runway
- Developing a coupled AMAN-DMAN to assess balance between arrivals and departures up to an hour ahead
- Aim is to set an appropriate arrival and departure rate to match the balance
- Closer to time of execution, a more precise arrival-departure pattern set

Numerous other exercises within SESAR on related aspects

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THANK YOU !

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DATA COMMUNICATION – THE 4D TRAJECTORY CONTEXT

Michael STANDAR
Chief Strategies & International Relations
June 25 2013,
Washington DC

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AGENDA

Why

What

How

When

?

THE FUNDAMENTAL CHANGES OF ATM

INTEGRATION OF AIRPORTS

Integrating airports - time synchronised operations of surface trajectories and flight turn-around

THE 4D TRAJECTORY PRINCIPLE

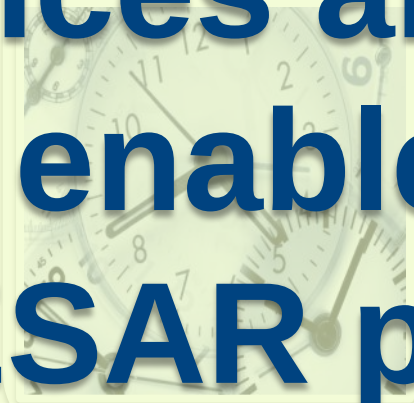
Integrating airspace users flight systems control predictable time synchronised flight precision

THE SYSTEM WIDE INFORMATION MANAGEMENT

The Intranet for Air Traffic Management

AUTOMATION

Human operators concentrate on high value-added tasks



Efficient data communication services are required to enable the key SESAR principles

COLLABORATIVE NETWORK PLANNING

Integrated with airport operations planning and airspace user flight planning

Data Communication in a 4 D Business & Mission Trajectory context

- ***Need connection FMS – data comm and safe high transfer rates***

ADS-B
Air/Ground
Air/Air

PBN/RNP

ASAS

AOC/WOC

Synchronised time reference

AIS/MET

4 D Business & Mission Trajectory

Wake and Wind data

FMS design

Initial 4 D
CPDLC and ADS-C
EPP
Point-to-Point

AMAN/DMAN/SMAN
Traffic synchronisation/seqencing/ spacing/merging

Information modelling and services

SWIM connectivity

More than 50% of SESAR Operational Improvements require efficient data communications

4-D Trajectory Developments in SESAR

- **Development and definition, planning, exchange and execution of 4D Business or Mission Trajectories** through Required Time of Arrival (RTA) and Controlled Time of Arrival CTA :
  - Operational procedures and technical definition and airborne system design for **"initial 4D"** mature, robust and interoperable with ground procedures and systems. – including ADS-C and CPDLC supporting elements.
  - **"Full 4D"** function aiming to provide significant benefits, on predictability and flight efficiency for all phases of flight, based on precise 4 D trajectory management.
  - **Assess capability levels by military aircraft** in relation to interoperability of Business Trajectory and Mission Trajectory and how military aircraft capabilities will comply with the 4D principles.

AGENDA

Why

What

How

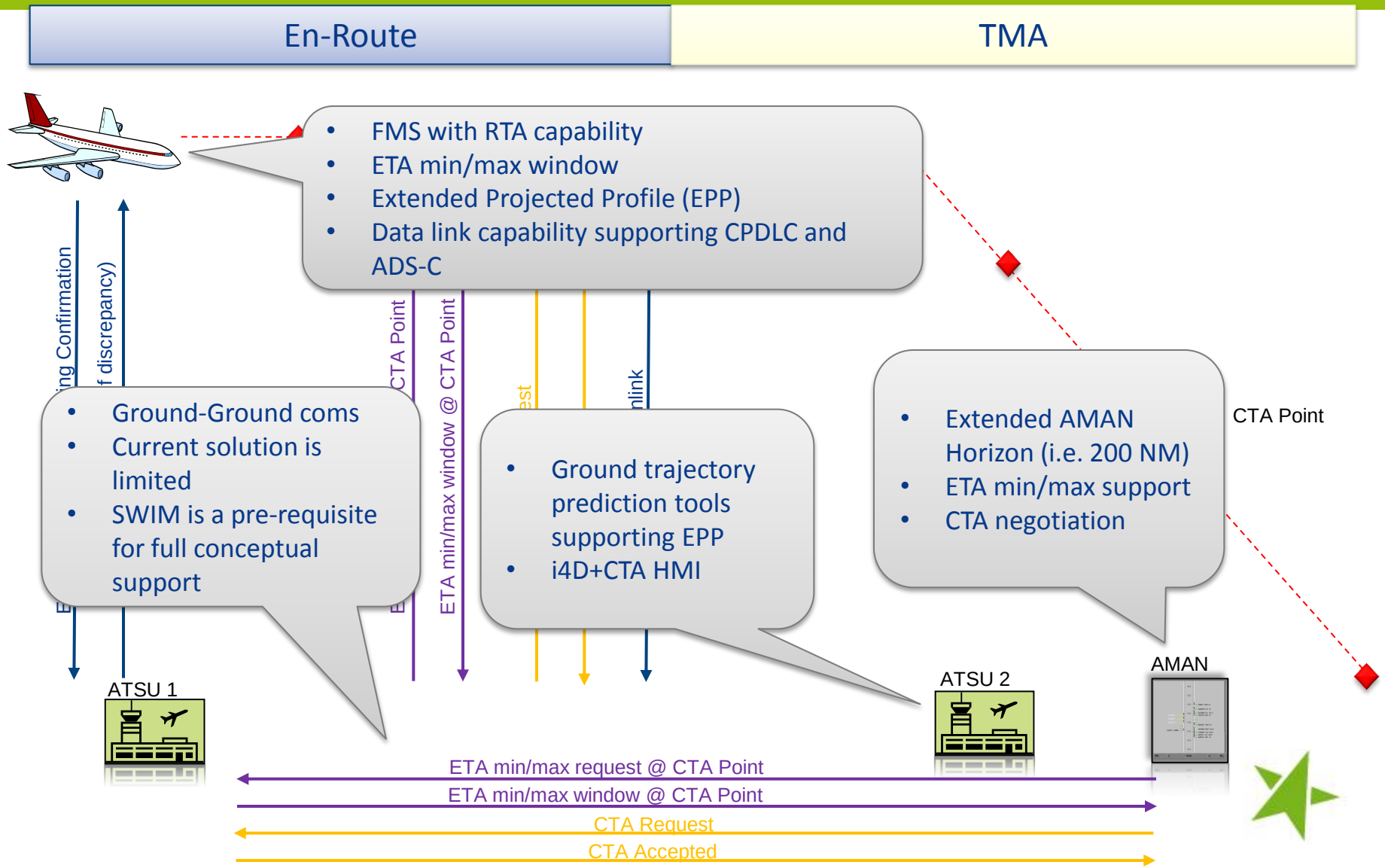
When

?

Supporting all airspace users

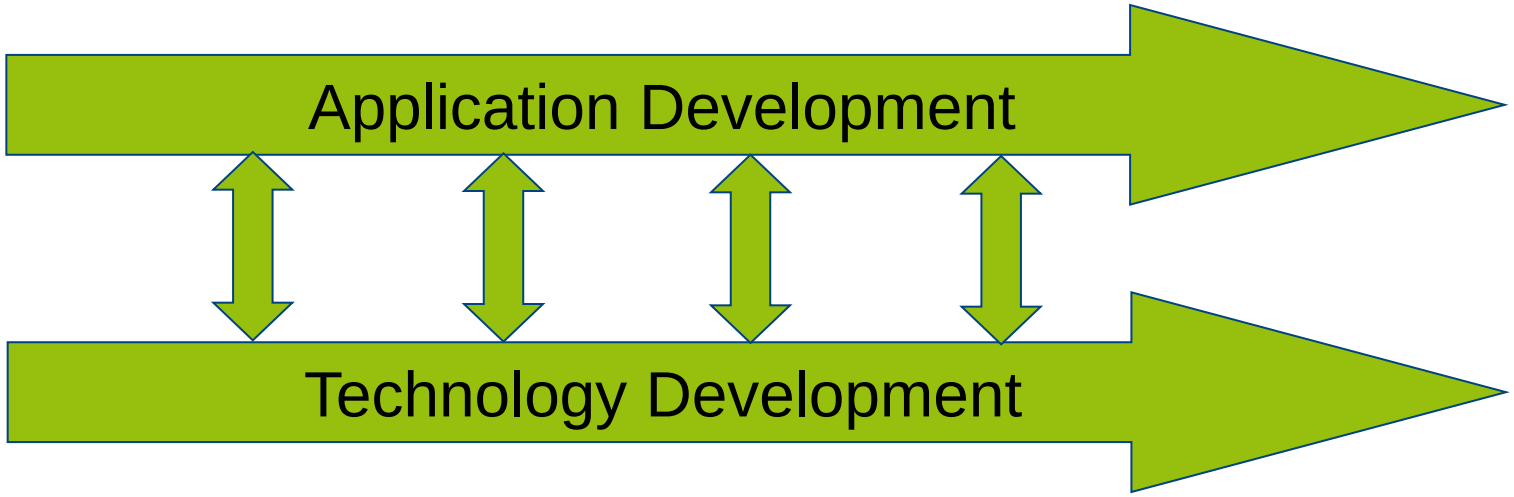
- **Mainline aircraft**
- **Regional aircraft**
- **Business aircraft**
- **General Aviation**
- **Military aircraft**
- ***Remotely Piloted Aircraft Systems (RPAS)***

Key Air and Ground System Enablers



Technology and Requirements

- Technology development is a long term action (but must be expedited)
- Operational Requirements not able to provide all of the detailed elements required for technology development
- Requires an iterative approach with initial technical developments based on initial and early view of customers upcoming operational requirements



Separating the Issues

'Data com' Services	CPDLC, DCL, D-TAXI, i4D, etc ...
'Data com' networking	(FANS) , ATN/OSI transition to ATN/IPS
Physical Data link	VDL/2 transition to Future L band etc...
Supporting Avionics	Retrofit and forward fit issues (FMS, Display, etc)
Deployment	Budget, business cases, mandates, timescales

Data Comm Actions Required

SHORT TERM	MEDIUM TERM	LONG TERM
Initial Data Link LINK 2000+ FANS1/A	Initial 4D Trajectories & Airport Services	Full 4D Business Trajectories
ATN Standards&FANS1/A	Converged Standards	New Standards - TBD
ICAO ASBU BLOCK 0	**ICAO ASBU BLOCK 1**	**ICAO ASBU BLOCK 3**
FINISH ON TIME	STANDARDISE PLAN COMMIT	RESEARCH & DEVELOP

Standards supporting i4D Trajectory Ops

- **ICAO Provisions**
  - Standards and Recommended Practices (SARPs)
  - Technical Manual (use reference to industry standards)
  - Procedures for Air Navigation Services (PANS) ATM
  - PBN/RNP/ CDO/CCO
- **Industry standards** (under development in EUROCAE/RTCA)
  - OSED, SPR and Interop
  - Technical Specifications and Minimal Operational Performance Standards MOPS
  - Avionics Specifications

AGENDA

Why

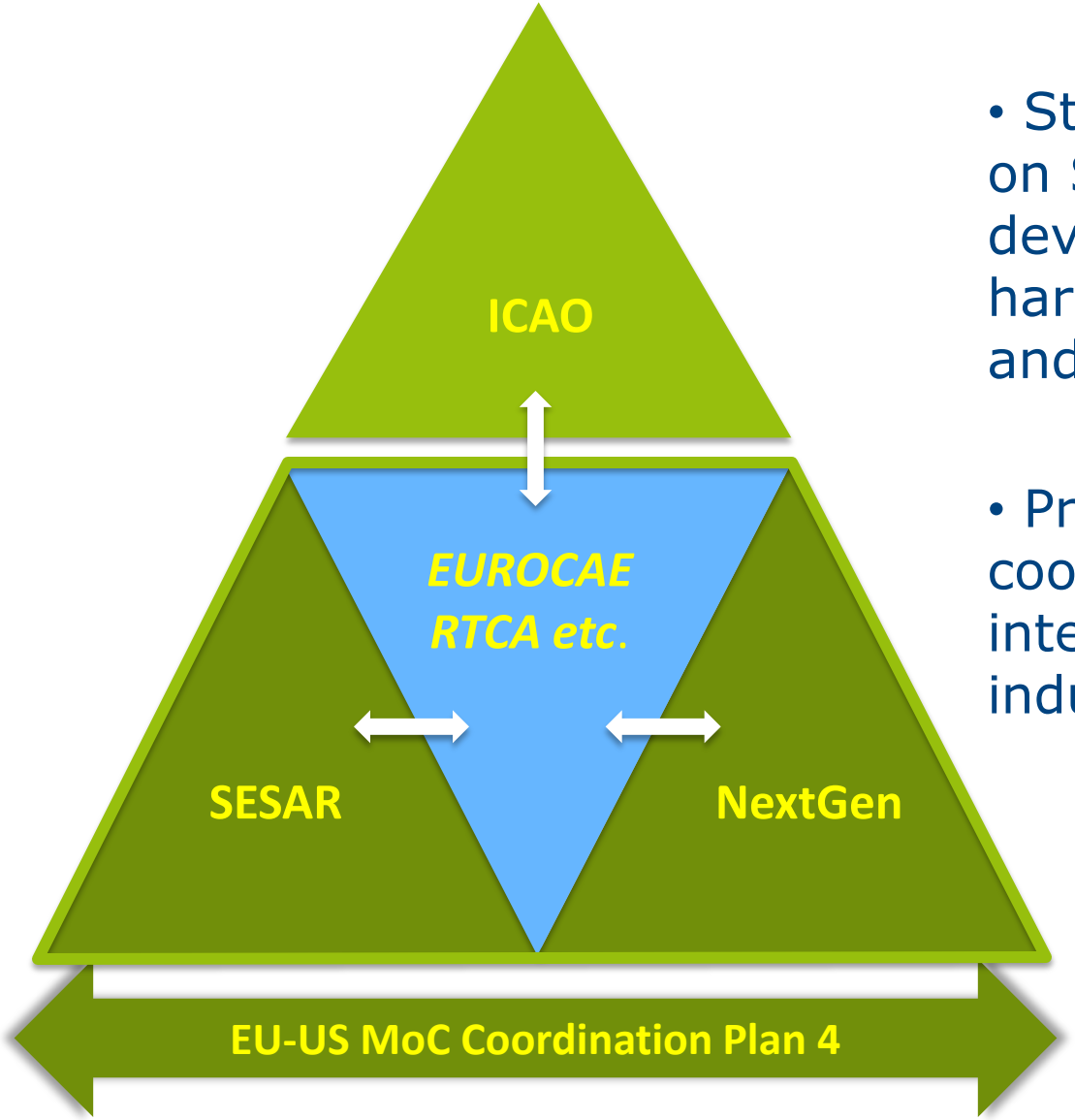
What

How

When

?

GLOBAL COOPERATION & INTEROPERABILITY



- Standards built on SESAR and NextGen developments will support harmonised Implementation and Regulation

- Programme level coordination enhanced by interoperability and wider industry buy-in.

AGENDA

Why

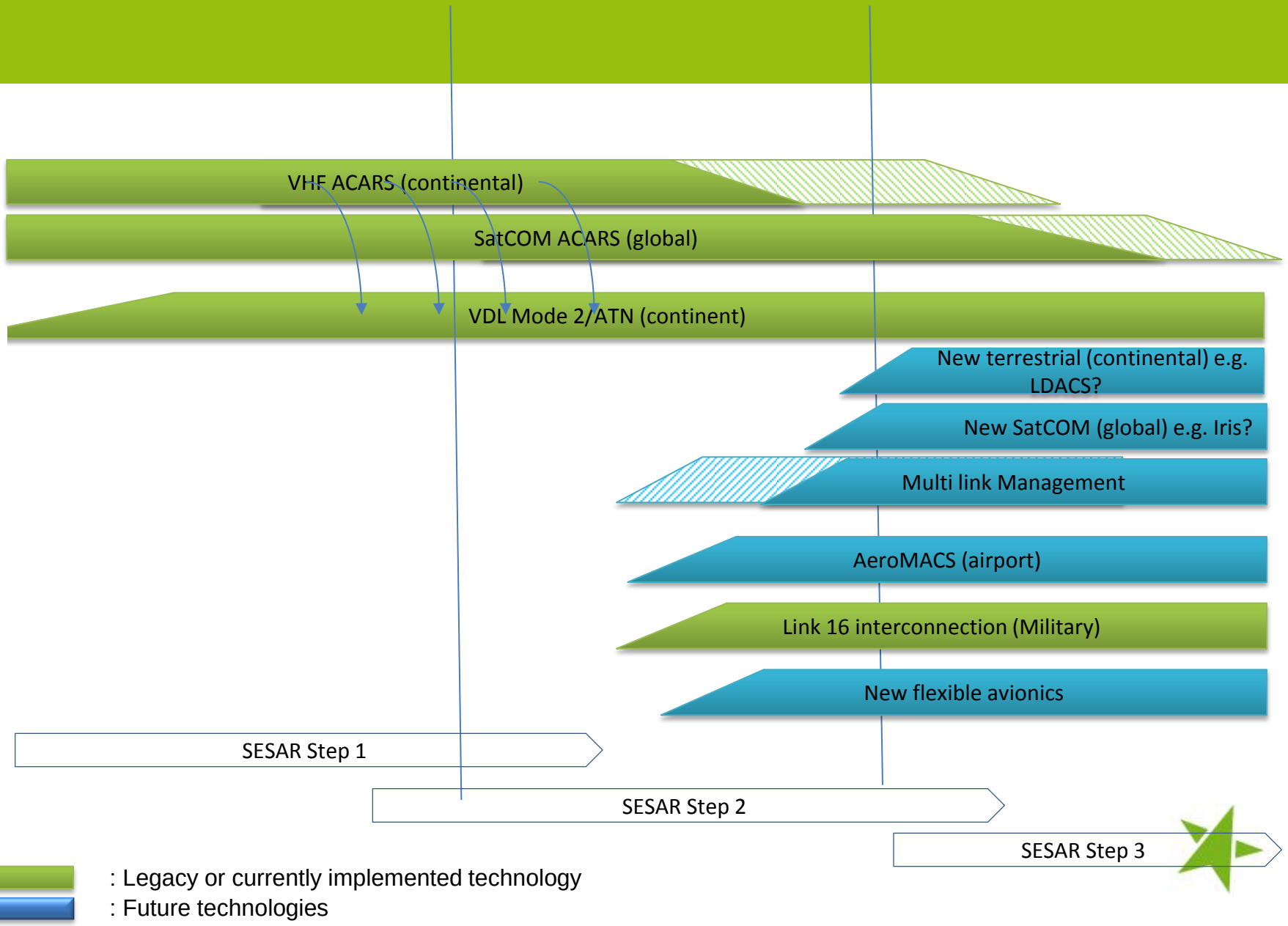
What

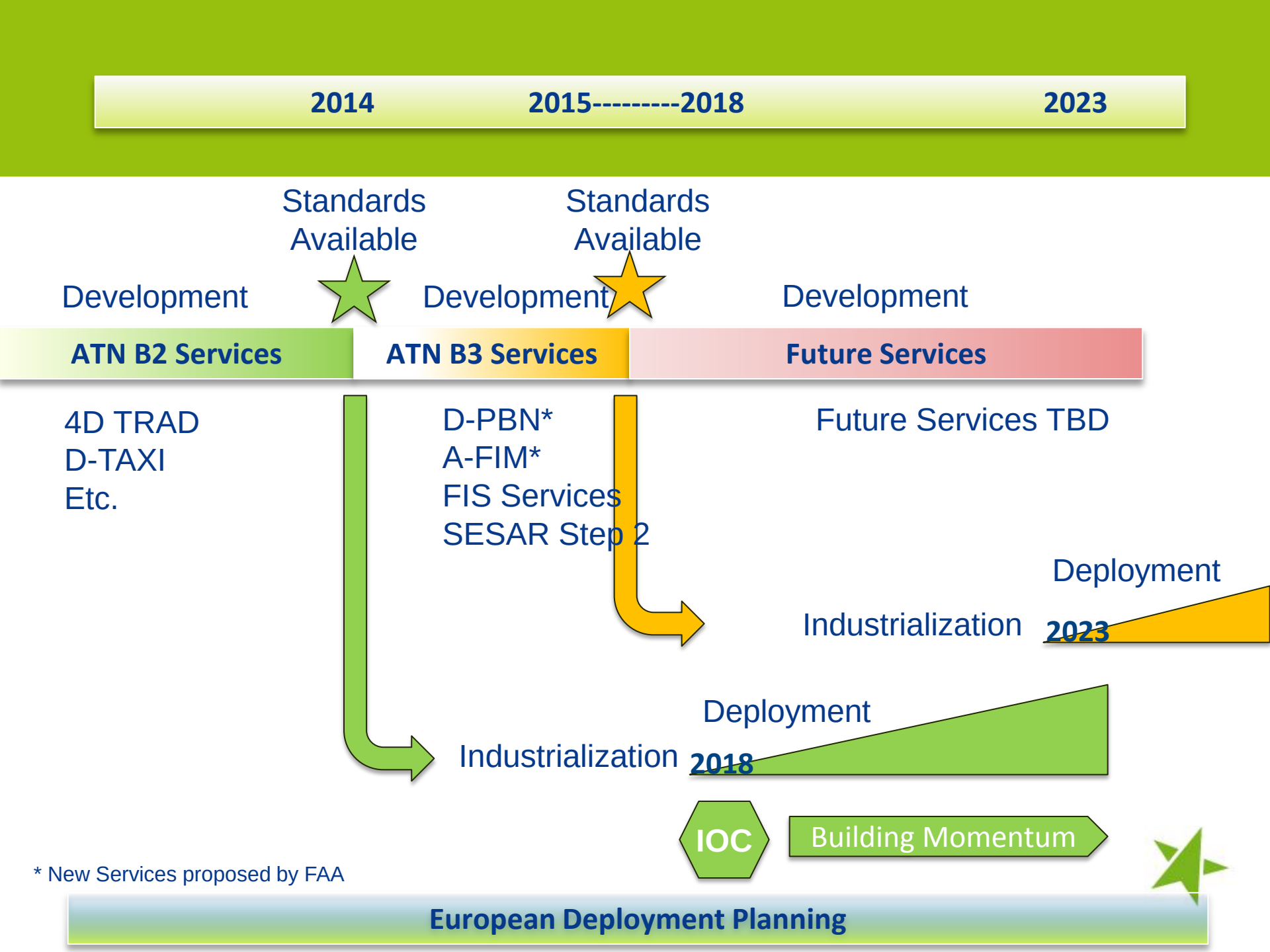
How

When

?

Communications Technology Roadmap




2014
2015---------2018
2023
Standards Available
Standards Available
Development
Development
Development
ATN B2 Services
ATN B3 Services
Future Services
4D TRAD
D-TAXI
Etc.
D-PBN*
A-FIM*
FIS Services
SESAR Step 2
Future Services TBD
Deployment
Industrialization
2023
Deployment
Industrialization
2018
IOC
Building Momentum
* New Services proposed by FAA
European Deployment Planning

Conclusions

- Data communication needs to be seen from a **performance driven 4D ATM TBO context.**

- **Initial 4D is the first important step** towards understanding the full 4D needs of datacommunications in the integrated air and ground ATM procedures and systems design

- We need to work together to achieve globally **endorsed ICAO provisions and agreed industry standards** to be interoperable and **timely ready for regional deployment planning** (SARPS, Standards (Services and technology) /Spectrum, Business case assessments – "BEBS" etc)

SESAR/NextGen as leading modernisation programmes have a global responsibility. We need to make good use our MoC to agree on the steps towards global interoperability

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AIRPORT OPERATIONS PLANNING/NETWORK OPERATIONS/AIRLINE OPERATIONS

Tim Hardy, Airside Director, Heathrow

SEAC

SESAR workshop

Washington DC, 25th June 2013

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AGENDA

	Airports' Role in SESAR
	Airport Operations
	Network Operations Plan
	Collaborative Airport Planning
	Airline Operations Planning

Airport Engagement in SESAR via SEAC – the SESAR European Airports Consortium

Why did Airports become an S-JU member through SEAC ?

- Airport involvement in the Definition Phase was less than 5% of total work
- ATM related resources within airport companies are very rare

⇨ Only a group of major airports can make a meaningful contribution

The SEAC Consortium

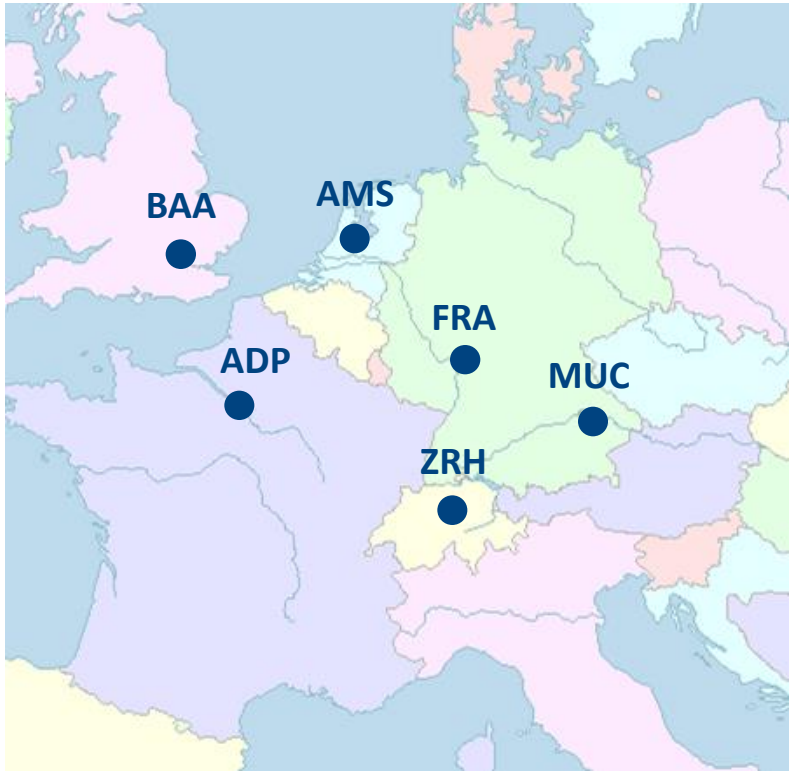
- SEAC is a consortium created for the duration of the SESAR Programme
- Together with the WP leader AENA, SEAC manages WP6 “Airport Operations”
- SEAC contribution is limited to projects and tasks relevant for airports (mainly WP6)
- SEAC is a relatively small player in SESAR: 16.7 Mio € contribution (< 1.5% of total effort)

SEAC Represents 5 of Europe's Top 10 Airports

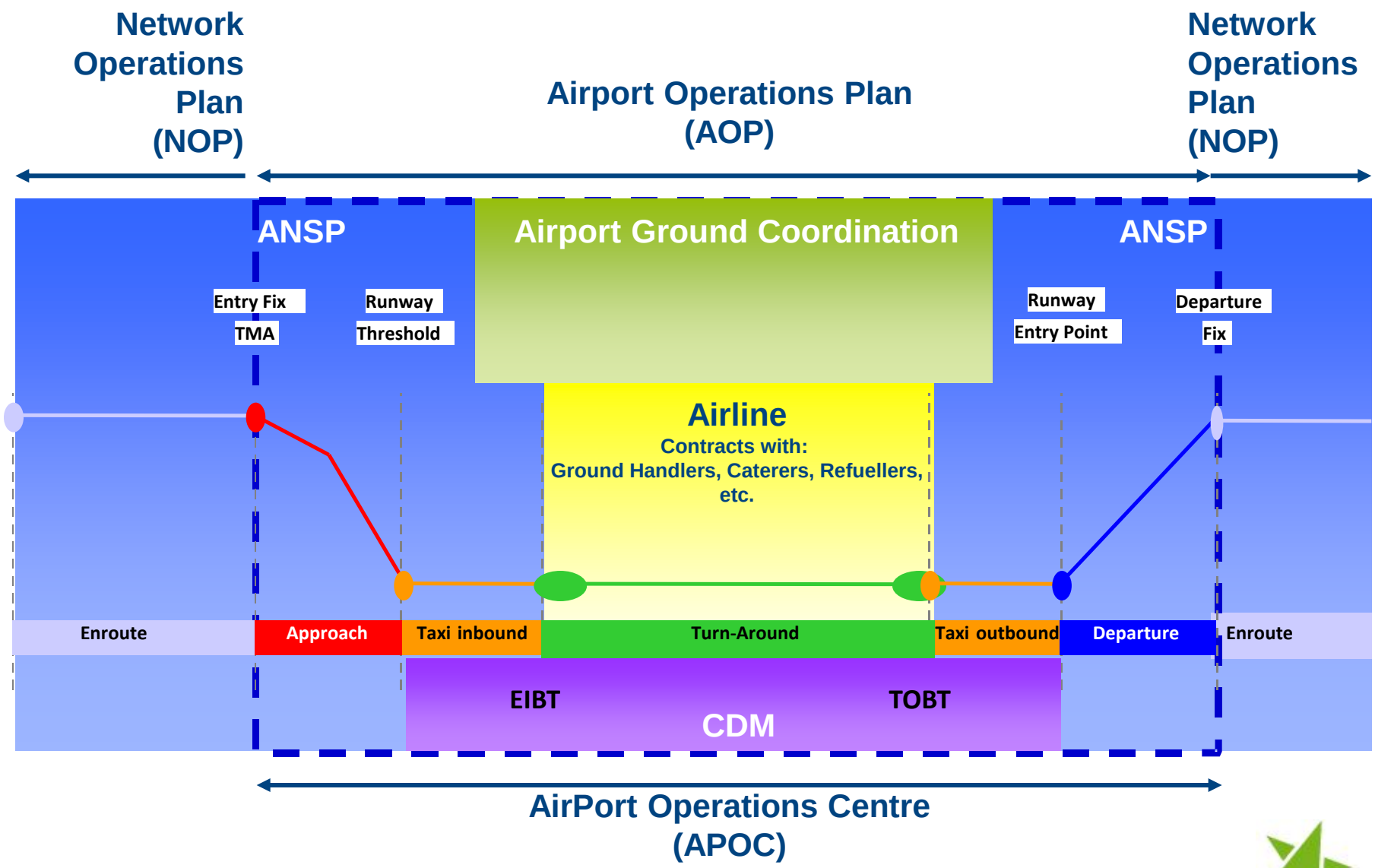
- and over 325 mppa

Rank	Airport	Mio. Pax / a	
1	London LHR	69.43	(SEAC)
2	Paris CDG	60.97	(SEAC)
3	Frankfurt	56.44	(SEAC)
4	Amsterdam	49.75	(SEAC)
5	Madrid	49.64	(AENA)
6	München	37.76	(SEAC)
7	Rom FCO	37.65	
8	Istanbul	37.40	
9	Barcelona	34.39	(AENA)
10	London LGW	33.67	
...	...	...	
11	Paris ORY	27.14	(SEAC)
14	Zürich	24.34	(SEAC)

ACI-Europe traffic statistics for 2011



How Airports Fit in the ATM Network

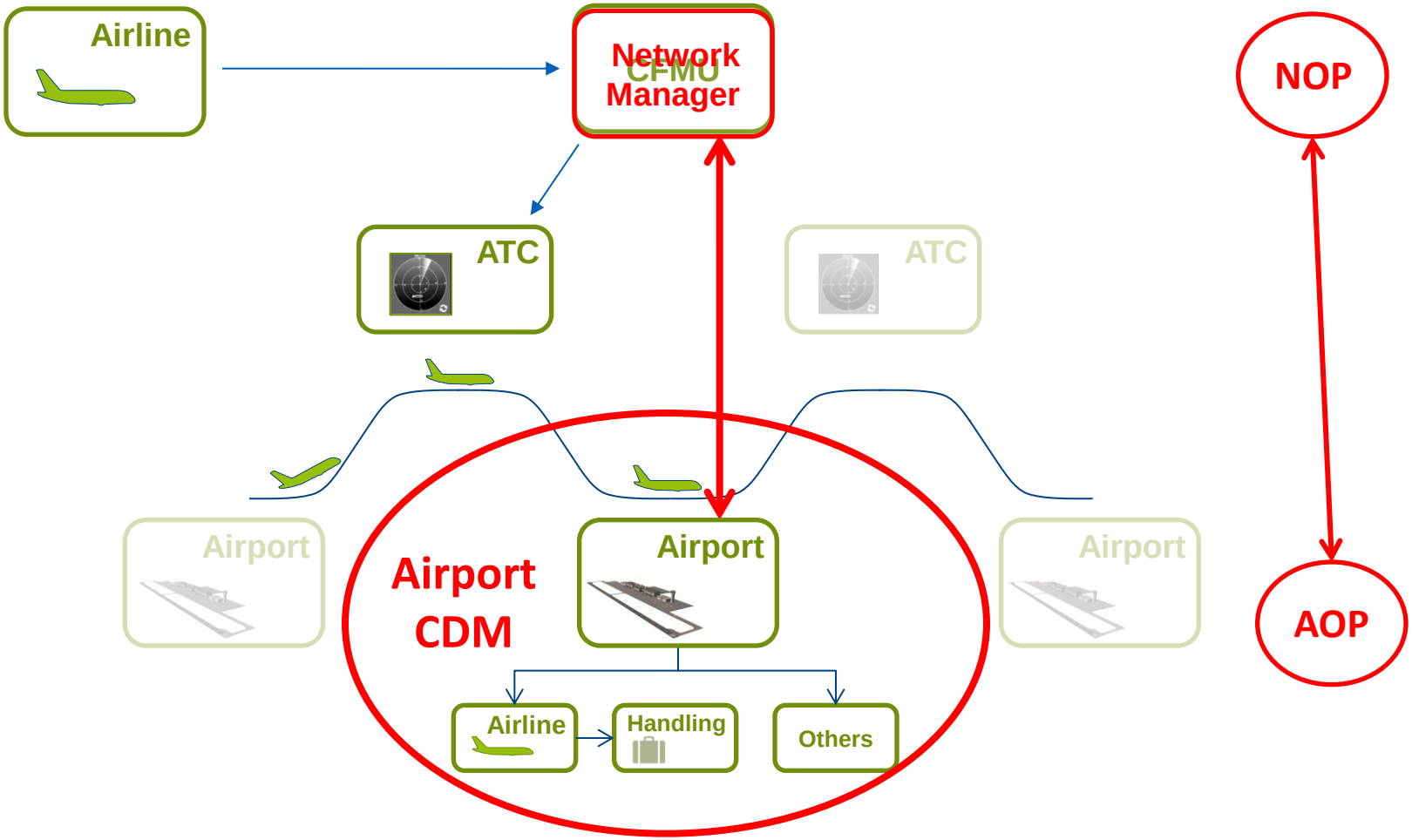


Towards Collaborative Airport Management

The Airport (R)evolution in SESAR:

- SESAR is building on **proven technologies** such as A-CDM, A-SMGCS, AMAN, etc.
- Based on the **ATM Masterplan** SESAR is developing a series of building blocks in the Airport environment
- This involves a series of philosophy-changes:
  - from time-based to performance-based operations - one continuous aircraft trajectory
  - integrating airports into the network
- One of the first building blocks ready for implementation at airports are the **Airport- and Network-Operations Plans (AOP / NOP)**

Operations before and after SESAR



- Local optimisation through A-CDM with point to point connection to the Network (ex CFMU)
- No network-wide common situational awareness especially for planning updates
- The airport as 'Ground Coordinator'

Collaborative Network Operations Plan (NOP)

What is the Network Operations Plan (NOP)

- **The NOP is a structured and coherent set of information**
  (e.g. the current demand, the situation of airspace/airports), but also the influences of ones versus the other (DCB)

- **The NOP is "performance driven"**
  the objective being to have the best possible plan and to show the actions required to reach this performance (i.e. minimum disruptions).

- **The NOP is the common view of the Network situation:**
  the same information is available to all ATM Stakeholders

- **The NOP is a rolling process**, through continuous assessment of performance and identification of improvement and/or mitigation actions

What does the NOP mean for Airports ?

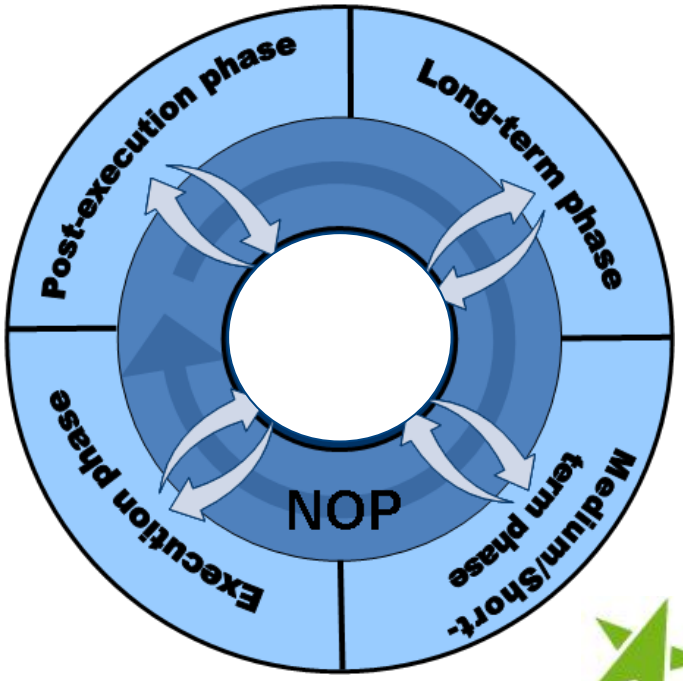
- **Agreed demand and capacity figures for airports, current and future**, are a vital input into the network operations planning (e.g. to ensure there is sufficient enroute capacity available in the correct locations).

- **Integration of airport information** such as changes to those capacity figures in real time will improve the network picture of 'real capacity' supporting better capacity planning.

- **Airports to regularly update the NOP** on any planned initiatives or special events that may affect airport operations (capacity or efficiency).

- **Better management of adverse conditions** Through common understanding of adverse conditions and better MET Information

- **Post-ops analysis** Support to effective post-ops analysis by facilitating stakeholders information sharing



Collaborative Airport Planning

AOP & APOC

SESAR Approach to Collaborative Planning

Collaborative Planning is based on a number of "pillars"

Airport Operations Plan (AOP)

- Demand and capacity information
- Resource monitoring (aircraft, pax, bax/cargo) based on up-to-date timestamps
- Strategies for operations management (special events, weather, ..)
- Airport activities.

A set of local Performance Targets agreed between all stakeholders

An Airport Operations Center (APOC) based on the above, supporting an integrated airport operations management.

AOP Definition

"The Airport Operations Plan (AOP)
is a single, common and collaboratively agreed rolling plan available to all airport stakeholders whose purpose is to provide common situational awareness and to form the basis upon which stakeholder decisions relating to process optimisation can be made".

Airport Operations Plan – What's new ?!?

Information sharing will be improved through the AOP

- **Wider scope**, e.g. overall airport resources, MET, key landside data
- **More anticipation**, starting as early as 6 months before operations
- **Improved quality** through more detailed monitoring leading to updates
- **One source of information** (for real !): the AOP

From milestones approach to Airport Performance Monitoring & Management

- More detailed monitoring of the aircraft process
- Monitoring of the impact of landside to the airside (pax & baggage process)
- The APOC: the Centre where collaborative decisions are made, CDM processes supported by decision support tools and what-if scenarios

Variable taxi times: supported by Surface management

Pre-departure sequence: supported by Surface management and RWY management

The Airport Operations Centre (APOC) to manage the **Airport Transit View (ATV)**

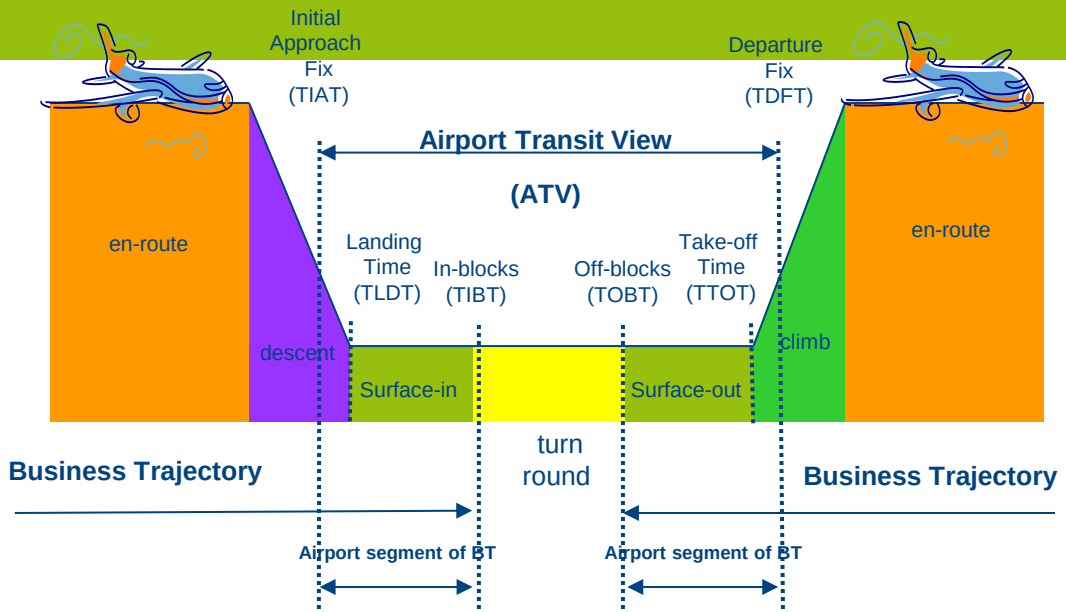
The Airport Transit View (ATV)

The Airport Transit View (ATV)
is the description of the "visit" of an aircraft to the airport. It consists of three separate sections:

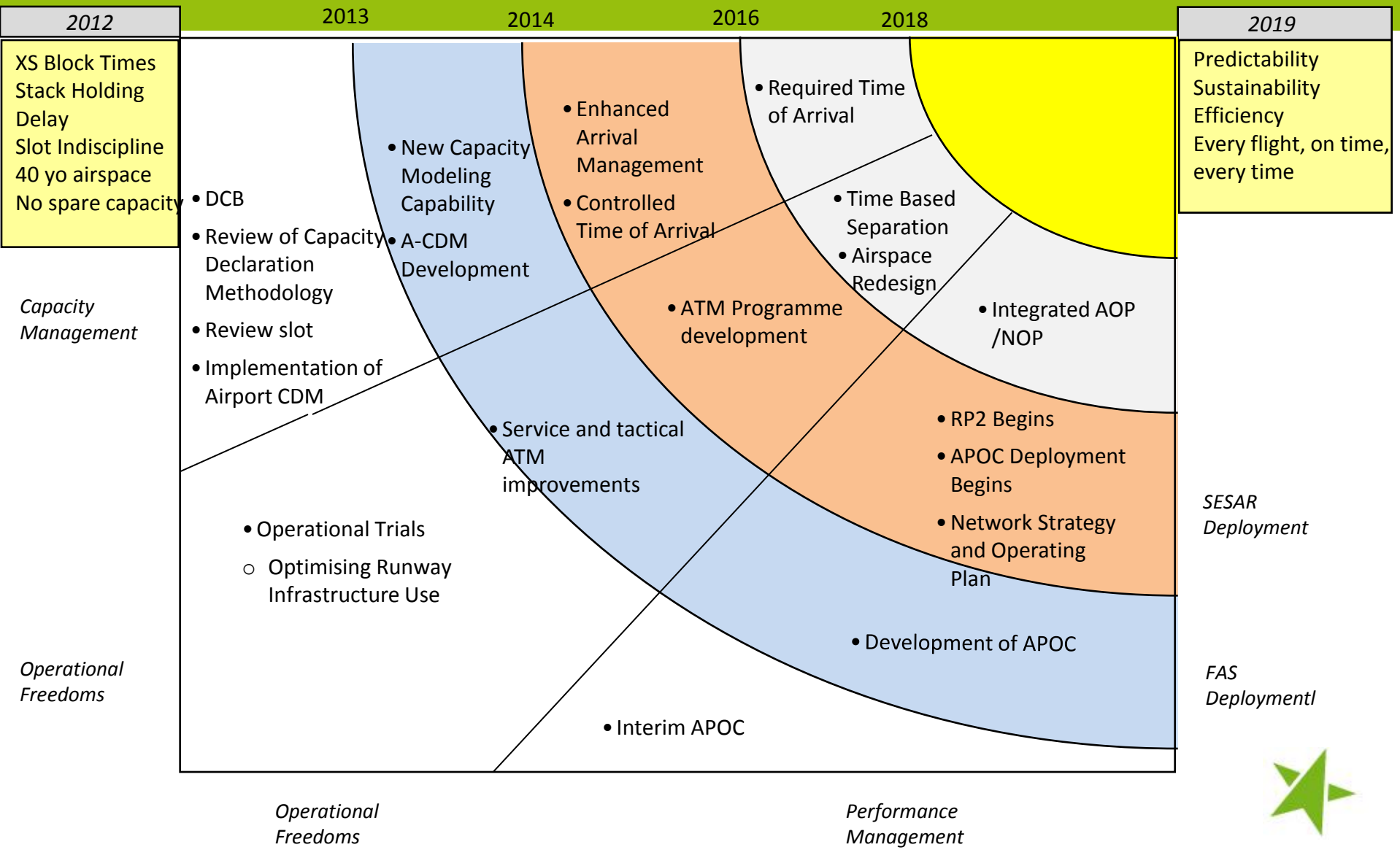
Final approach and "Surface-in"
ground section of the inbound flight,

Turn-round process
section in which the inbound and the outbound flights are linked,

"Surface-out" & Initial Climb
ground section of the outbound flight"



LHR - ATM Improvement Initiatives



Airport Operations Centre – Services (1)

The APOC is built around 4 main services:

The ***Steer Airport Performance*** service **develops the performance standard** (i.e., goals, targets, rules, thresholds, trade-off criteria and priorities) for airport operations and **sets an overall strategic direction**. Airport stakeholders develop a mutually agreed performance standard in a collaborative manner.

The ***Monitor Airport Performance*** **maintains surveillance over airport operations**, airport performance (against KPAs), airport environment (e.g. weather monitoring), supervising airport related information and any information that can impact the airport performance, providing observations, forecasts, alerts and warnings against predefined thresholds.

Airport Operations Centre – Services (2)

The ***Manage Airport Performance*** **assesses the overall impact of warnings / alerts** on upcoming airport operations and **supports decision making activities** (what-if, etc.) in accordance with AOP consistency rules

The ***Post-Operations Analysis Service*** **provides**

- A facility to **understand the airport performance** against the performance plan and identify the root causes of deviations,
- A facility to **assess the relevance of the performance plan**
- A **foundation for the development of new operational scenarios** and for assessing the relevance of existing ones

Airline Operations Planning

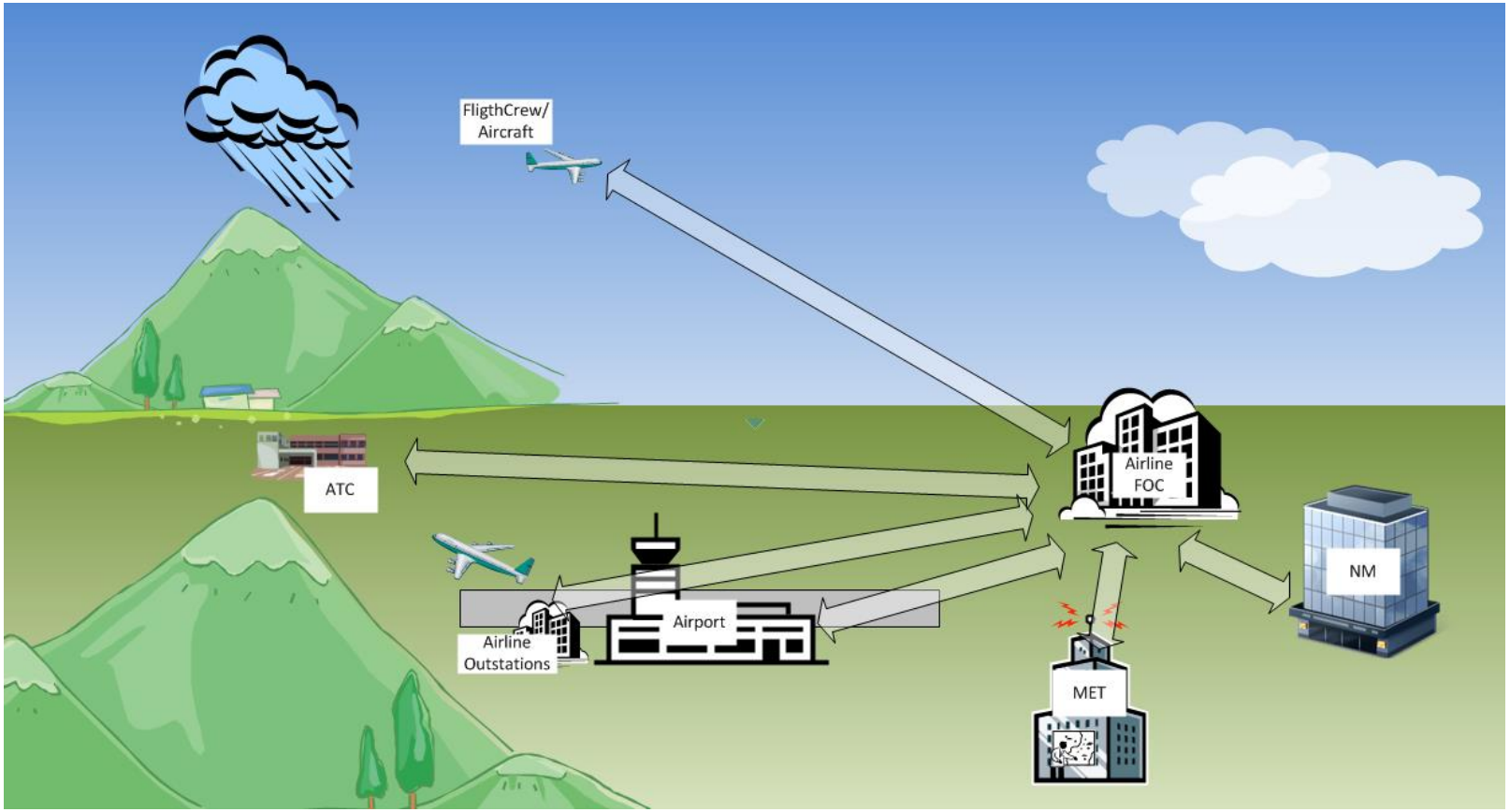
AOC interactions

The AOC system is an integral part throughout the entire lifecycle of a single flight as well as the entire lifecycle of an entire flight schedule.

This can be summed up but is not limited to the following:

- Producing the flight schedule
- Producing the data that is needed to execute a flight
- Allowing efficient flight execution
- Receiving the data that is needed to produce a flight plan
- Receiving and processing data that is needed to support decision making in the planning as well as the execution phase

AOC interactions



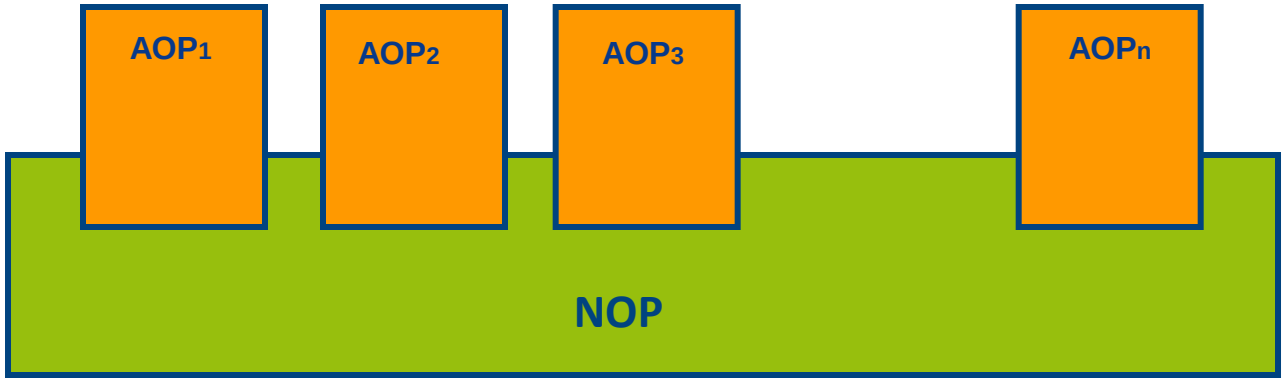
APT - AOC interaction (example)

The Airport Transit View (ATV) of a turnaround during the execution phase would cover the following phases of the flight including:

- Initial Approach which is fixed by the Targeted Initial Approach Fix Time (TIAT)
- Landing is fixed by the Targeted Landing Time (TLDT)
- In-Block time is fixed by the Targeted In-Block Time (TIBT)
- Off-Block time is fixed by the Targeted Off-Block Time (TOBT)
- Take-off time is fixed by the Targeted Take-Off Time (TTOT)
- Departure Fix is provided by the Targeted Departure Fix Time (TDFT)

- The NOP provides visibility of:
  - Network OPS Performance targets and KPIs;
  - Forecast Traffic Demand - Business/Mission Trajectories;
  - Service Providers' Planned Resources and Capabilities;
  - Any detected "network influencer" (e.g. special event),
    - its impact on Demand Capacity Balance (assessment),
    - related DCB actions/measures
  - Residual Bottlenecks/Hot Spots

AOP-NOP Sharing Principles



The NOP contains airport data amalgamated from all AOPs data agreed to be shared with the network (incl. airport constraints/events, airport capacities, timely ground trajectory information).

The NOP consolidates this information into a network view. NOP data is available to all authorised users in order to support their planning.

Airport x can access airport data from other airports if it is shared, and it should do so via the NOP.

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THANK YOU !

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