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OF CENTRAL FLOW MANAGEMENT

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Capacity Planning and Assessment Network Operations Planning

Air Traffic Services System Capacity Seminar/Workshop
Nairobi, Kenya, 8 – 10 June 2016

Raffaele Russo
EUROCONTROL Operations Planning

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Introduction - EUROCONTROL

EUROCONTROL

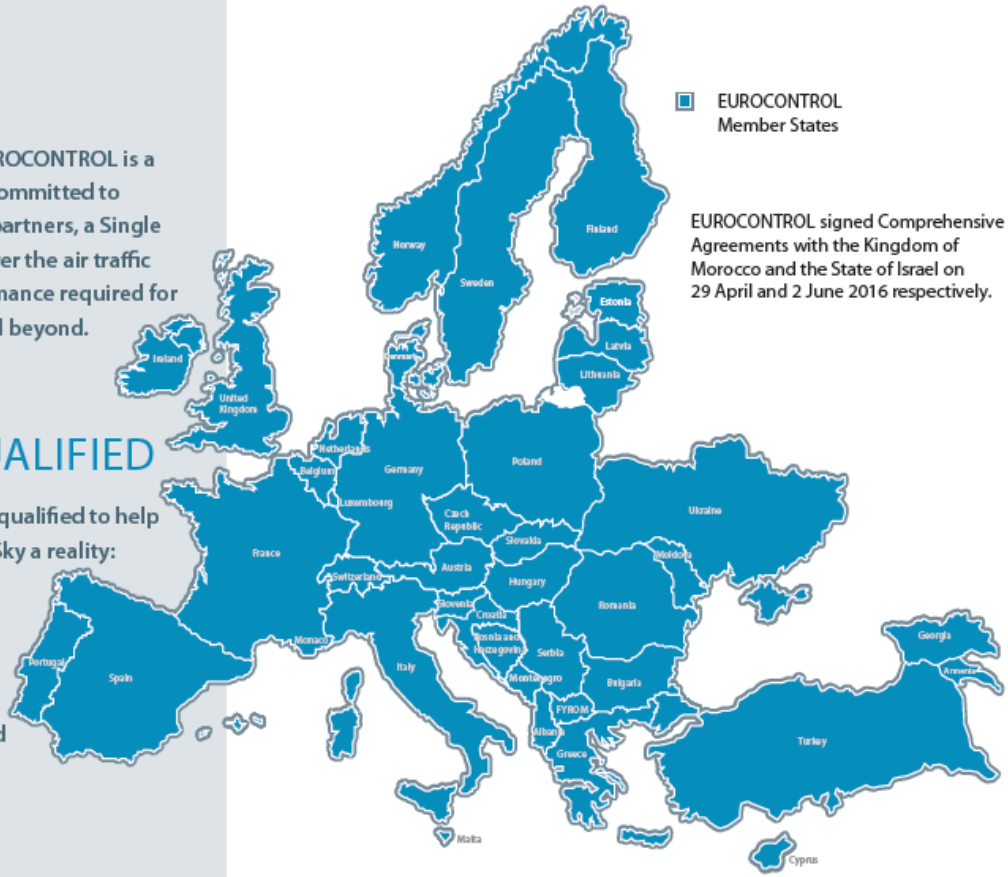
MISSION

Founded in 1960, today EUROCONTROL is a civil-military organisation committed to building, together with its partners, a Single European Sky that will deliver the air traffic management (ATM) performance required for the twenty-first century and beyond.

UNIQUELY QUALIFIED

EUROCONTROL is uniquely qualified to help make the Single European Sky a reality:

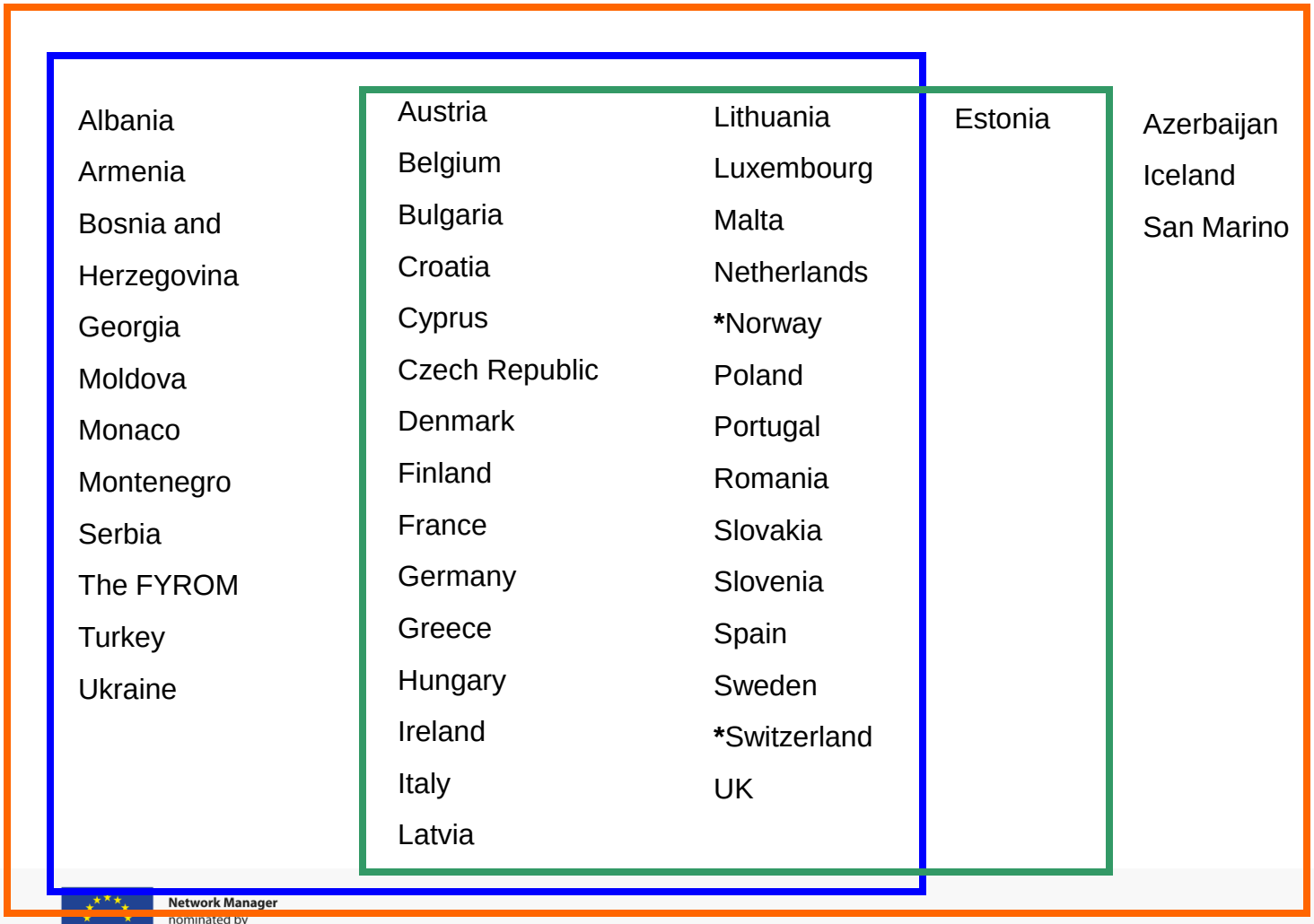
- its 41 Member States provide a truly pan-European perspective;
- its expertise is unrivalled and covers both the operational and technical elements;
- can advise on both the civil and the military aspects of ATM;
- has real experience at bringing States with different needs together for a common goal;



MEMBERSHIP

EUROCONTROL is an intergovernmental organisation with 41 Member States. The European Community signed an Accession Protocol in 2002. Member States include all of the EU States.

European Organisations



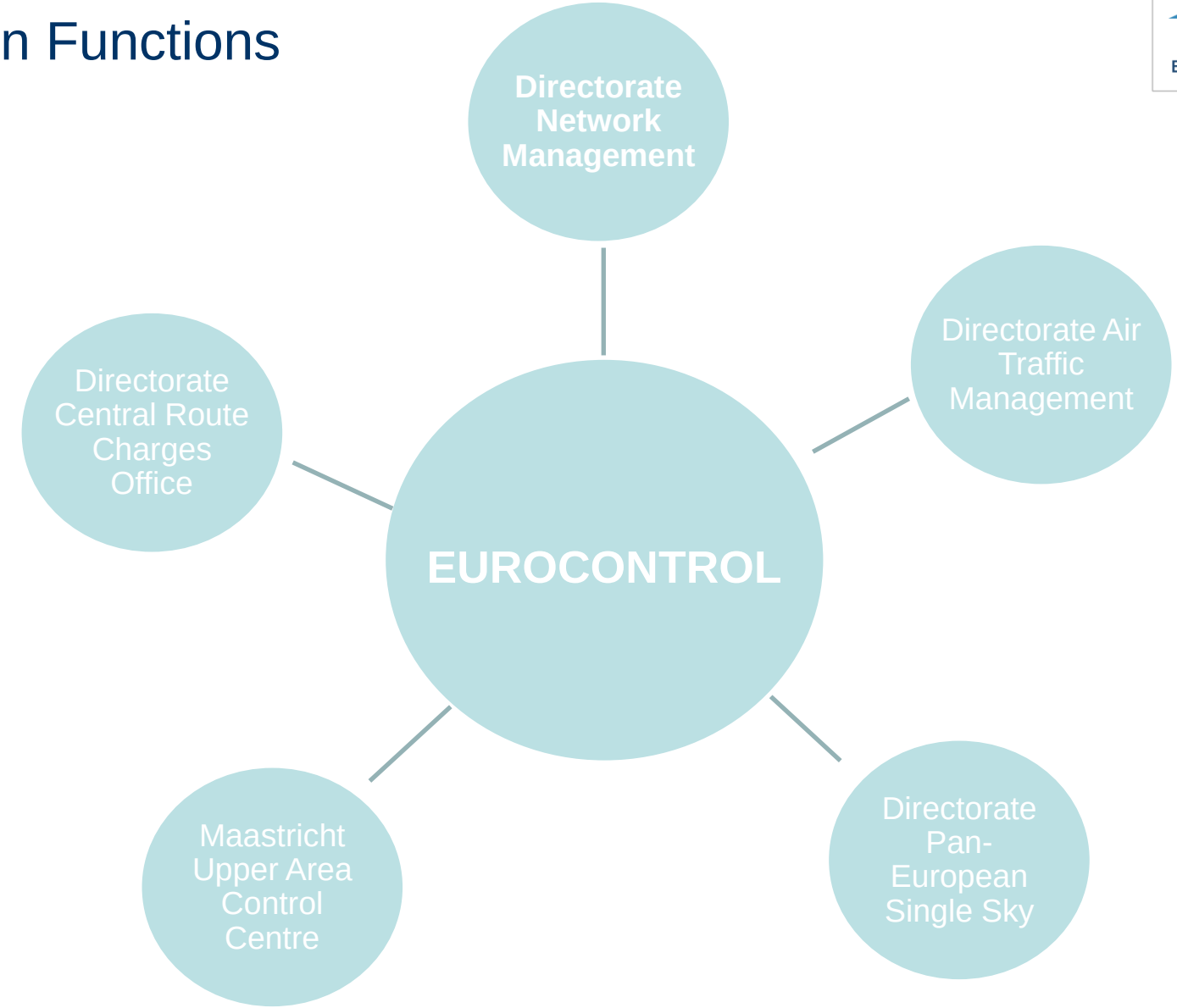
ECAC

EU

EUROCONTROL

* - States with the special agreements with EU. In the context of ATM they are treated like members.

Main Functions



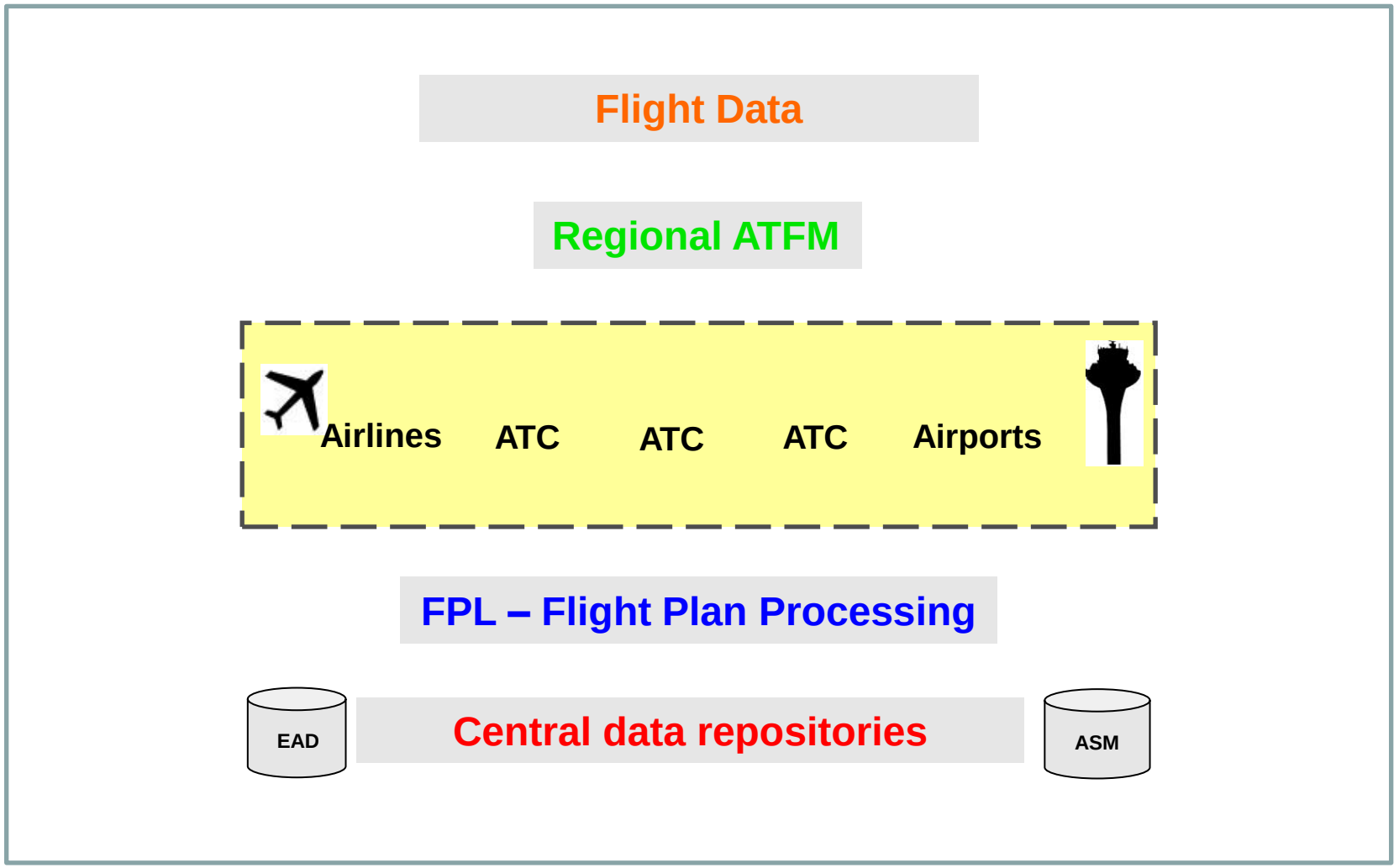
Areas of Expertise – EUROCONTROL/NETWORK MANAGER

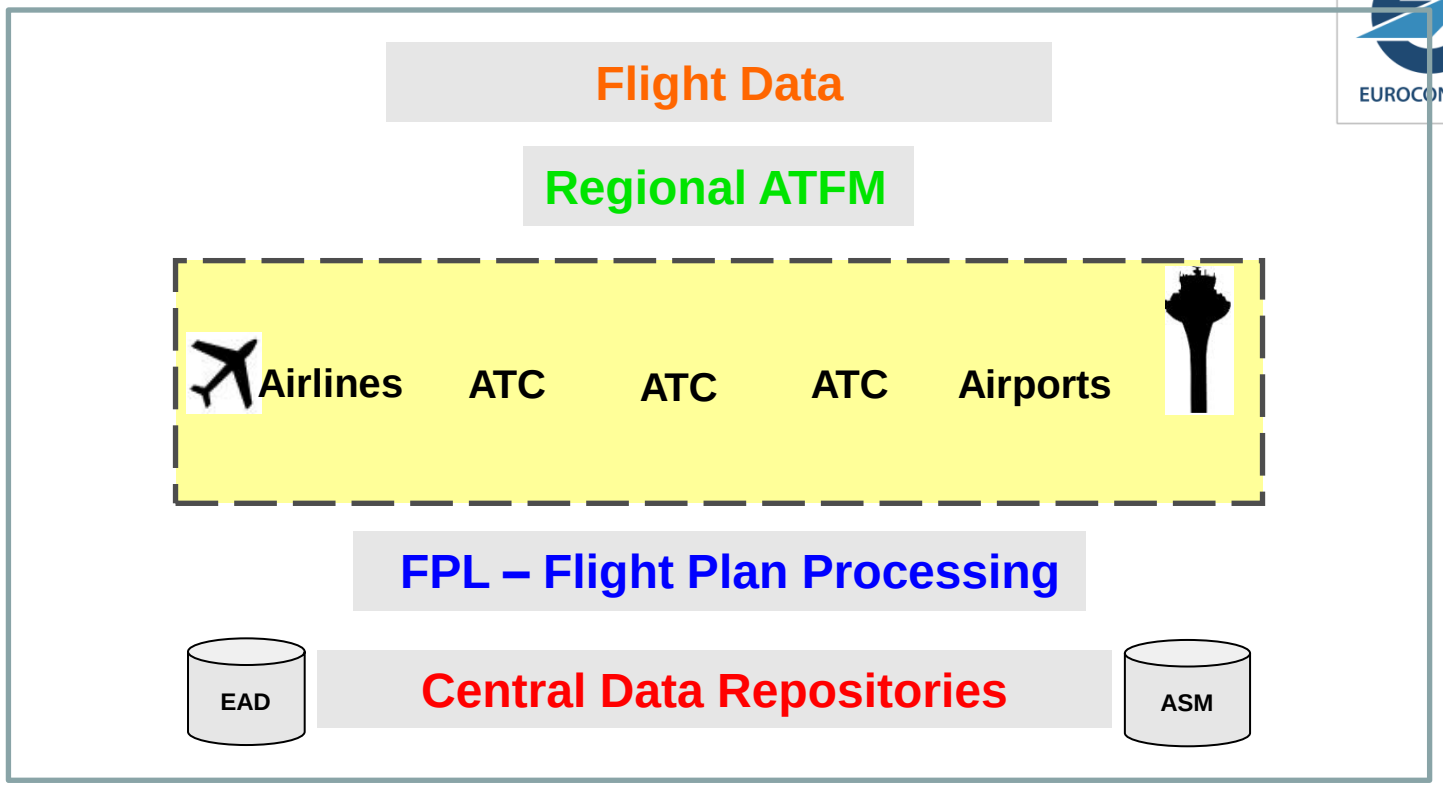
CNS – Communication, Navigation, Surveillance	• Surveillance tools • CNS Standards and Specifications • RVSM Monitoring • Transponder Codes and Radio Frequencies Coordination
Airspace Design	• Evaluation, analysis and design of traffic flows and airspace structures, including civil/military • Macroscopic, Fast/Real Time Data, Tools and Simulations
Capacity: analysis and planning	• Network and local capacity optimisation • Macroscopic, Fast/Real Time Data, Tools and Simulations
Airspace Management (Civil/Military Coordination)	• Various levels of planning for civil/military coordination and Flexible Use of Airspace, including network procedures • LARA – Civil/Military Airspace Management Planning Tool
Safety	• Network Safety Risks Identification, including network management risks • Continuous operational safety improvements • Support to the implementation of safety management systems and procedures • Safety Culture
Airport capacity enhancement and optimisation	• Capacity, efficiency and environment studies • A-CDM: Familiarisation and implementation
Training and human resources development	Our training covers: • Various Air Traffic Management courses (ATM), • Network Operations • Communication, Navigation, Surveillance

Areas of Expertise – EUROCONTROL/NETWORK MANAGER

- Involvement is ensured through:
  - Participation in EUROCONTROL Expert Groups on all ATM/CNS areas
    - Operational or technical
    - Coordination and support of projects
  - Direct support work on individual implementation projects:
    - Airspace design
    - Capacity evaluations
    - ATM procedures
    - Operational performance evaluations
    - Civil/military (FUA) implementation support
    - Technical projects, including specifications
    - Fast and Real Time Simulations
  - Execution of tasks on behalf and together with ICAO
    - Transponder Codes and Frequency coordination
    - RVSM monitoring
    - Airspace design
    - Operational and technical aspects on the interfaces between the ICAO EUR Region and other Regions

“ATC Chain” and Network Operations





Network Manager operations cover:

- Central management of airspace data (AIS, AIP, NOTAM and military requirements)
- A single flight plan based on an integrated process: a single entry point for submission, reception, verification and distribution (IFPS).
- Central Air Traffic Flow and Capacity Management (ATFCM)
- Real time flight data: real time situation shared and accessible for all partners: reception, centralisation and distribution of all available information

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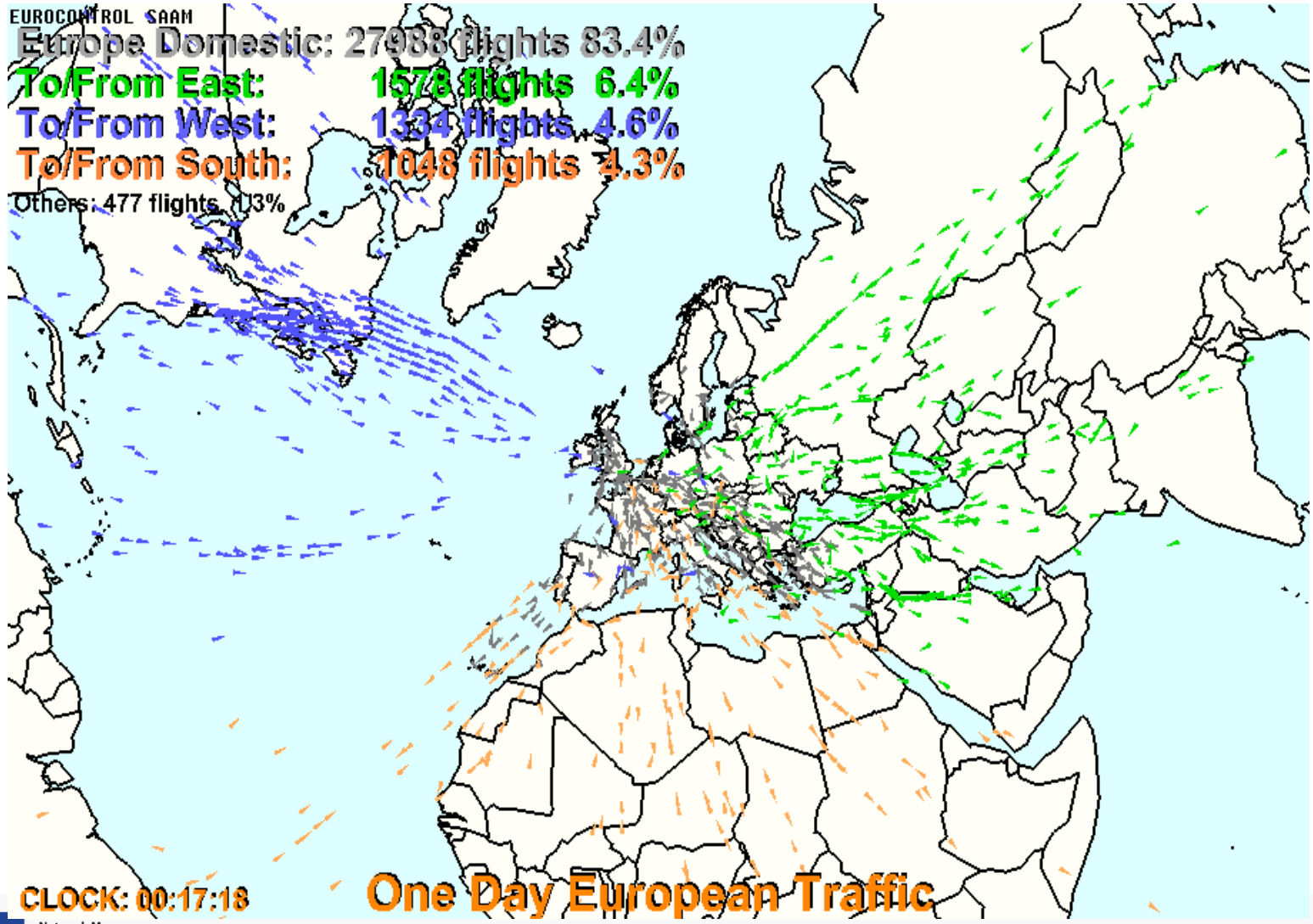
Our Challenges

Our Challenge
Every day Traffic Situation



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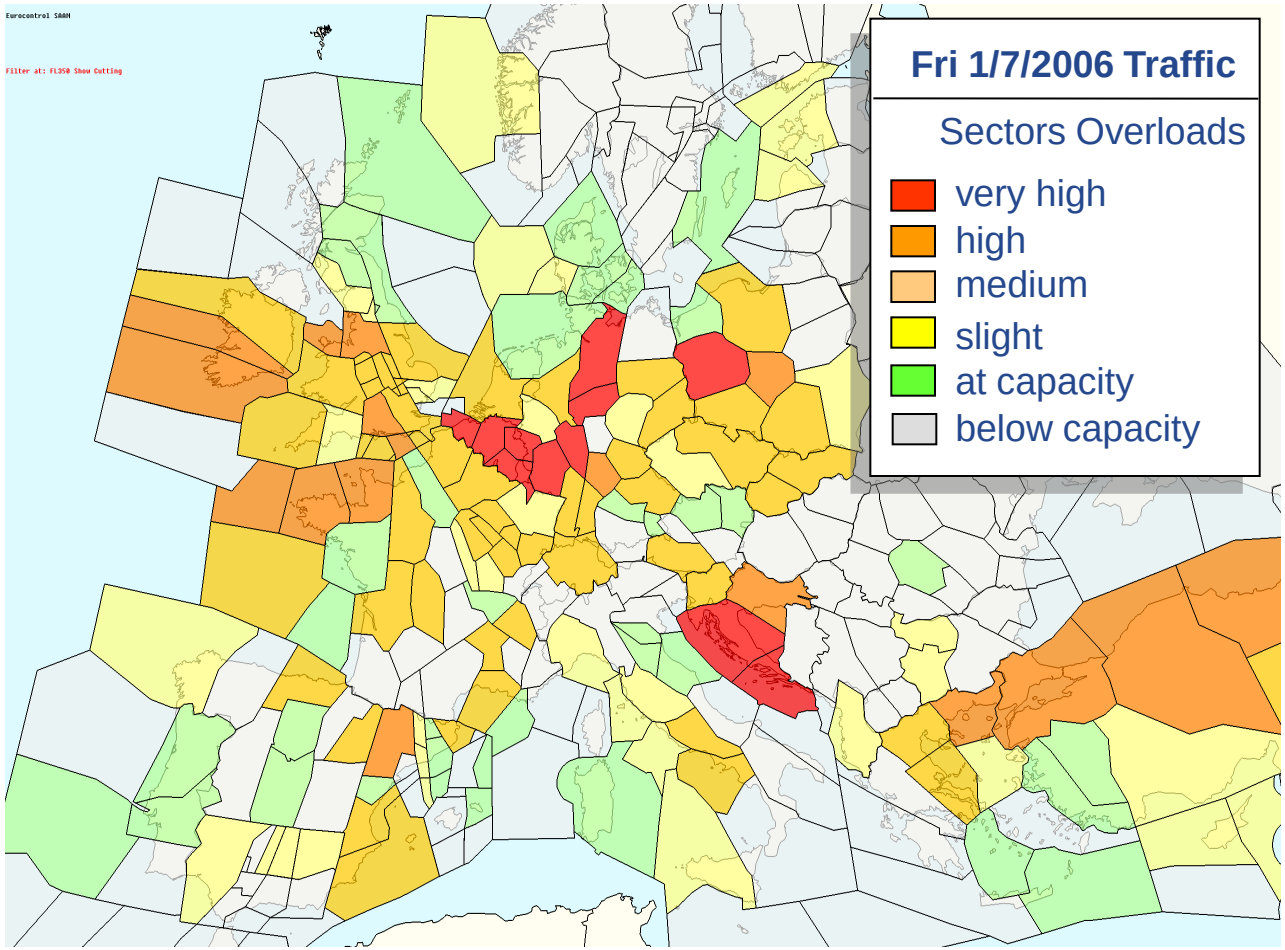
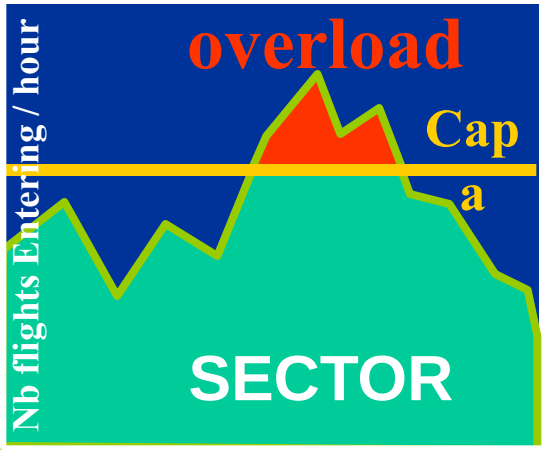
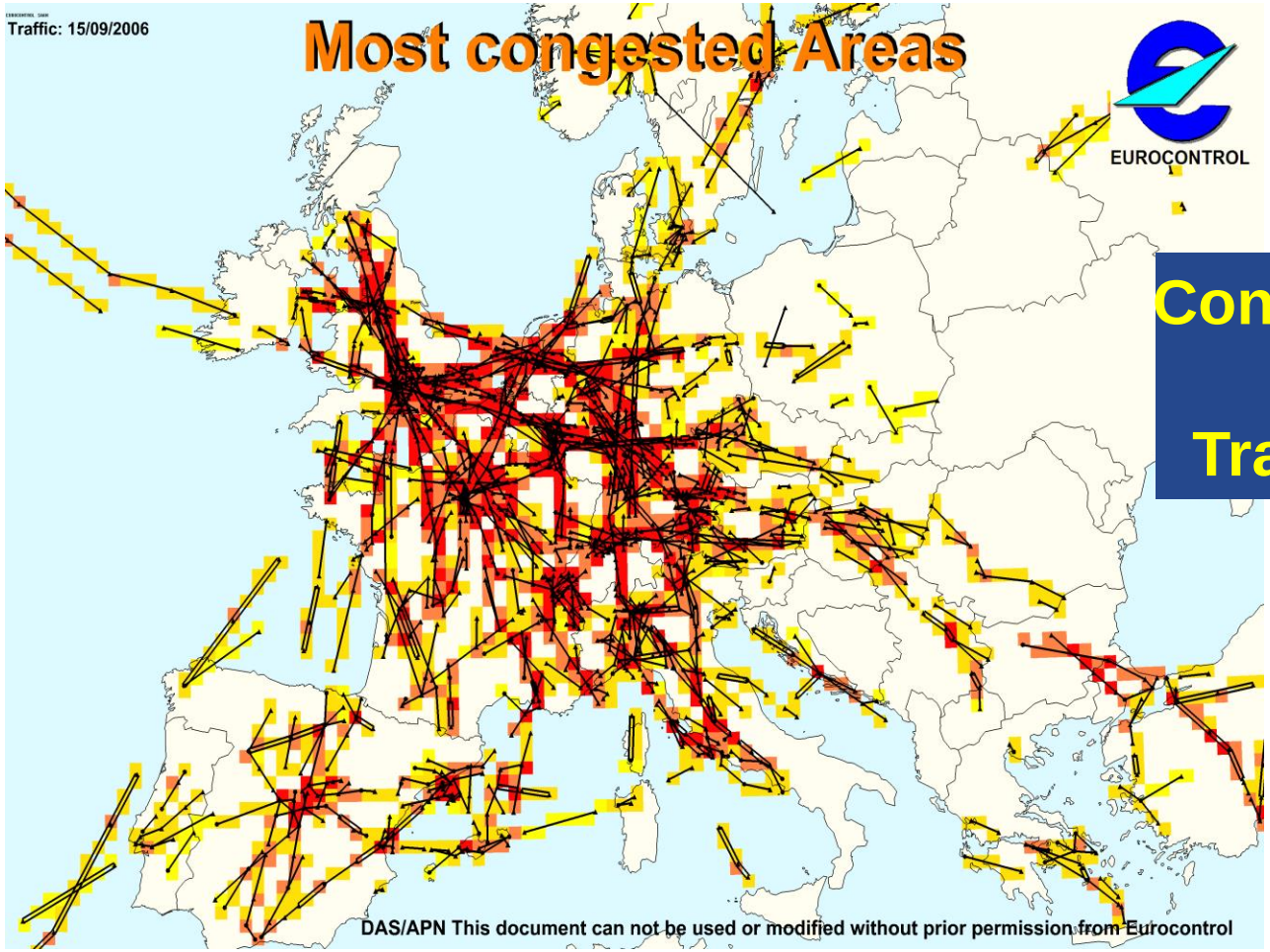
Analysis: AIRSPACE OVERLOAD





Capacity weaknesses

Analysis: NETWORK BOTTLENECK

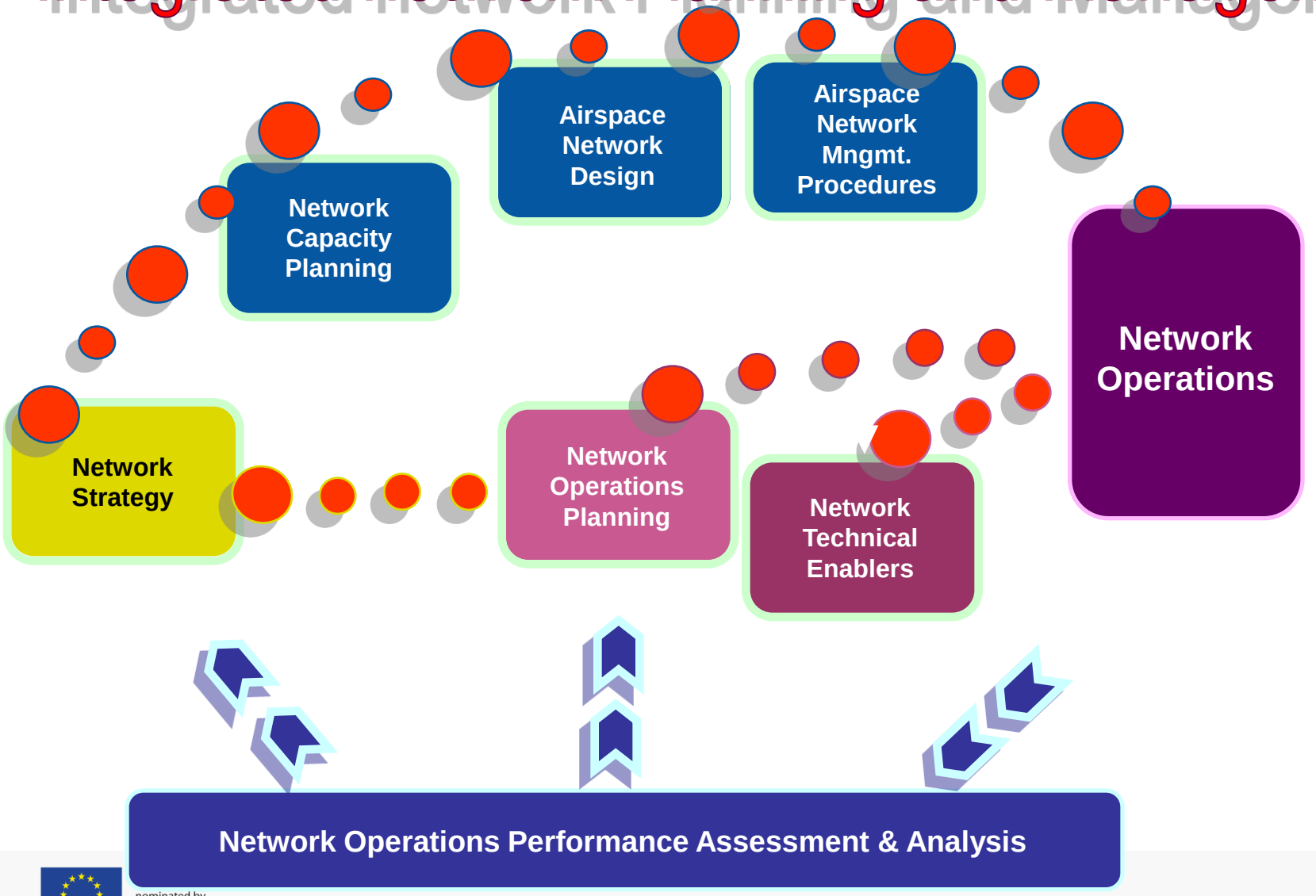


Conflicts Densities mixed with **Traffic** Densities

Complexity assessment

European Airspace Network "Life Cycle"

Integrated network Planning and Management



From Ops Planning to Post-Ops

ACC Baseline – capacity indicator

Optimise sectorisation

Sector configurations

Sector opening schemes

Staff planning

New ATC system or upgrade

Route structure development

Axis meetings

Simulation

Planning

Coordination

Special events planning

Re-routings

Play book

Scenarios

ADP

Regulation

Slot Allocation

STAM

Sector occupancy

Analysis

Reports

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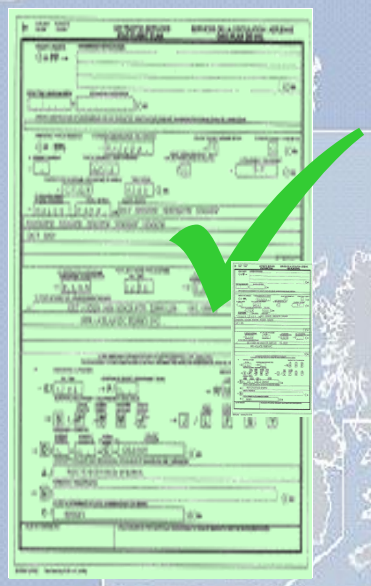
Assessing traffic demand

- Centralised flight planning
- Traffic forecast

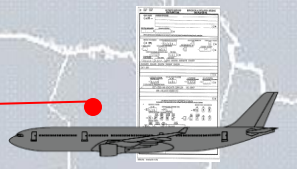
Flight Planning in Europe **with NM IFPS**

One FPL for all NM area

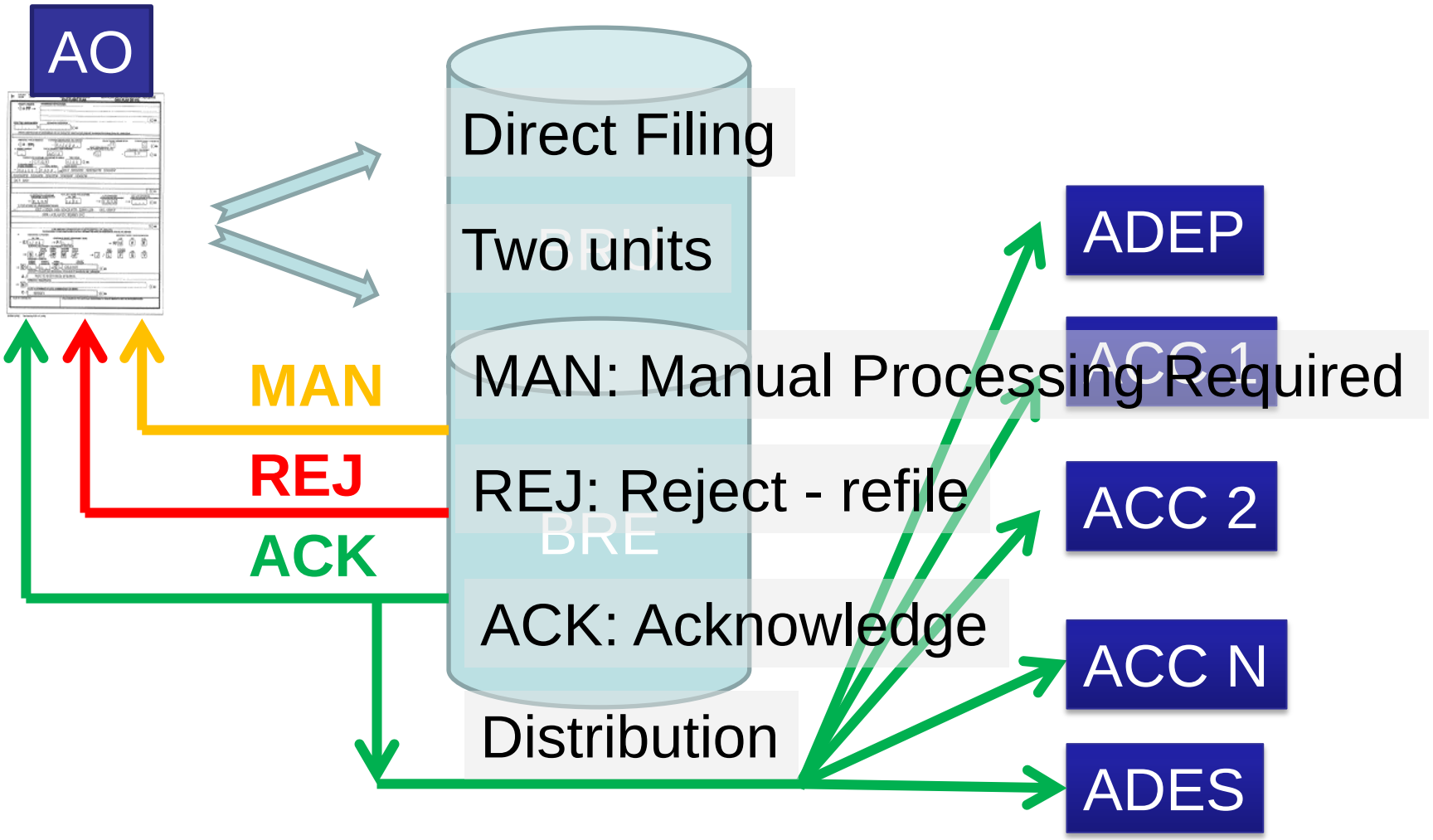
- Full acknowledgement process
- Dynamic re-processing
- Highly automated (>95%)



NM IFPS



Flight Planning Process



IFPS Initial Flight Plan Processing System

- Centralising the management of flight plans at REGIONAL level
- Collaborative with civil and military airspace users
- Delivered with the highest degree of security and service continuity, including disaster recovery
- A single flight profile AGREED with airlines & shared between ALL ATM actors
- Direct filing from aircraft operator to IFPS
- **Accurate, predictable, consistent picture of DEMAND across a region**
- Routing assistance: Opportunities for more efficient routes
- KEY STEP for building a regional ATFM capability, optimising capacity and flight efficiency
- Implementing System Wide Information Management (SWIM) standards to support interoperability in order to give wide access to our services, via business to business and client applications, without geographical constraints

IFPS Initial Flight Plan Processing System

- Additional Functions
  - Safety/security watch: alerting function
  - Callsign Similarity Service (CSS): support to airlines & ANSPs for preventing call sign confusions
  - **Demand Data Repository (DDR):** traffic MODELLING system to anticipate future demand

IFPS BENEFITS

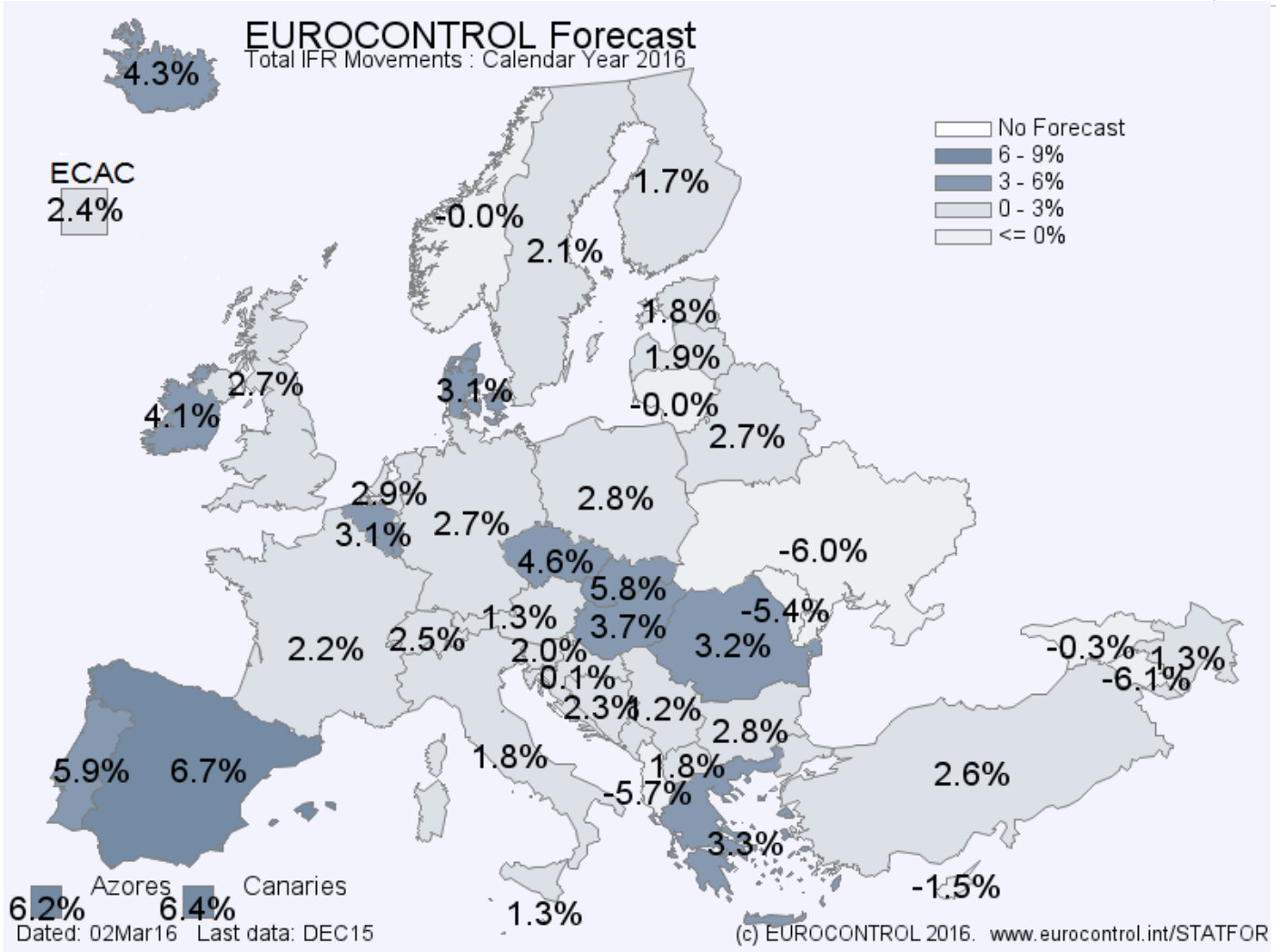
- Highly automated > 96% of flight plans automatically processed.
- Single consistent flight plan for all ATM stakeholders.
- Concrete gains in flight efficiency (flight plan route as close as possible to the shortest direct route).
- Simplified flight plan handling for all actors, with access via business to business and client interfaces, in addition to legacy systems.

Traffic Forecast
EUROCONTROL (STATFOR) 7 Year forecast

ECAC		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	AAGR 2022/2015	RP2 2019/2014 AAGR
IFR Flight Movements (Thousands)	H	.	.	.	.	10,293	10,639	11,092	11,503	11,997	12,417	12,868	3.8%	3.3%
	B	9,710	9,603	9,770	9,917	10,153	10,364	10,578	10,818	11,091	11,301	11,535	2.2%	2.1%
	L	.	.	.	.	10,023	10,107	10,140	10,231	10,335	10,373	10,440	0.7%	0.9%
Annual Growth (compared to previous year unless otherwise mentioned)	H	.	.	.	.	3.8%	3.4%	4.3%	3.7%	4.3%	3.5%	3.6%	3.8%	3.3%
	B	-2.2%	-1.1%	1.7%	1.5%	2.4%	2.1%	2.1%	2.3%	2.5%	1.9%	2.1%	2.2%	2.1%
	L	.	.	.	.	1.1%	0.8%	0.3%	0.9%	1.0%	0.4%	0.6%	0.7%	0.9%

7-year IFR movements forecast: 2016-2022

STATFOR Traffic Forecast 2016



7-year IFR movements forecast: 2016-2022

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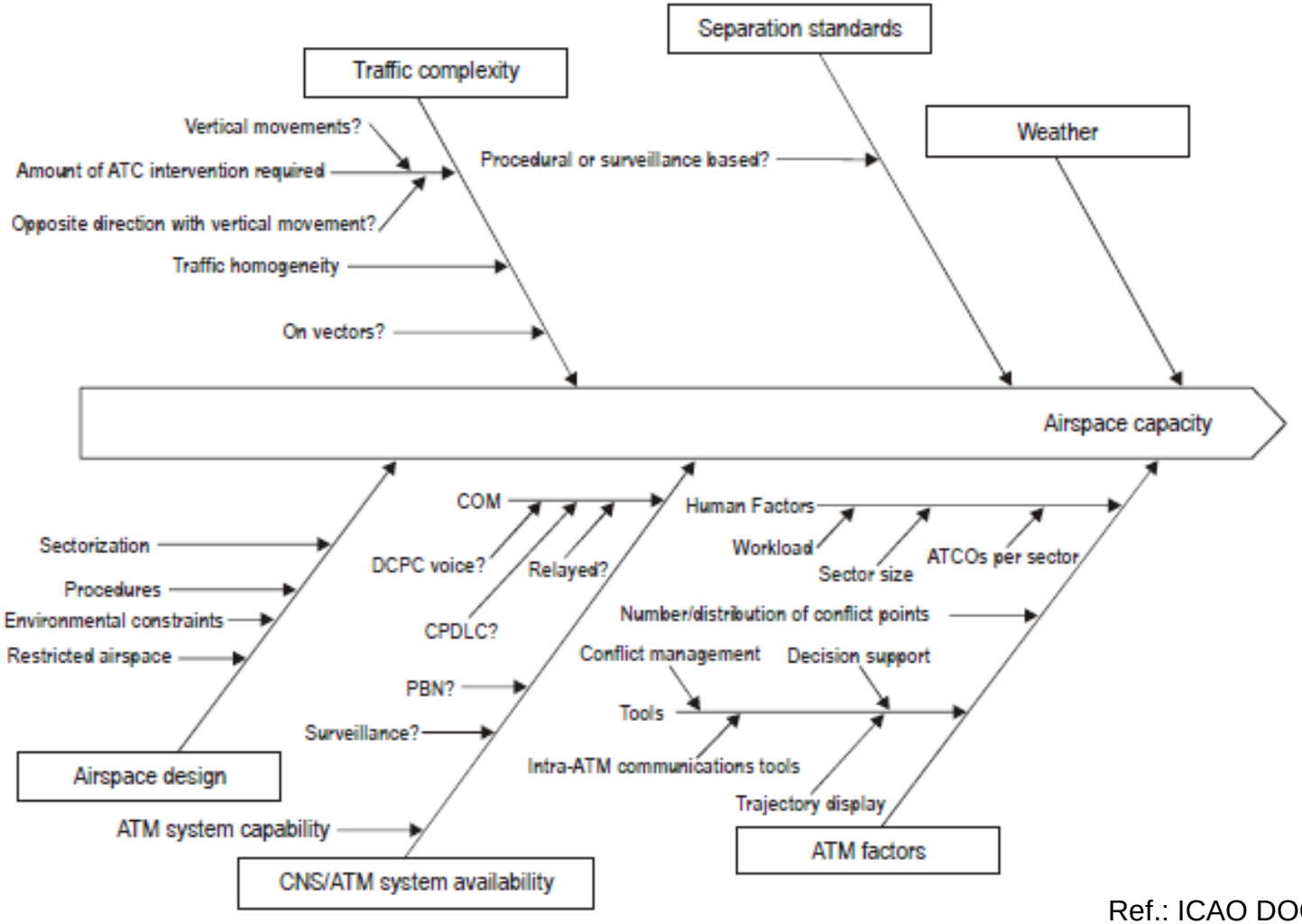
Assessing Sector Capacity
The CAPAN Methodology

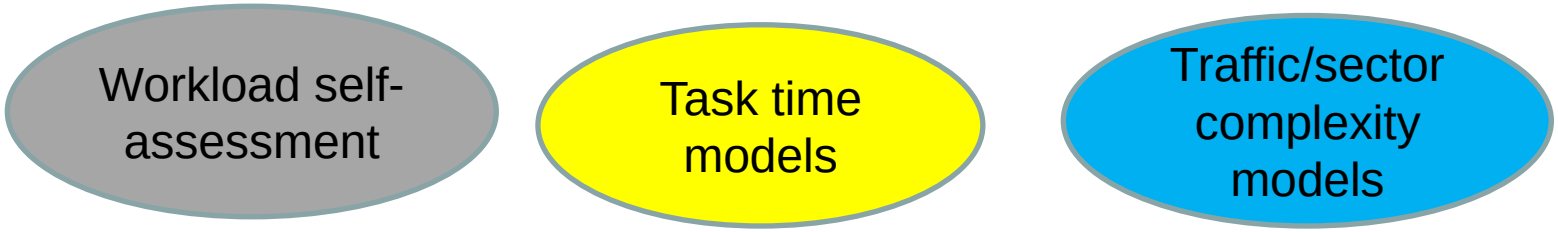
ATC Capacity Influencing Factors



Ref.: ICAO DOC.9971

Assessing sector capacity through controller workload

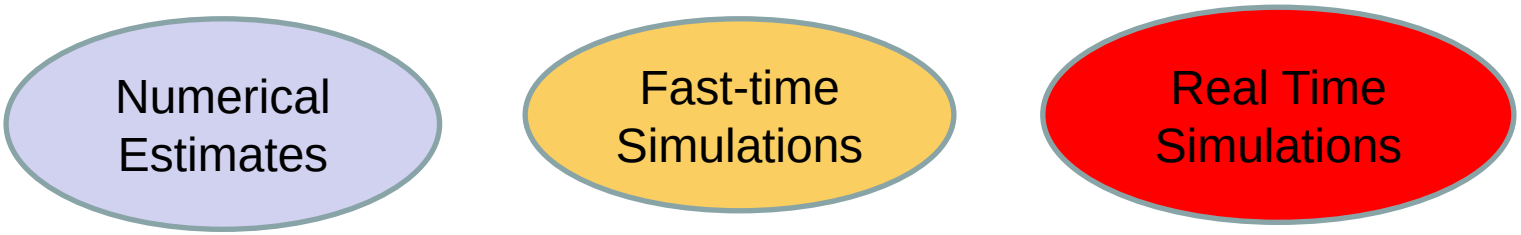
- Several approaches to workload modelling

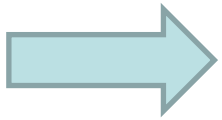


- Different workload vs.capacity relationships

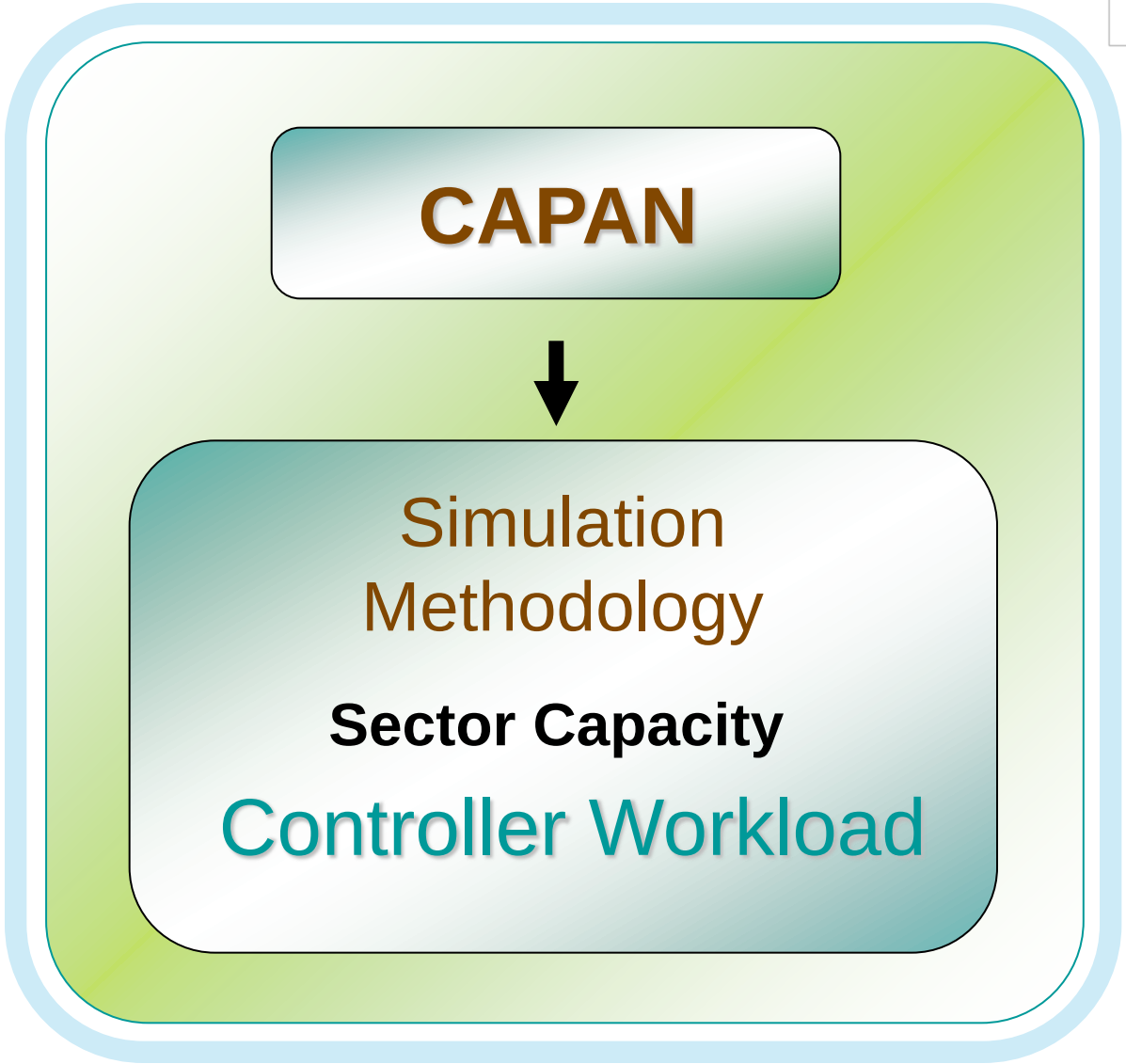
  → Workload thresholds

- Different assessment process



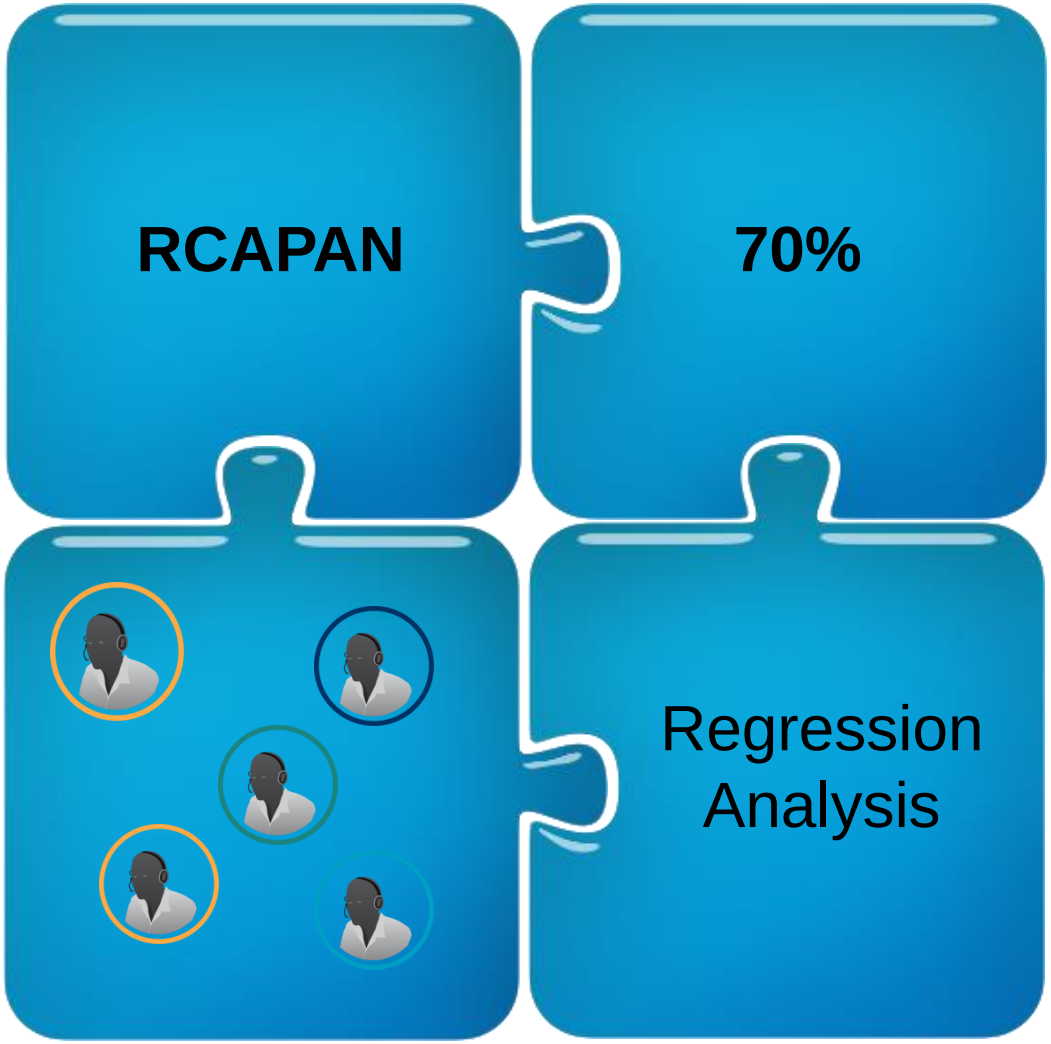


Several valid methodologies available


CAPAN
Simulation
Methodology
Sector Capacity
Controller Workload

Fast Time Simulation in ATM

CAPAN



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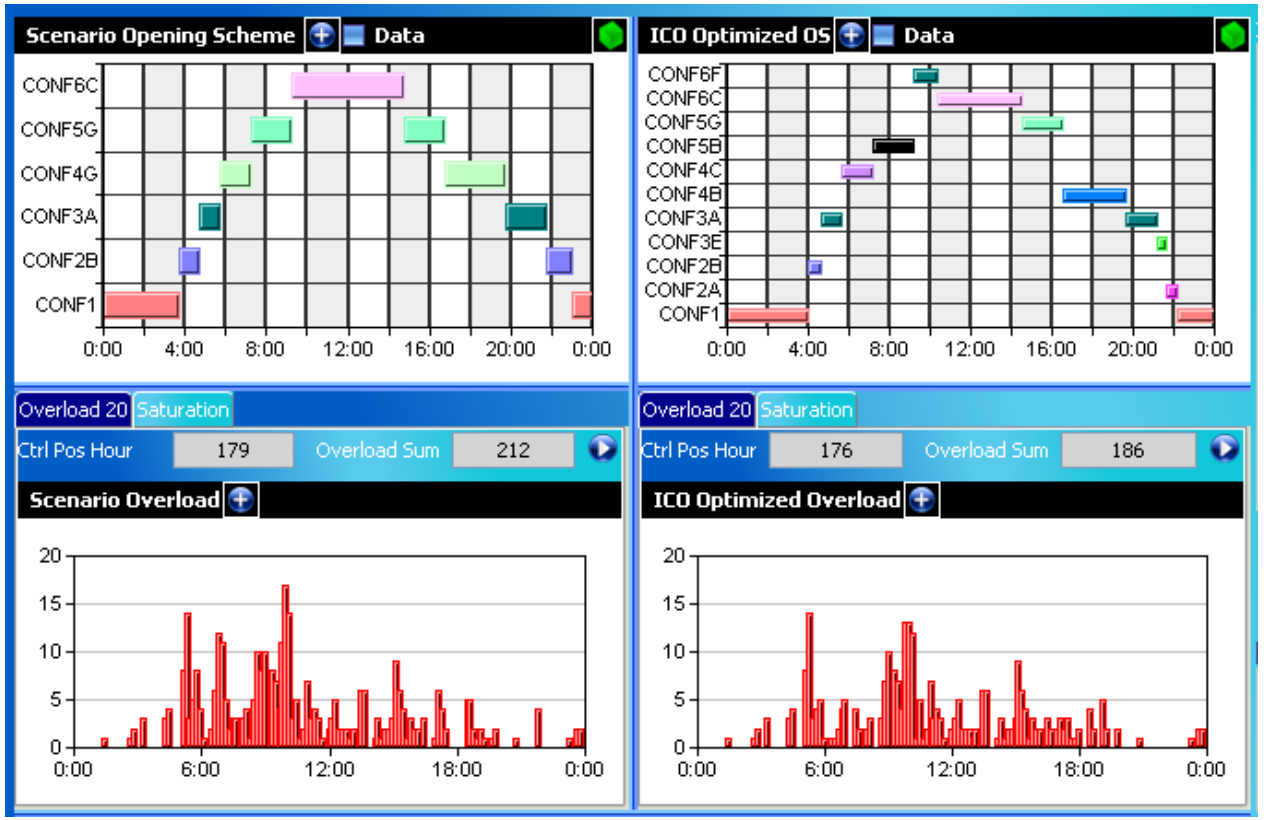
Assessing Optimum Opening Schemes and Future Bottlenecks

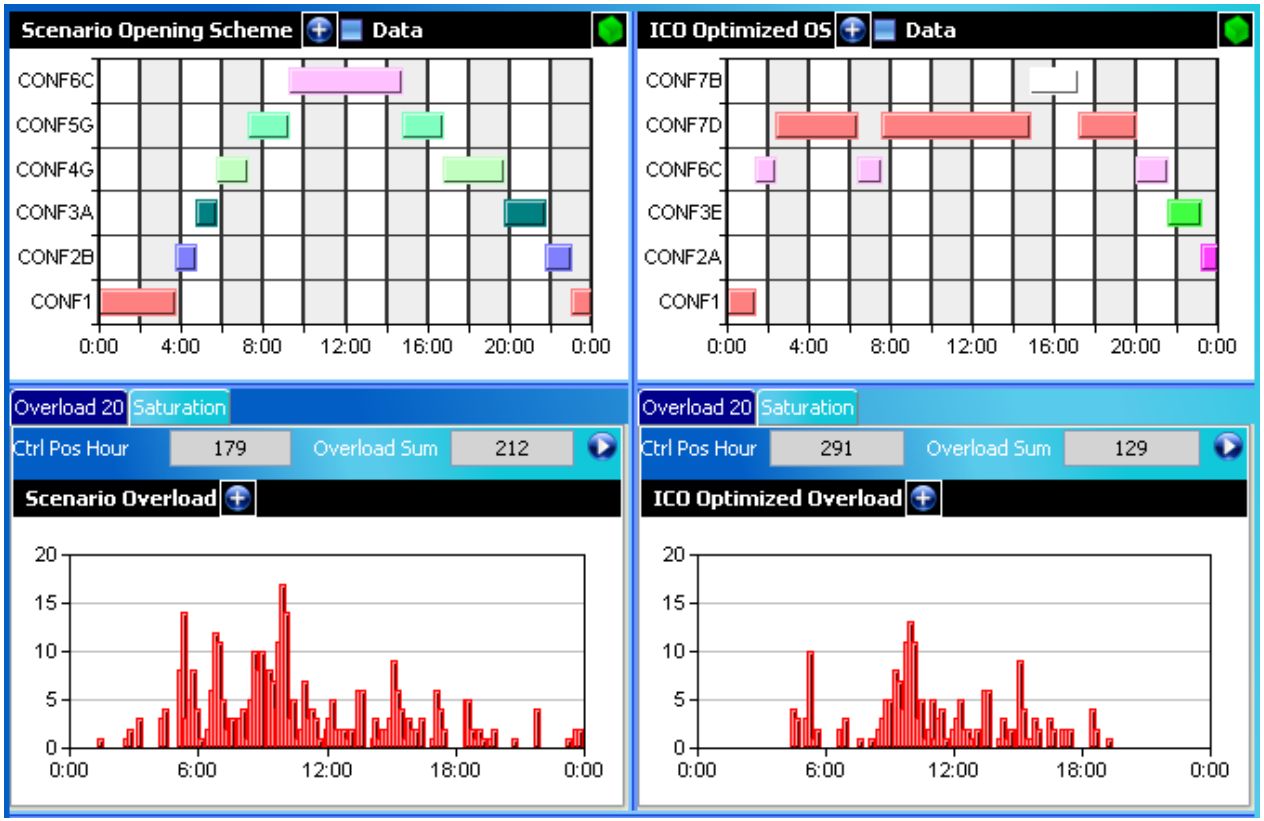
Optimize configuration opening schemes

- Using the same controller-hours differently results in less sector overloads



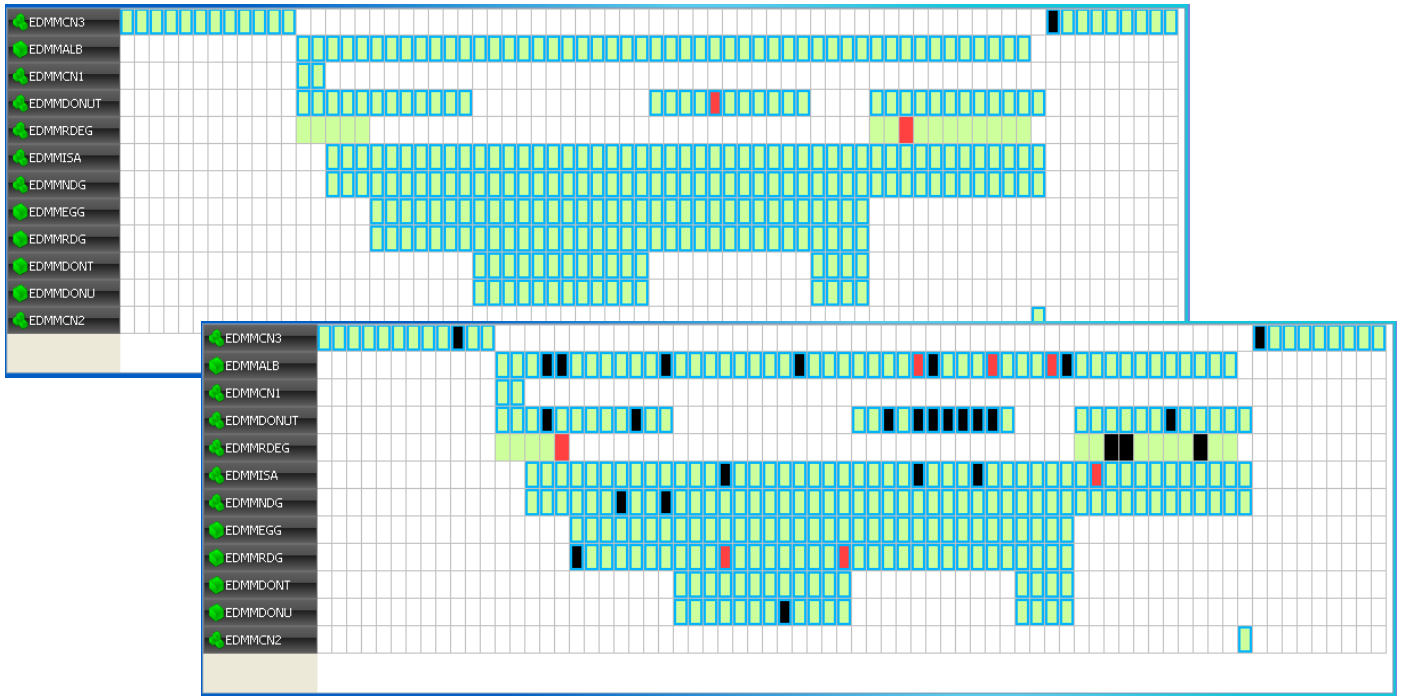
Optimize configuration opening schemes

- Using additional controller-hours only solves some of the overload problems



Find future bottlenecks

- Use the latest STATFOR forecasts to see where bottlenecks are likely to appear



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Network Capacity Planning

Winter

Annual Performance Analysis - Network Operations Report –(the NOR)

Consolidation of Plans - Network Operations Plan (the NOP)

Spring

Traffic Forecast
Network Delay Forecast

Update NOP

Tool
NEST
(SAAM + NEVAC)

Demand Data Repository DDR2

Summer

Evaluation of Summer performance

ACC Capacity Baselines

Autumn

Traffic Forecast update

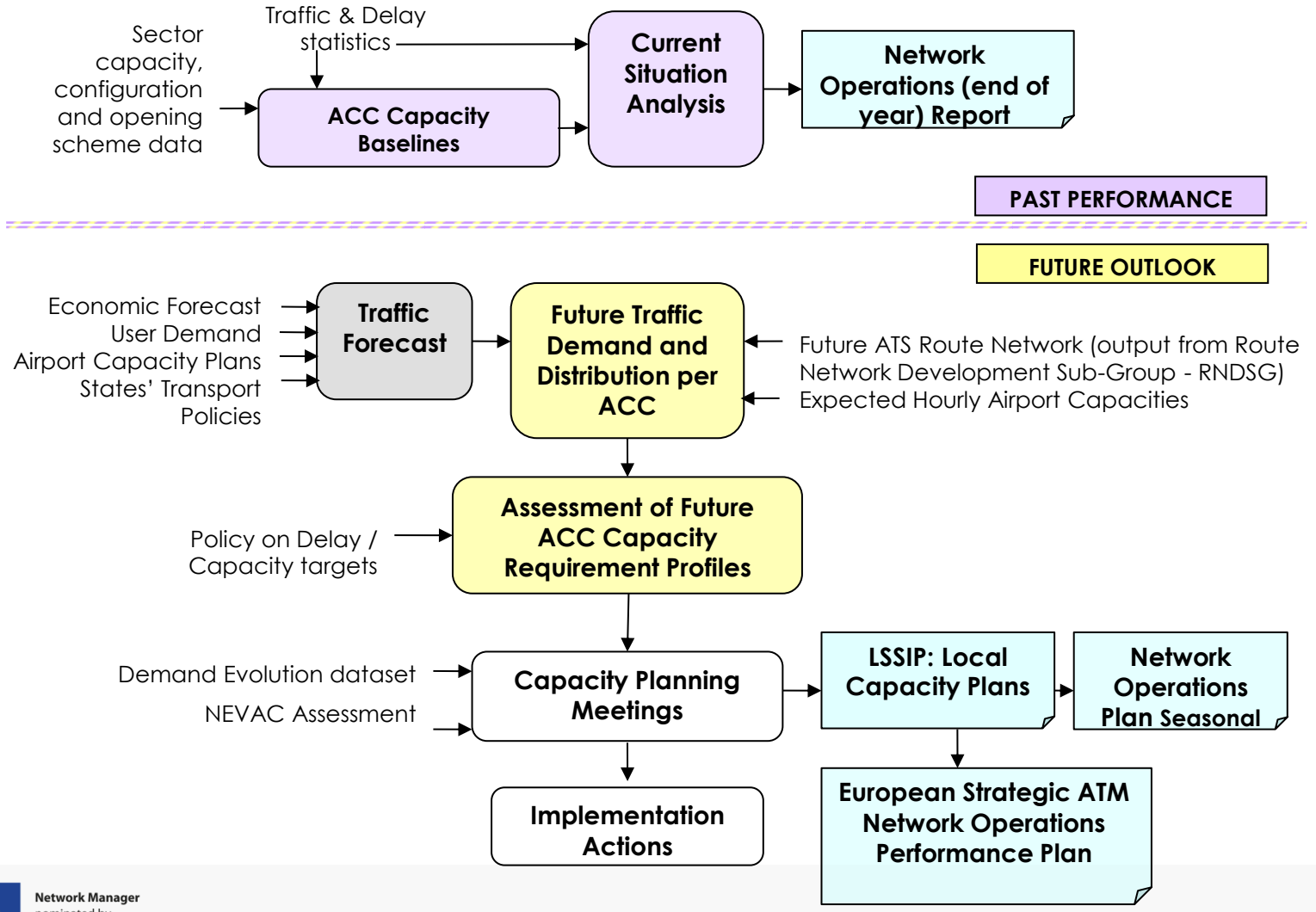
Traffic Demand and Distribution

Capacity Requirements and Delay

Interactive Capacity Planning meetings with ANSPs

ANSP Plans

Capacity Planning and Monitoring



Approved Capacity Planning Methodology

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DIRECTORATE OF NETWORK MANAGEMENT

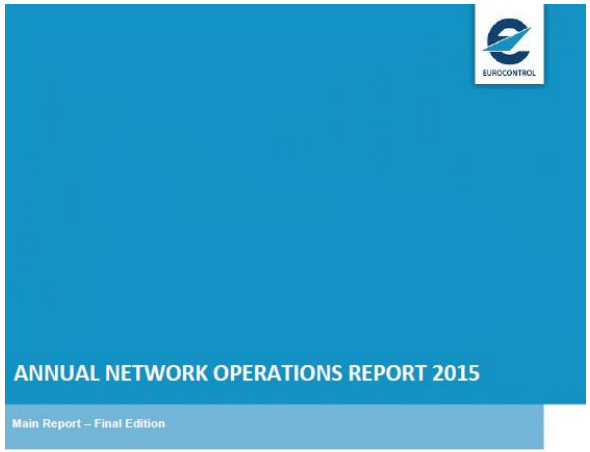
CAPACITY ASSESSMENT AND PLANNING GUIDANCE DOCUMENT

Consolidated performance-based planning process

2015

2016

2016 - 2020



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Operational Performance monitoring

Short/Medium-Term Planning

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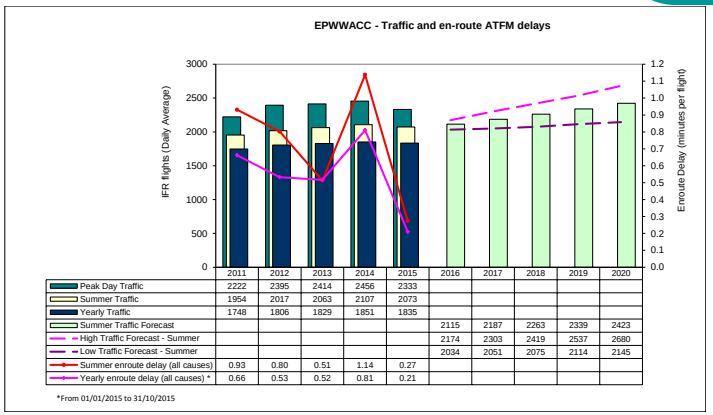
Consolidated performance-based planning process

2015 | Summer 2016 | 2016 - 2020



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Peak Day Traffic	2222	2395	2414	2456	2333					
Summer Traffic	1954	2017	2063	2107	2073					
Yearly Traffic	1748	1806	1829	1851	1835					
Summer Traffic Forecast						2115	2187	2263	2339	2423
High Traffic Forecast - Summer						2174	2303	2419	2537	2680
Low Traffic Forecast - Summer						2034	2051	2075	2114	2145
Summer enroute delay (all causes)	0.93	0.80	0.51	1.14	0.27					
Yearly enroute delay (all causes) *	0.66	0.53	0.52	0.81	0.21					

*From 01/01/2015 to 31/10/2015

2.1.1 Summer 2015 performance

Traffic Evolution	2015 Capacity Baseline	En-route Delay (min/flight) - Summer		Capacity gap
		Ref value	Actual	
-1.6 %	142 (+5%)	0.34	0.27	No

The average en-route delay per flight decreased from 1.14 minutes per flight in Summer 2014 to 0.27 minutes per flight in Summer 2015.

84% of delays were for the reason ATC Capacity, 6% for Weather and 4% ATC Staffing

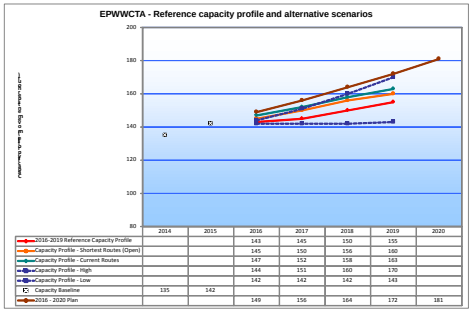
Capacity Plan +3%	Achieved	Comments
Improved ATFCM techniques, including STAM	YES	New sector's occupancy reference values
Additional controllers	YES	2015 – 125 ATCOs available
Improved sector configurations and management (additional measure to the 2015 plan)	YES	Increased number of effective configurations (up to total of 87)
Introduction of Traffic Manager position (additional measure to the 2015 plan)	YES	D-1 and tactical planning, EU restrictions and scenarios applied during Summer 2015
Minimizing ATC Staffing cause of delays (additional measure to the 2015 plan)	YES	Achieved (decrease from 13% on 2014)
Maximum configuration: 9 sectors	YES	9 sectors
Summer 2015 performance assessment		
The ACC capacity baseline was measured with ACCESS/Reverse CASA at 142, 5% higher than in 2014. During the measured period, the average peak 1 hour demand was 149 and the average peak 3 hour demand was 140.		

Capacity Profiles

ACC	2015 baseline	Profiles (hourly movements and % increase over previous year)							
			2016		2017		2018		2019	
EPWW	142	H	144	1%	151	5%	160	6%	170	6%
		Ref.	143	1%	145	1%	150	3%	155	3%
		L	142	0%	142	0%	142	0%	143	1%
		Open	145	2%	150	3%	156	4%	160	3%
		C/R	147	4%	152	3%	158	4%	163	3%

Capacity Plan

	2016	2017	2018	2019	2020
Free Route Airspace	Stepped implementation of FRA		Full implementation of FRA in Baltic FAB		
Airspace Management Advanced FUA			Initial ASM Tool to support Advanced FUA		
Airport & TMA Network Integration	Implementation of A-CDM at Warsaw Chopin airport				
Cooperative Traffic Management	Advanced ATFCM techniques, including STAM				
Airspace	Polish 2010+ airspace project				
	Stepped implementation of vertical sectorisation			Additional layer	
Procedures			Introduce 5 NM longitudinal separation		
Staffing	7 additional controllers	Additional controllers			
Technical			Initial ATC air-ground data link services above FL-285		
					Implementation of air-ground 8,33 kHz ch. spacing requirements below FL195
Capacity	Re-evaluation of sector capacities in new vertical split airspace				
	Improved flexibility in vertical sectorisation, new configurations responding to flow demand				
	Improved sector configurations and management of configurations				
Significant Events	World Youth Days in Krakow (July 2016)				
Max sectors	9/10	9/10	10/11	10/11	10/11
Capacity increase p.a.	5%	5%	5%	5%	5%
Reference profile	1%	1%	3%	3%	N/A
Profile – Current routes	4%	3%	4%	3%	N/A
Additional information	Transition to vertical sectorisation in the first phase in 2016 will be focused on safe transition and familiarisation with the new operational environment. Therefore overall performance however planned to be enhanced, might not be necessarily a primary target.				



	2014	2015	2016	2017	2018	2019	2020
2016-2019 Reference Capacity Profile			143	145	150	155	
Capacity Profile - Shortest Routes (Open)			145	150	156	160	
Capacity Profile - Current Routes			147	152	158	163	
Capacity Profile - High			144	151	160	170	
Capacity Profile - Low			142	142	142	143	
Capacity Baseline	135	142					
2016 - 2020 Plan			149	156	164	172	181

Operational Performance monitoring

Short/Medium Term Planning

Strategic drivers

Capacity Plan					
	2016	2017	2018	2019	2020
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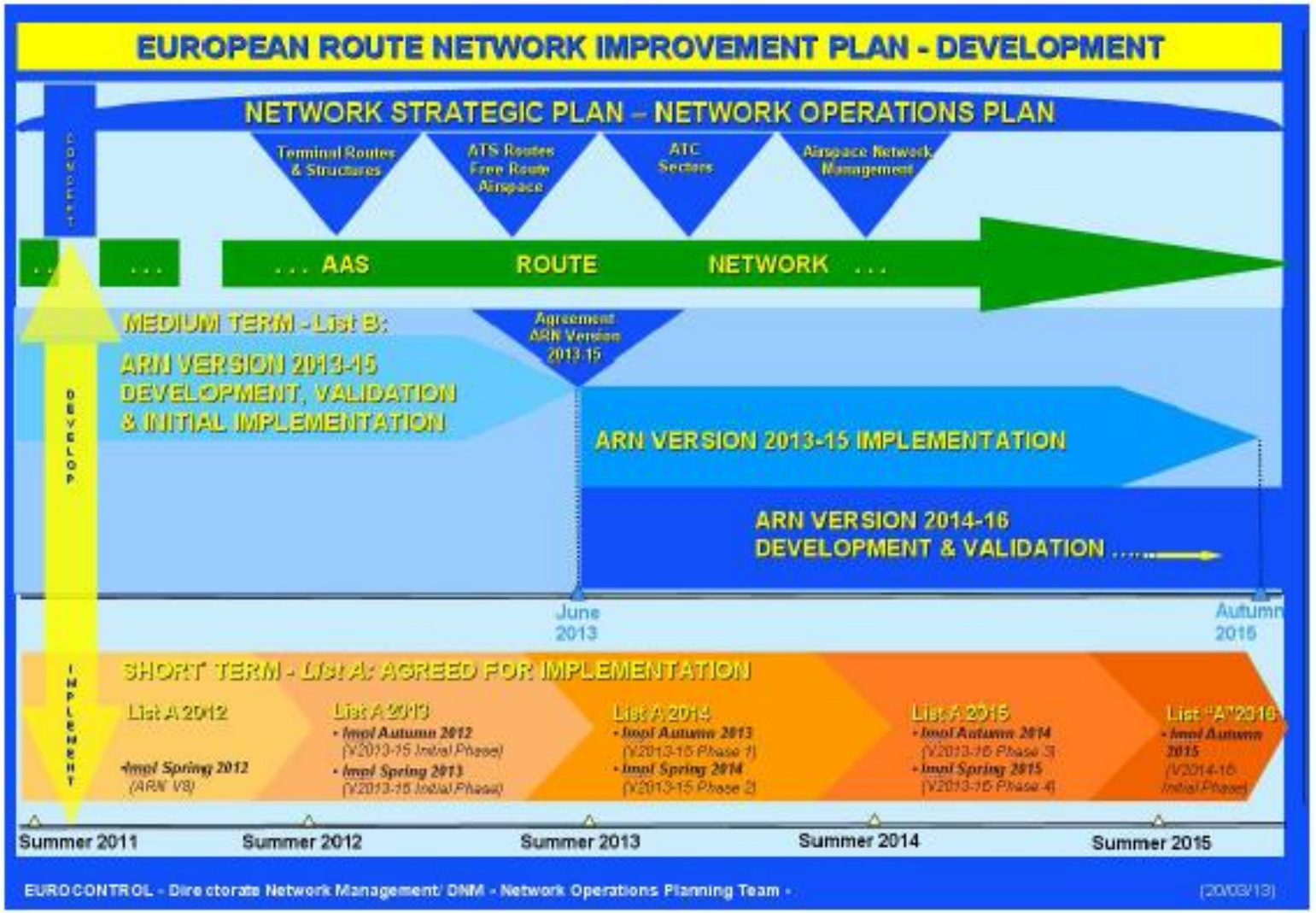
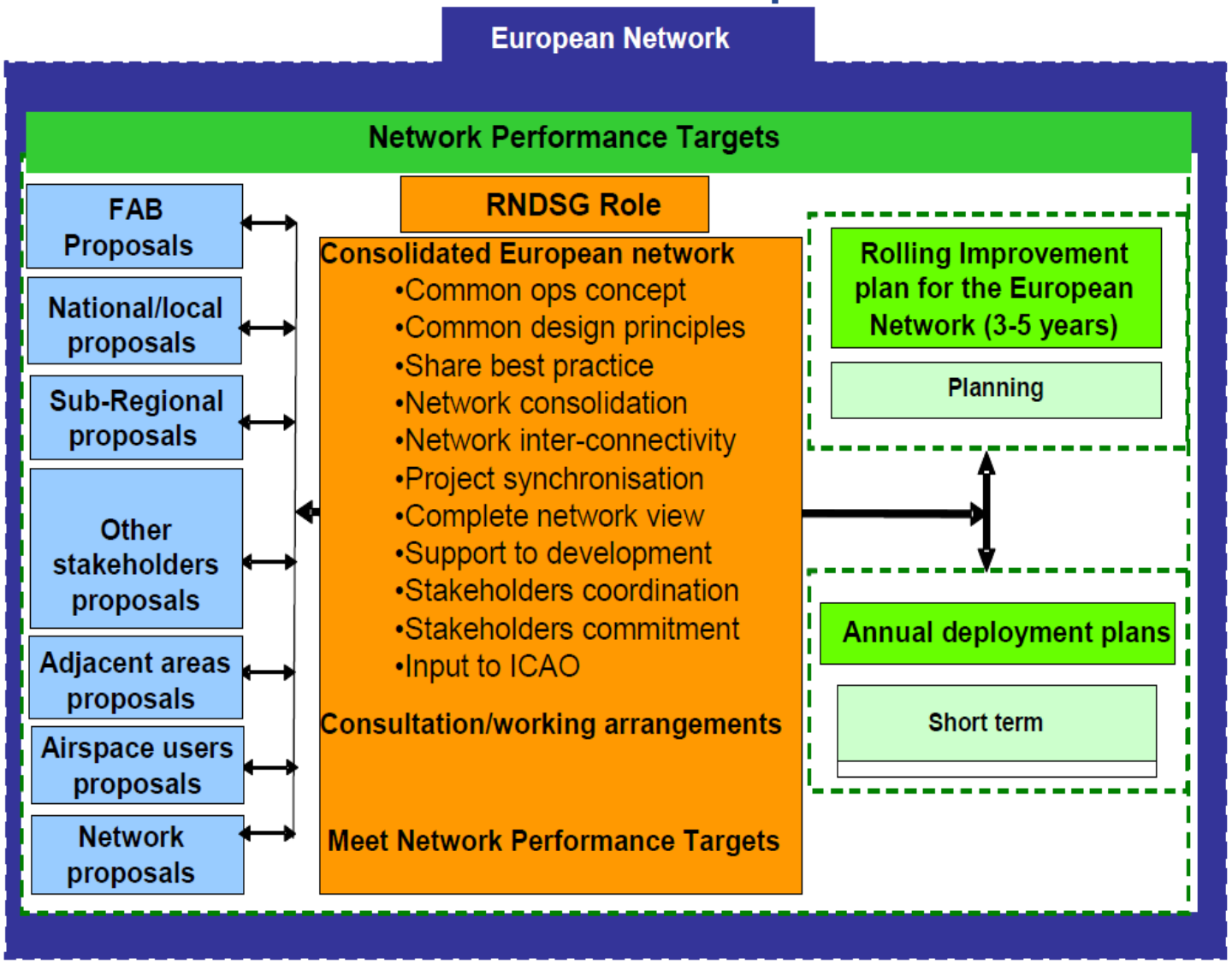
Airspace Network Design

Collaborative Rolling Airspace Design Planning
Preparing the European Route Network Improvement Plan

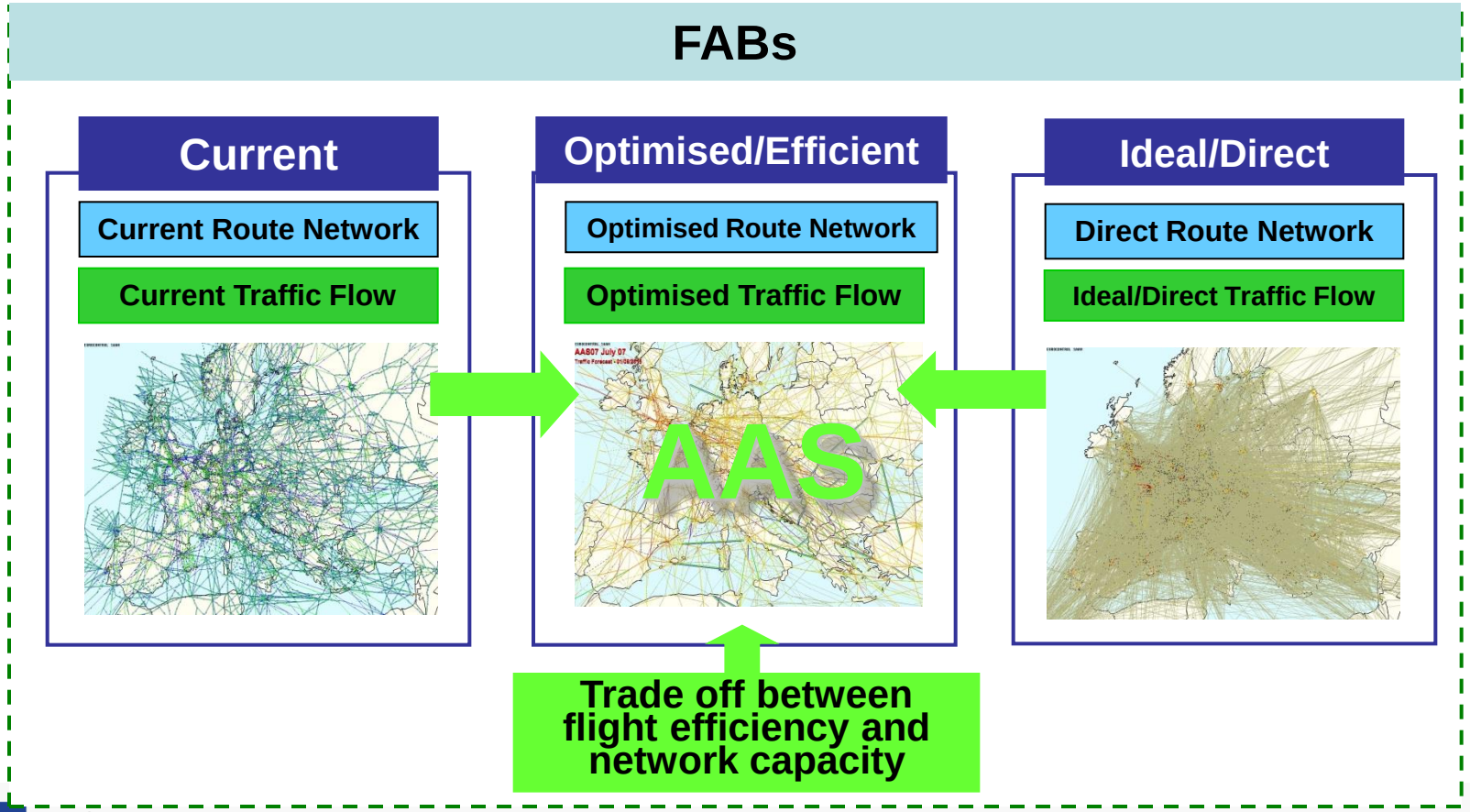


Collaborative Airspace Design Planning, Integrating a coherent European Route Network Improvement Plan

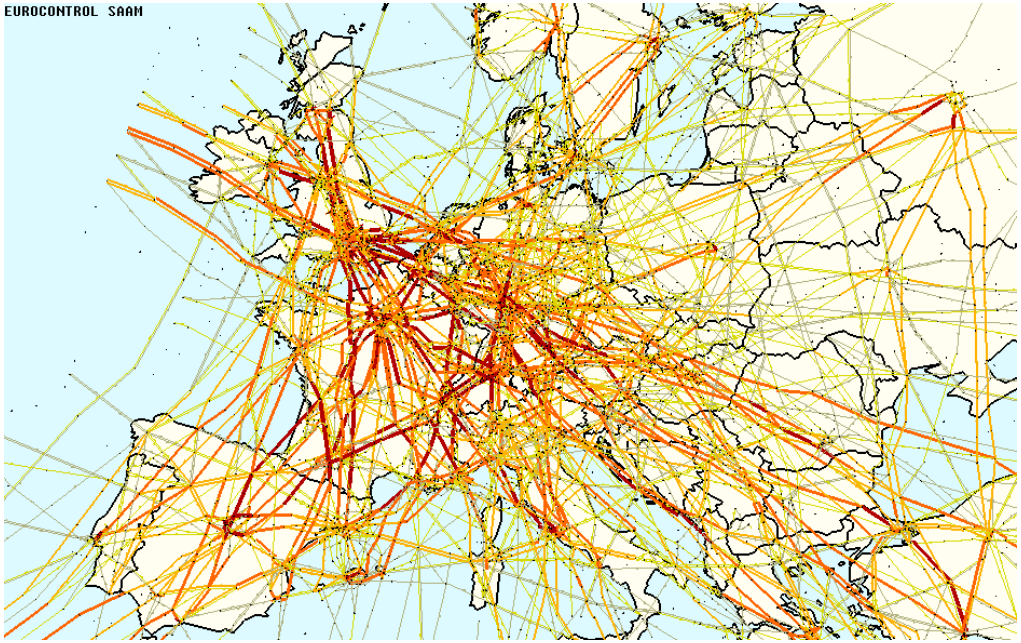


AIRSPACE DESIGN

Advanced Airspace Scheme (AAS): LONG TERM
A living Master Plan, Collection of FABs & Network Plans
Guideline for Medium & Short term Developments



Consolidated Airspace Structure Development



FREE ROUTE AIRSPACE

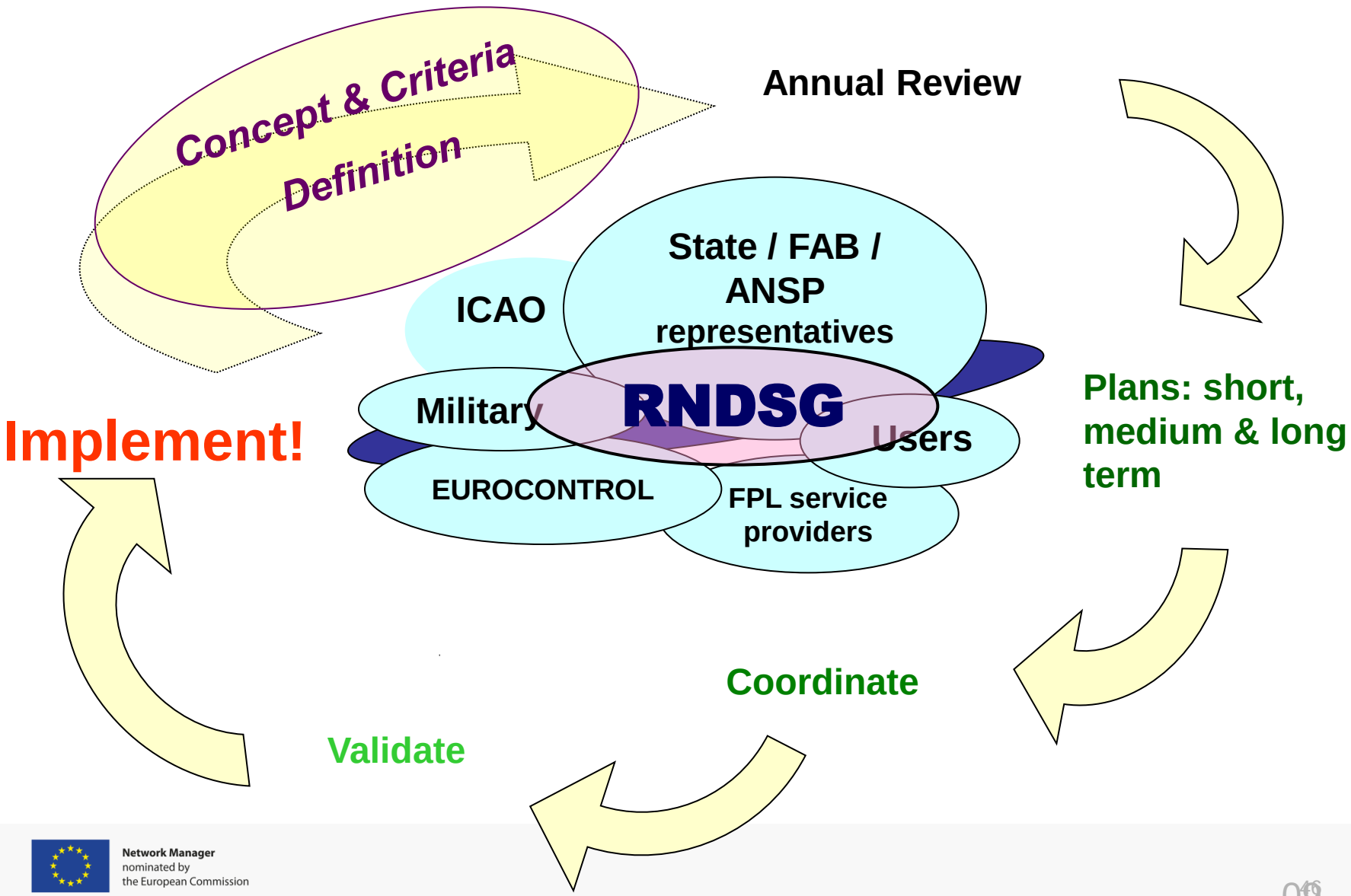
REDUCED SEPARATION NAT TRACKS

NIGHT / WEEKEND ROUTES

FAB INITIATIVES

RVSM

TERMINAL AIRSPACE IMPROVEMENTS

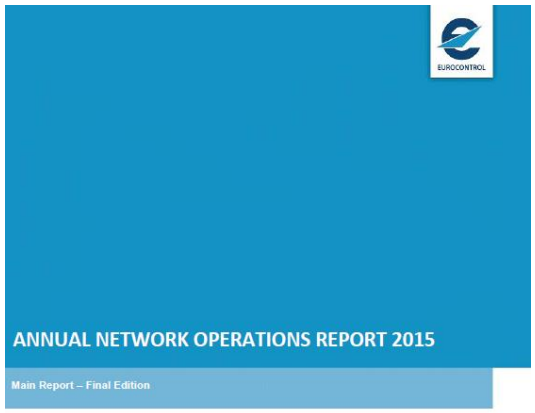

Concept & Criteria
Definition
Annual Review
State / FAB / ANSP representatives
ICAO
Military
RNDSG
Users
EUROCONTROL
FPL service providers
Plans: short, medium & long term
Coordinate
Validate
Implement!

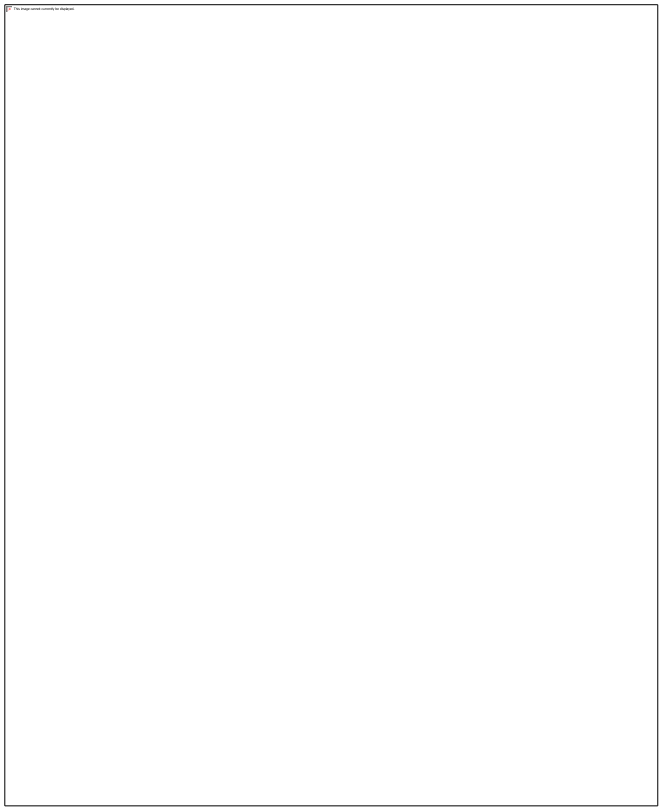
European Route Network Improvement Plan

2015

2016

2016-2020



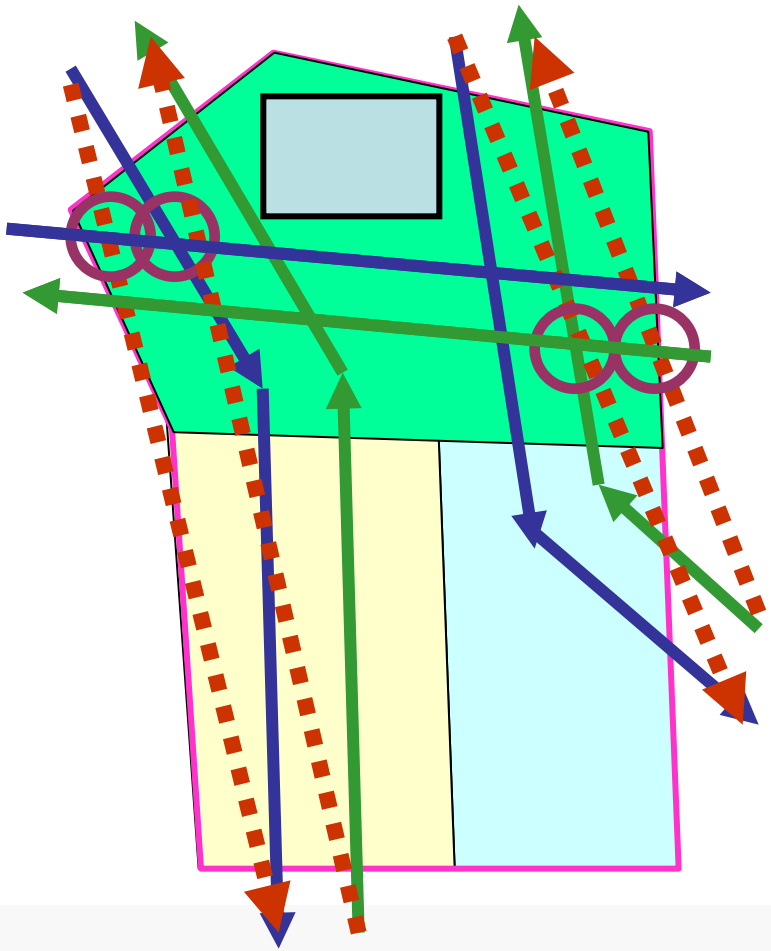


Operational Performance monitoring

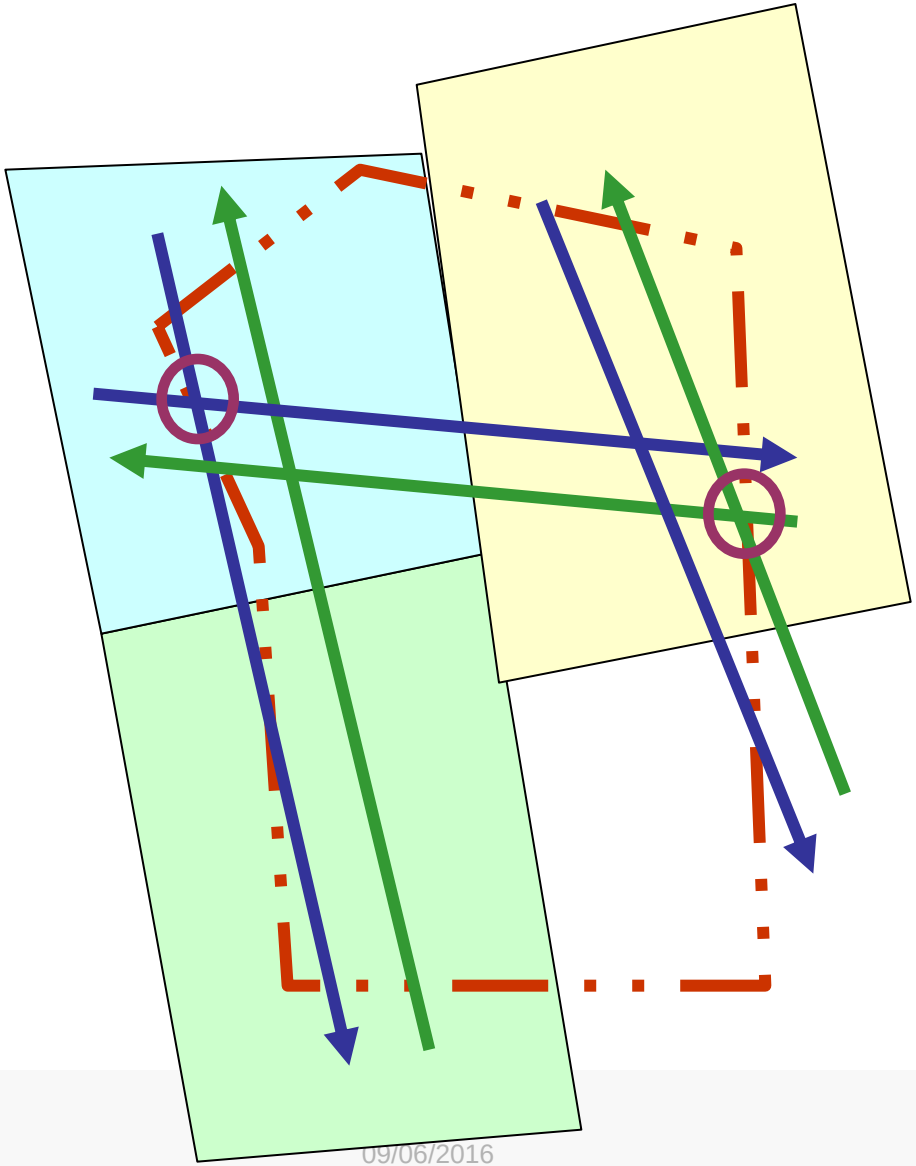
Short/Medium-Term Planning

nominated by
the European Commission

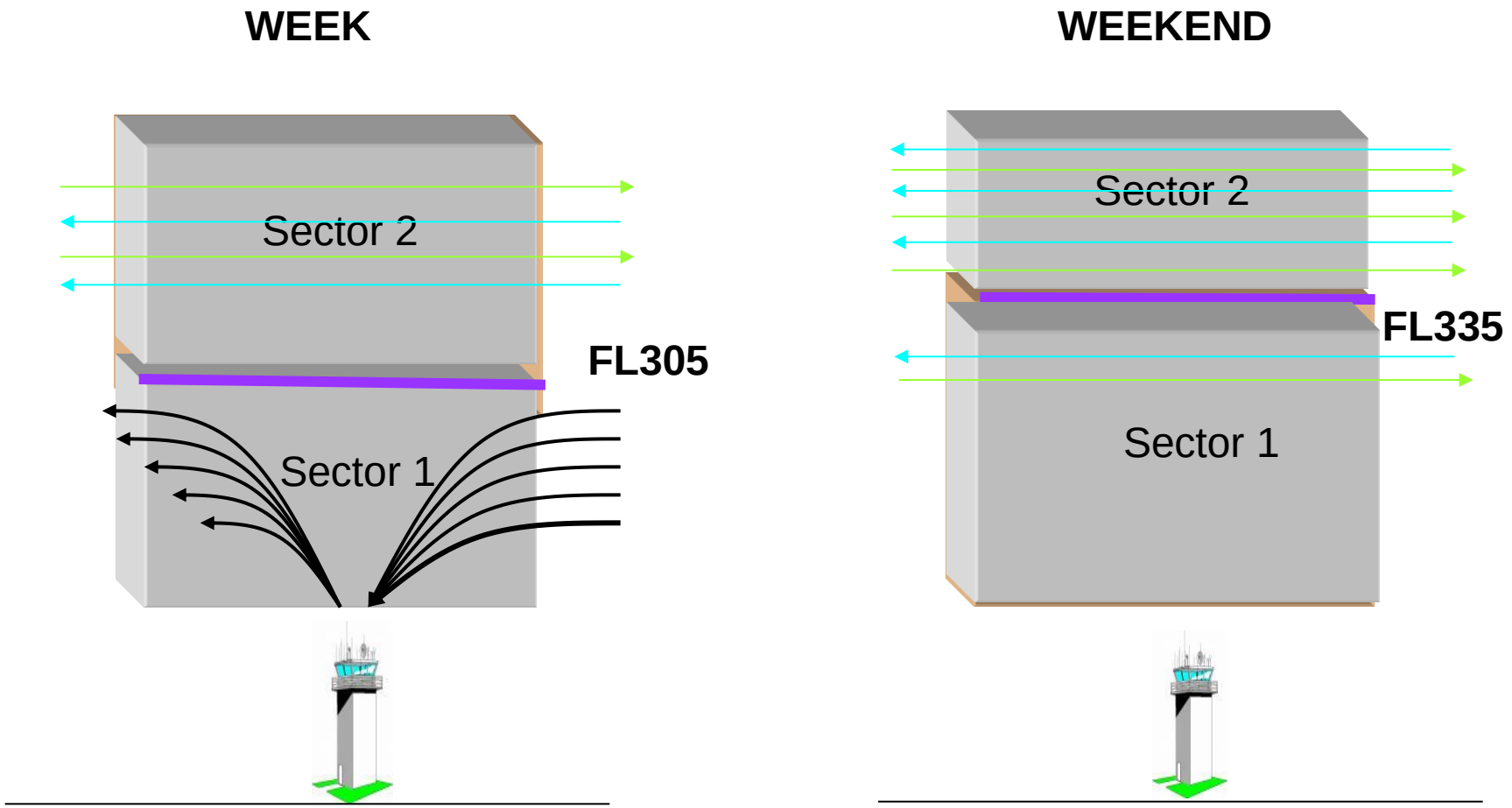
Enroute Design - The Old Way



Enroute Design - The New Way

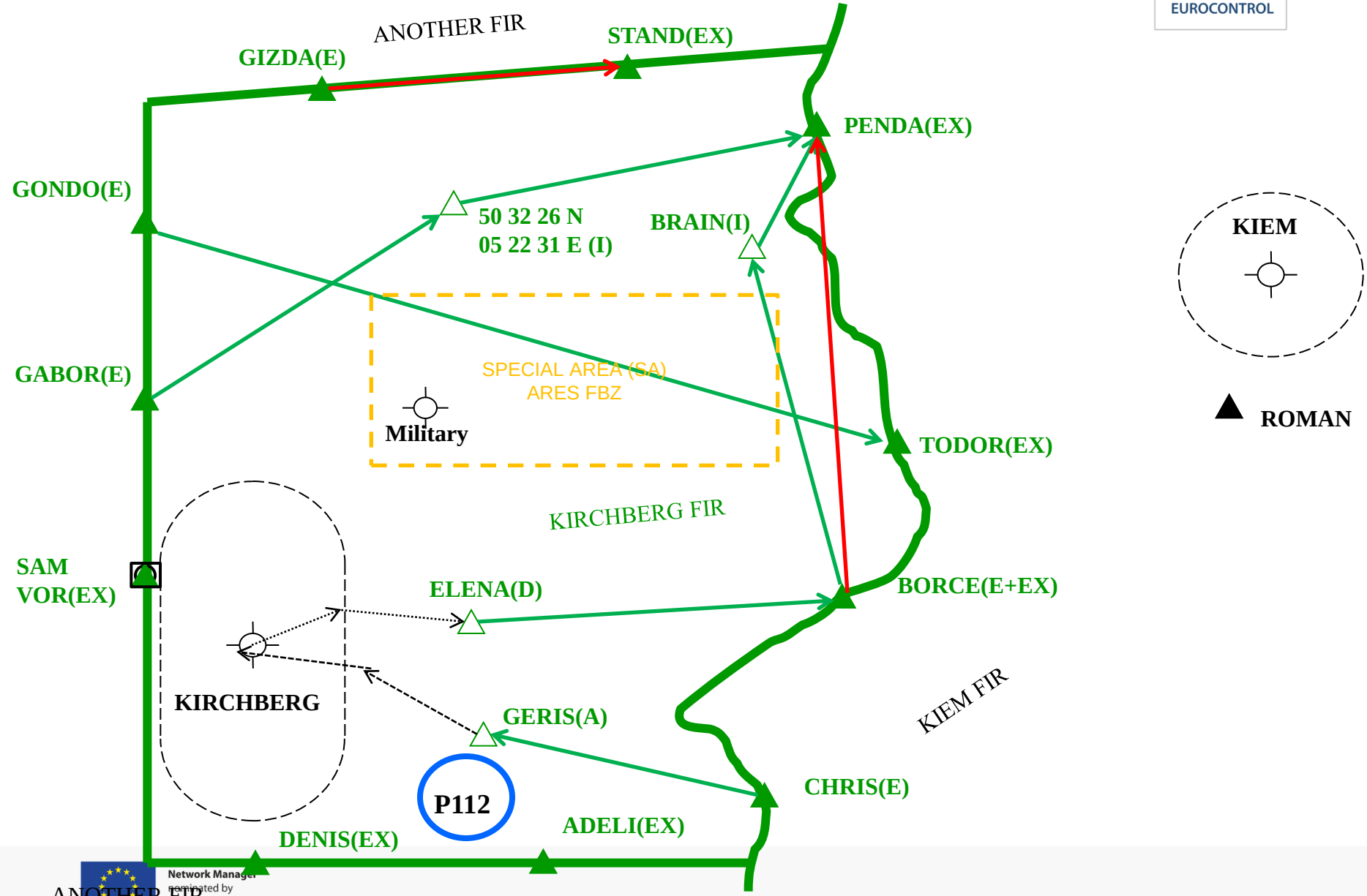


Modular Sectorisation

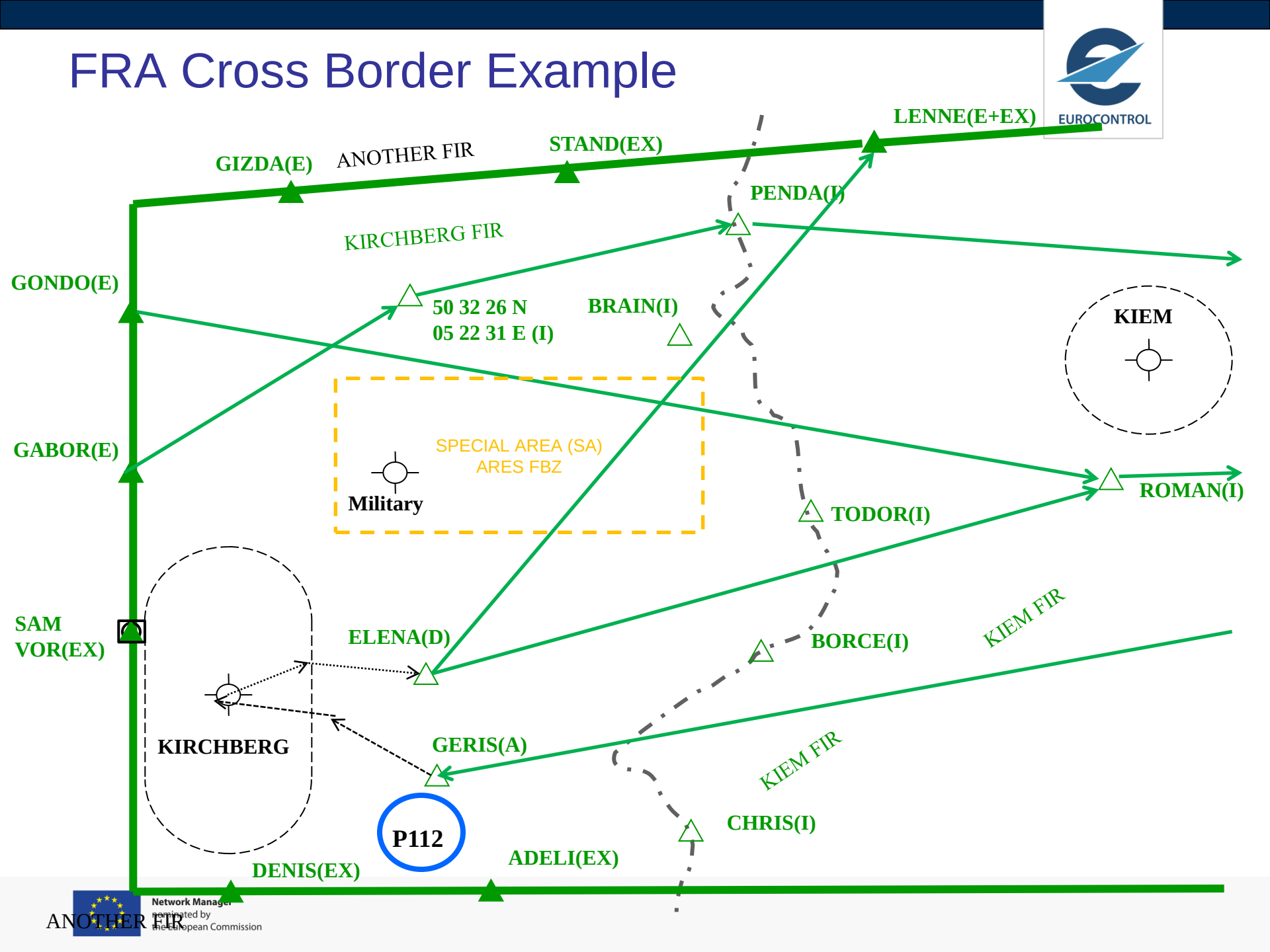


Flexible and dynamic sectorisation able to respond to different traffic patterns

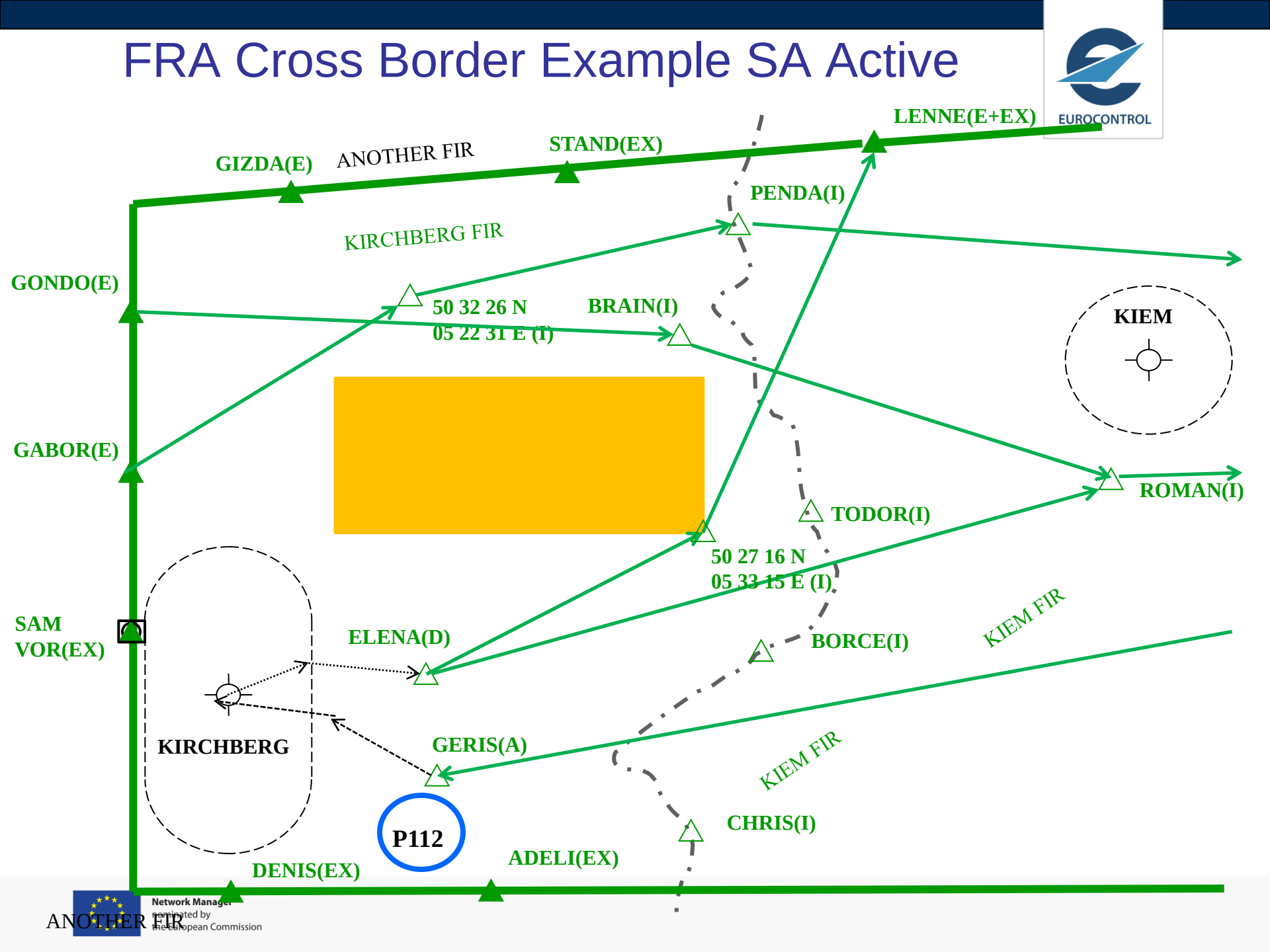
FRA State Example



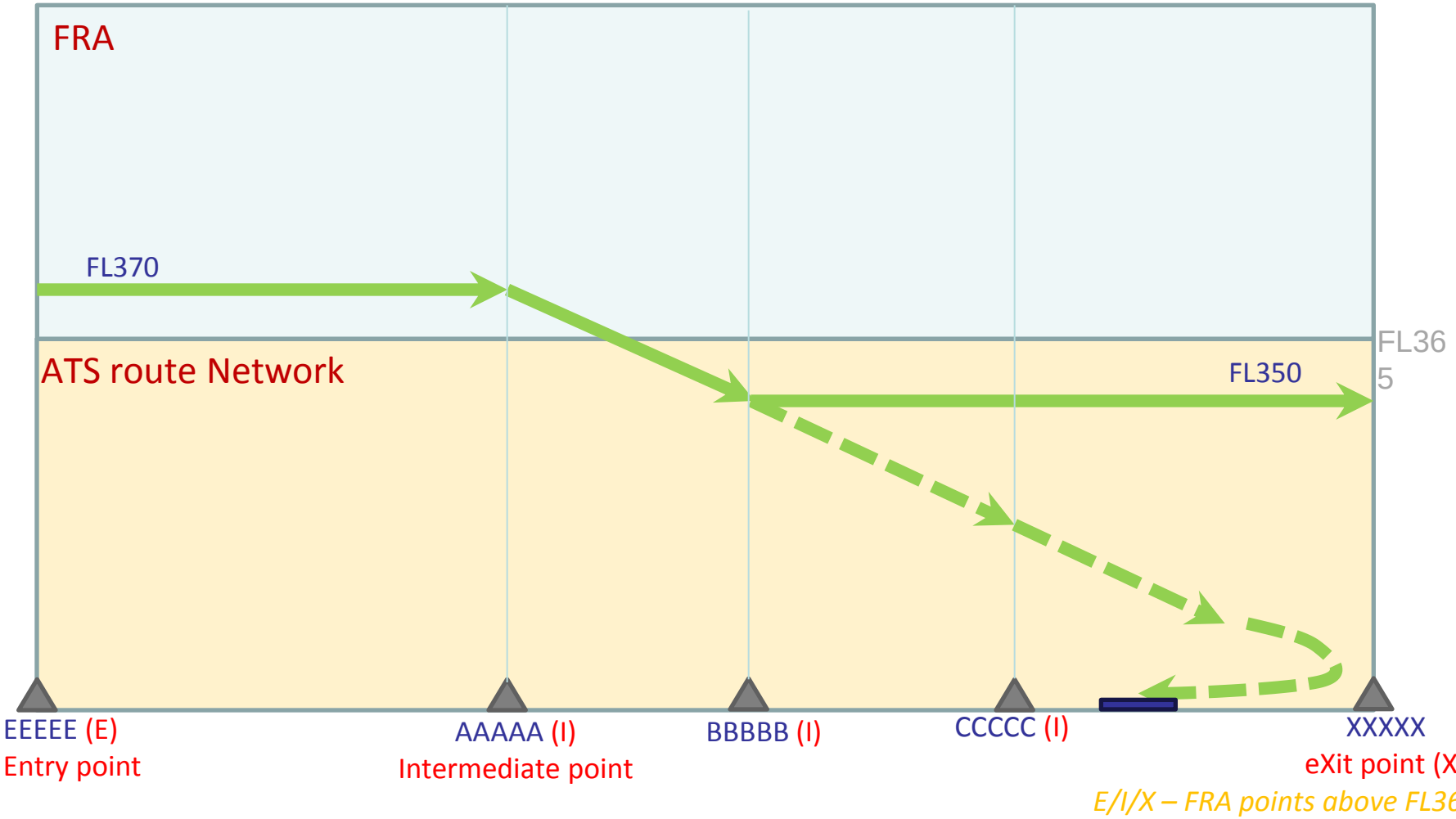
FRA Cross Border Example



FRA Cross Border Example SA Active



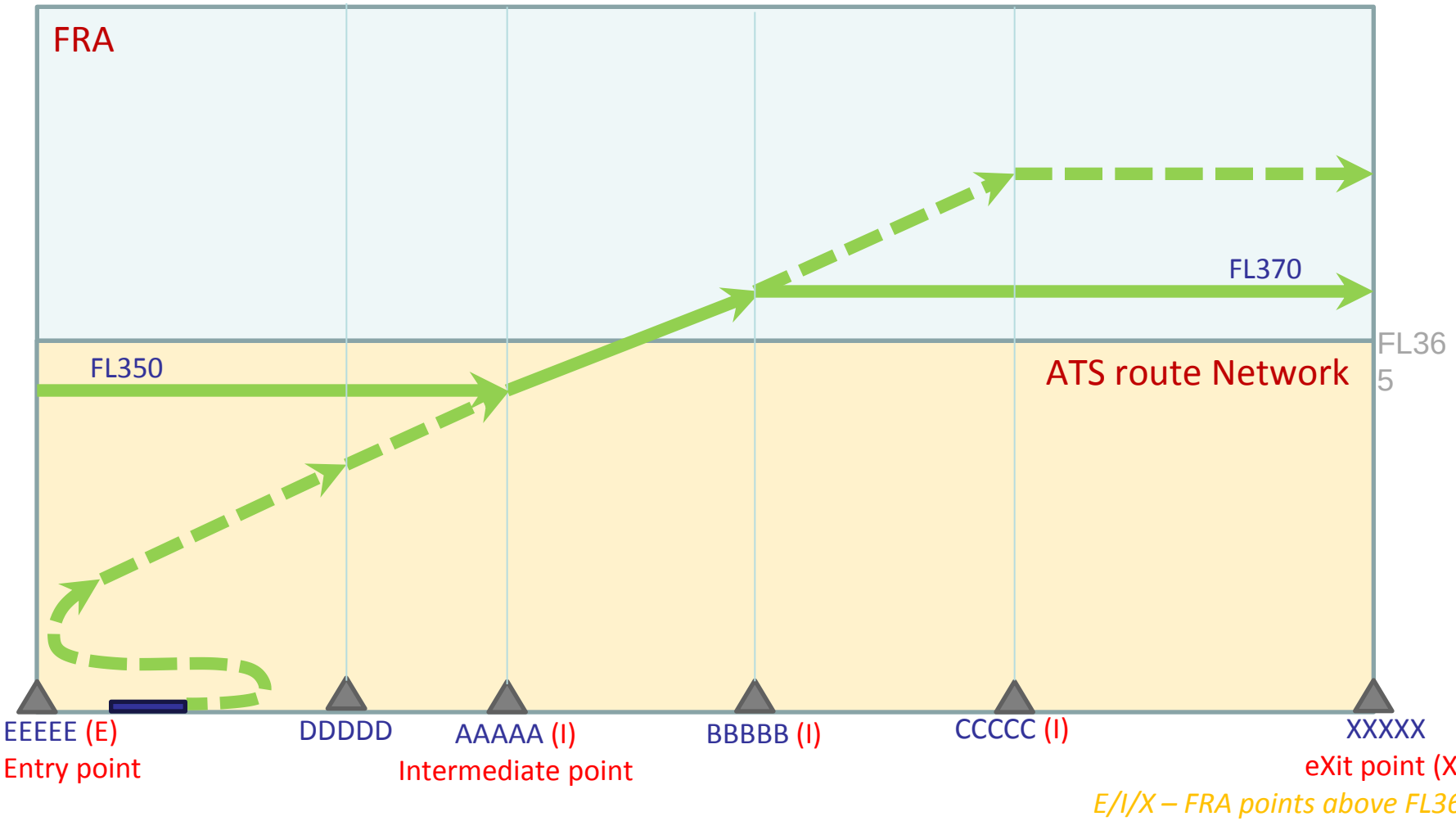
Flight Planning when Transiting from FRA



FPL: … EEEEE/N460F370 DCT AAAAA/N460F350 UA1 BBBBB UA1 XXXXX …

FPL: … EEEEE/N460F370 DCT AAAAA/N460F350 UA1 BBBBB UM01 CCCCC … STAR … AD

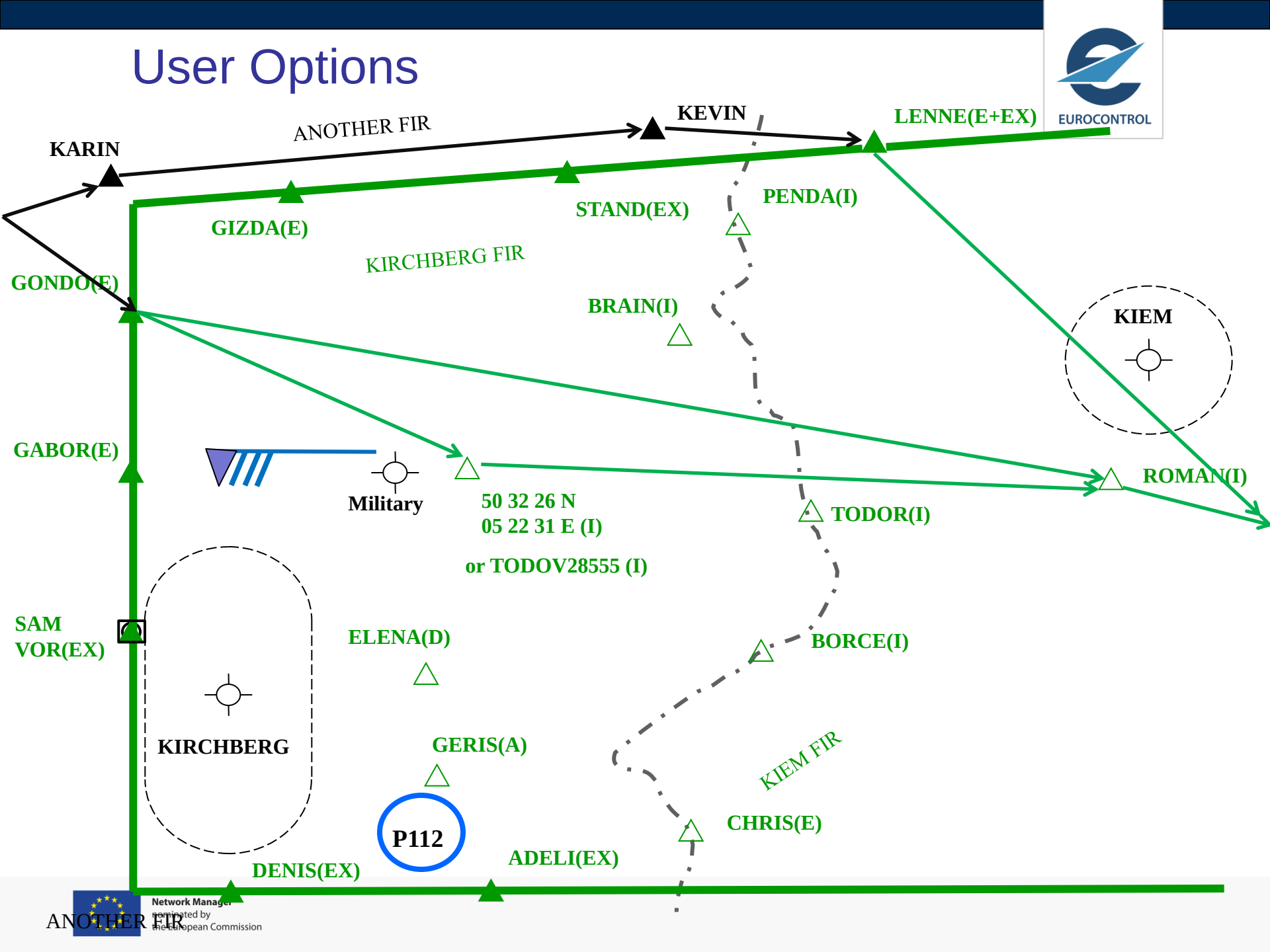
Flight Planning when Transiting to FRA



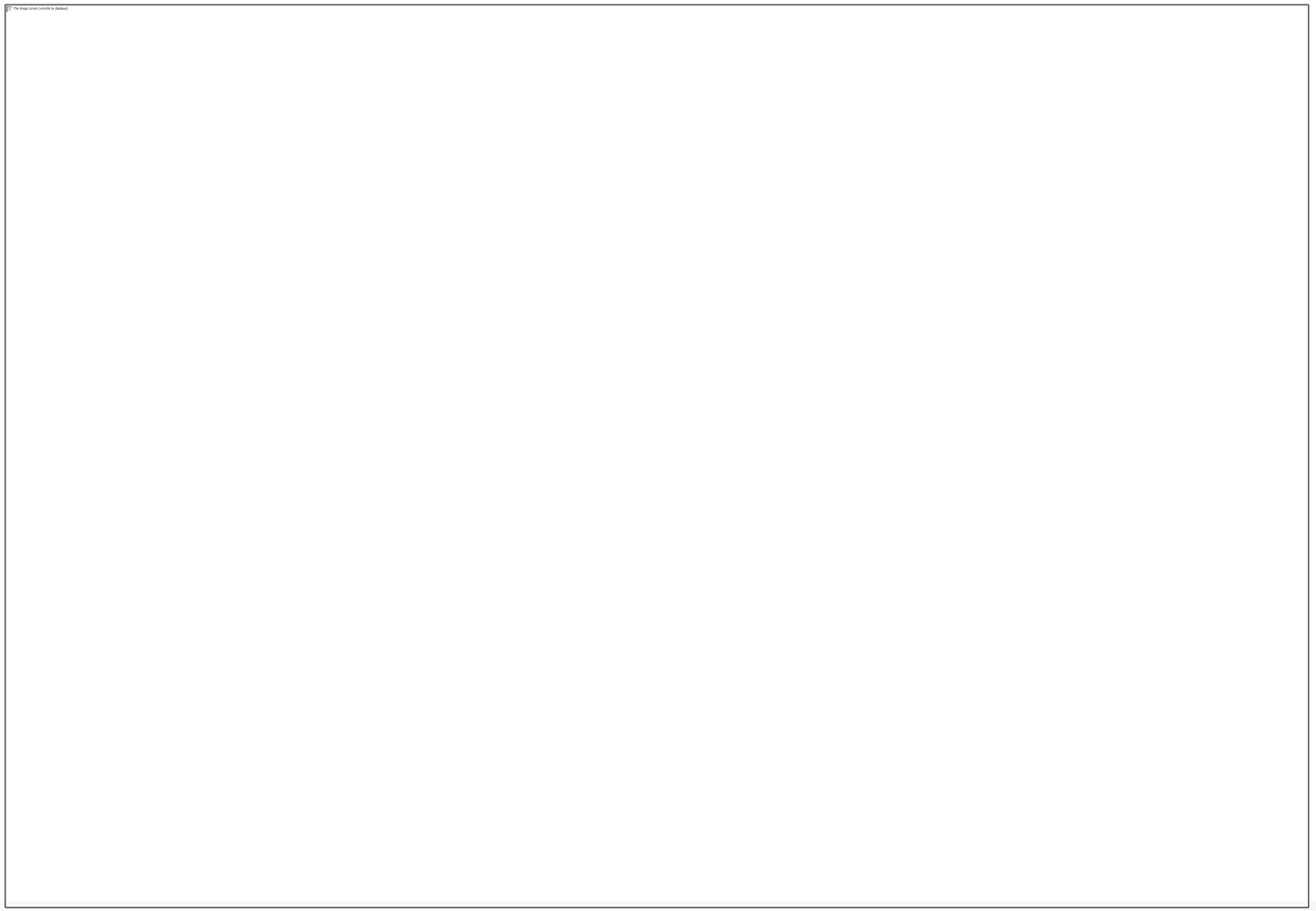
FPL: … EEEEE/N460F350 UA1 AAAAA/N460F370 UA1 BBBBB DCT XXXXX …

FPL: AD … SID … DDDDD/N460F260 UM01 AAAAA/N460F370 UA1 BBBBB DCT CCCCC DCT …

User Options



ERNIP Part 2 – ARN Version 2016-2020
Main developments
Free Route Airspace



ERNIP Part 2 – ARN Version 2016-2020
Main developments
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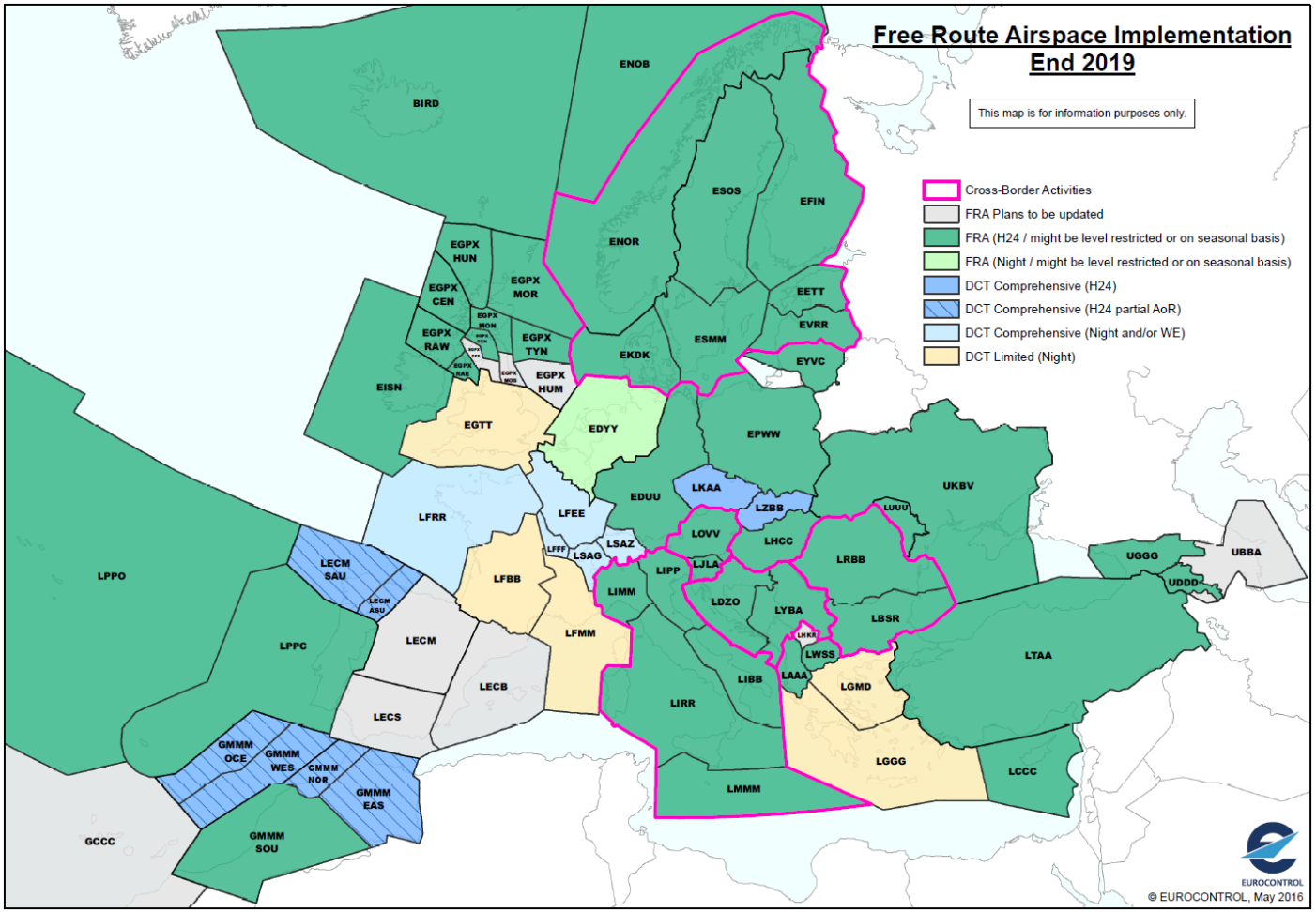
Main developments
Free Route Airspace



Network Manager
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the European Commission

BUILDING ON
20
YEARS
OF CENTRAL FLOW
MANAGEMENT

EUROCONTROL

Civil Military Cooperation

Improved ASM/ATFCM Coordination Process

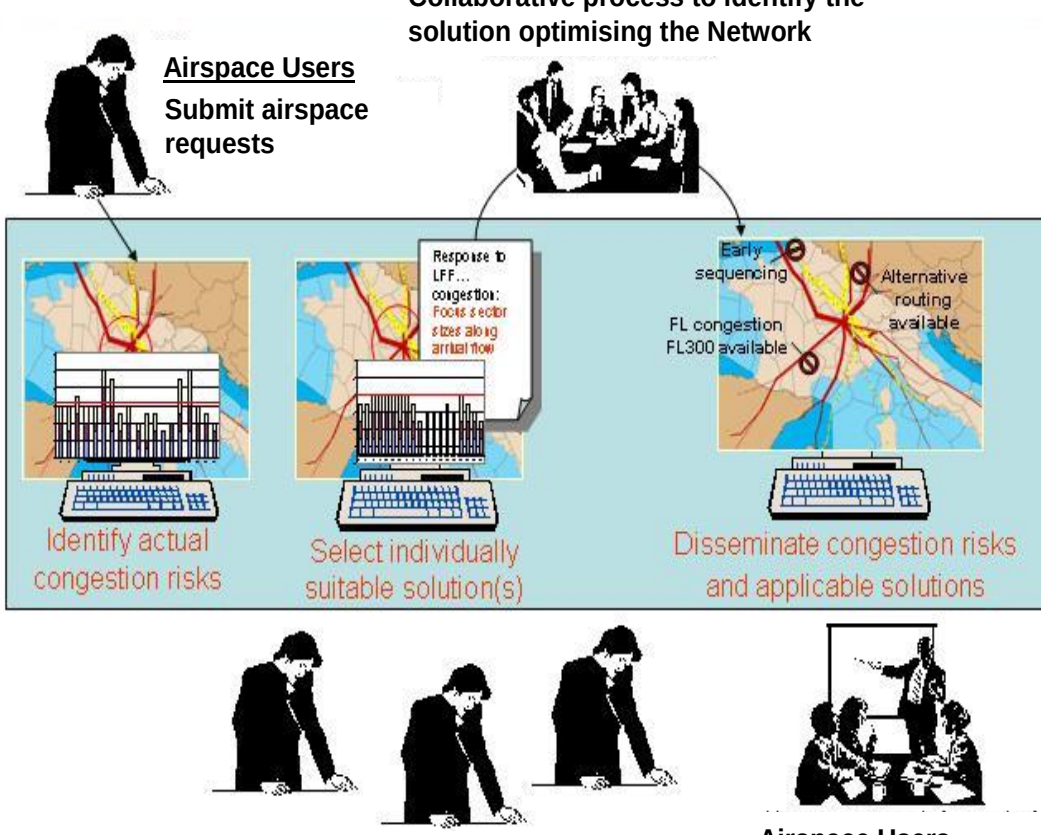
Moving closer to the time of operations with better anticipation

Network Manager with local partners

Collaborative process to identify the solution optimising the Network

Airspace Users

Submit airspace requests



ASM & Local Flow Managers

Identify possible solutions

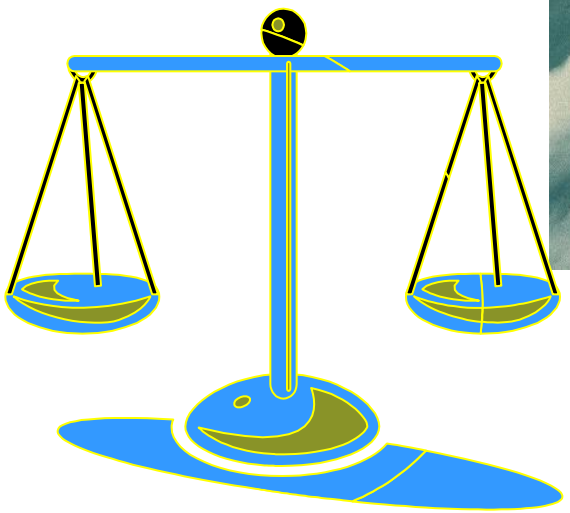
Airspace Users

Informed about the airspace status and replanning operations accordingly

Better consideration of the airspace dynamicity

Re-filed FPLs back in the ATM system

WIN-WIN Approach



Optimised Network with more route options

Better use of new route opportunities

Consideration of re-routing scenarios due to route closure

More Precise airspace requests / Less Segregated airspace

Improved information process about released airspace

Better flexibility in ad-hoc airspace allocation

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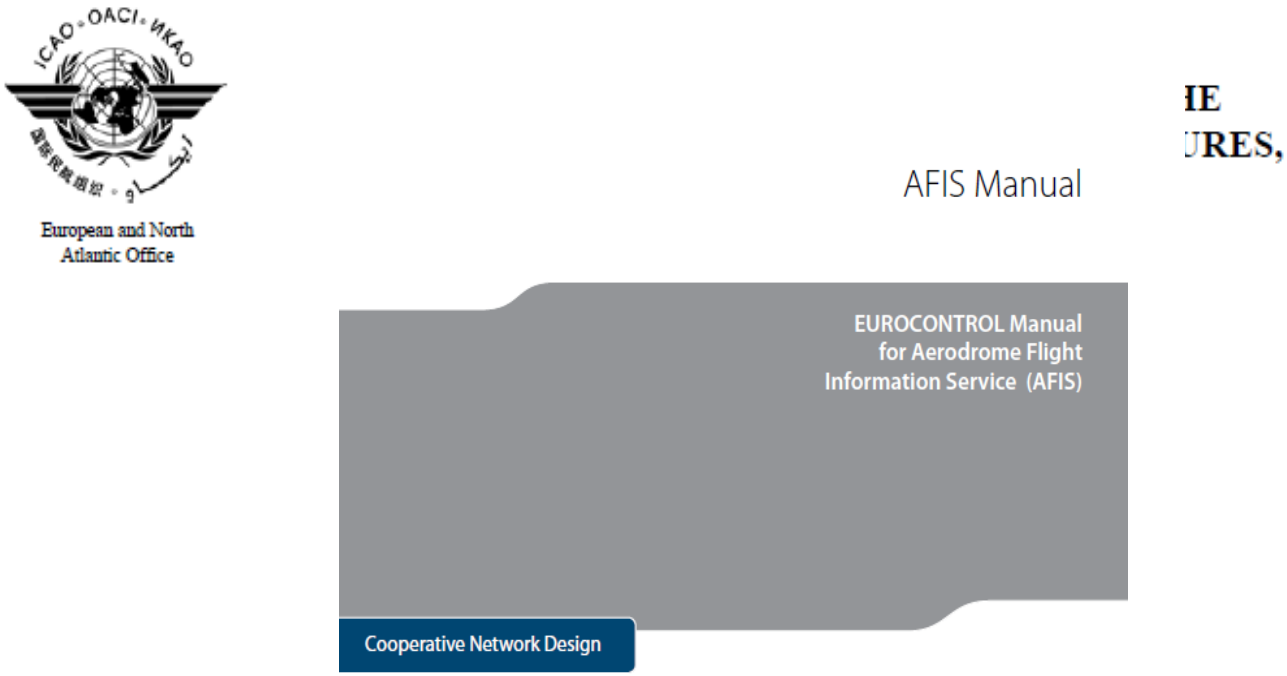
OF CENTRAL FLOW
MANAGEMENT

EUROCONTROL

ATM Procedures

Enhanced ATM & ATFCM Procedures



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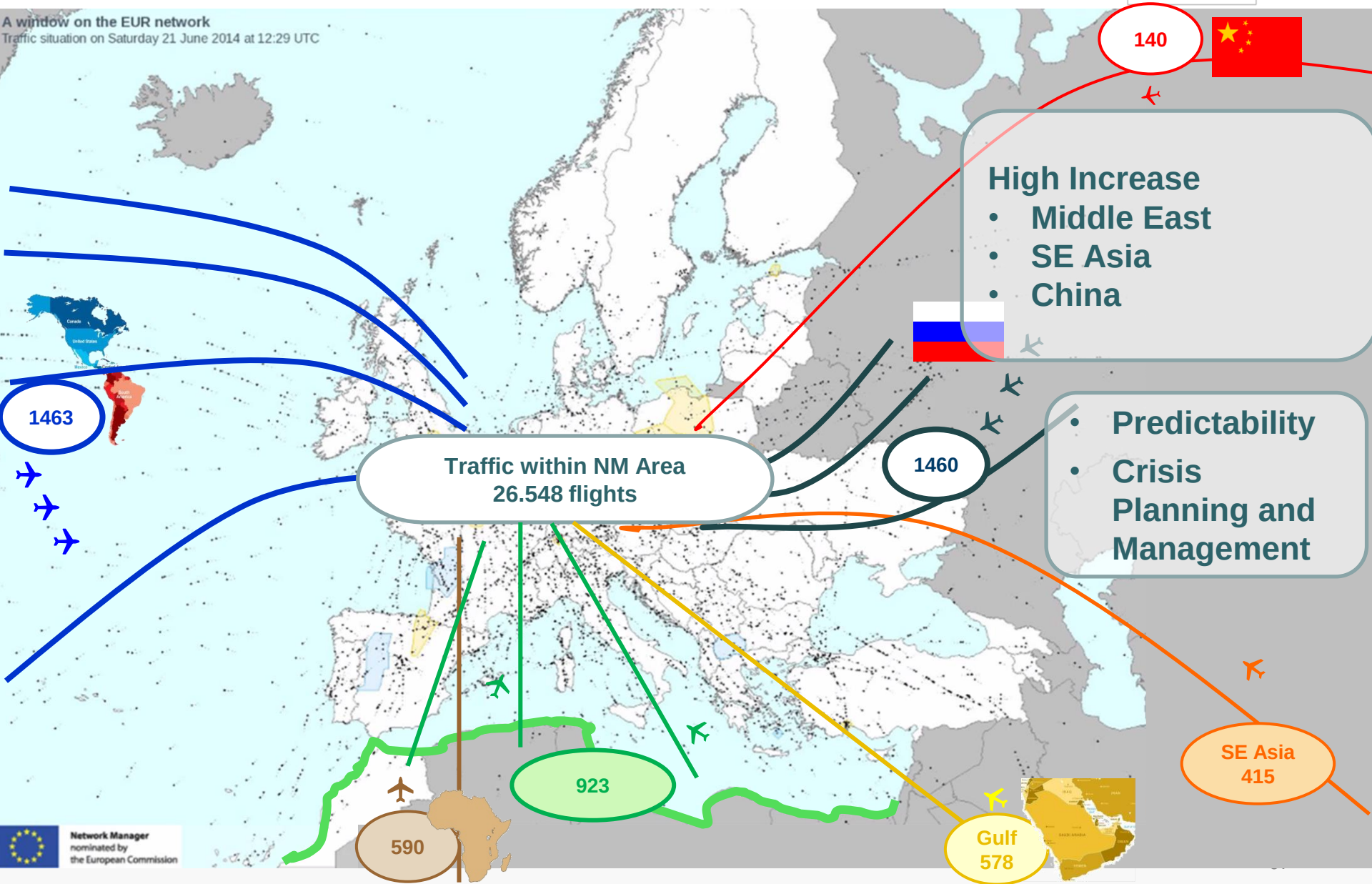
OF CENTRAL FLOW
MANAGEMENT

EUROCONTROL

Addressing capacity at Inter-Regional Level

2014 – Daily NM Flights



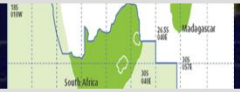
Predictability
Local, Regional and Global Interoperability and Data Sharing

Surveillance and updates of flight data – Radar, ADSB, ACARS….

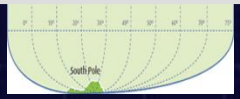
Local, Regional and inter-regional ATFM measures

Traffic Demand: Schedules and Flight Plans

Information: capacities, special events, meteo, disruptions



Network Infrastructure: airports, airspace structures, FIR, ACC, sectors



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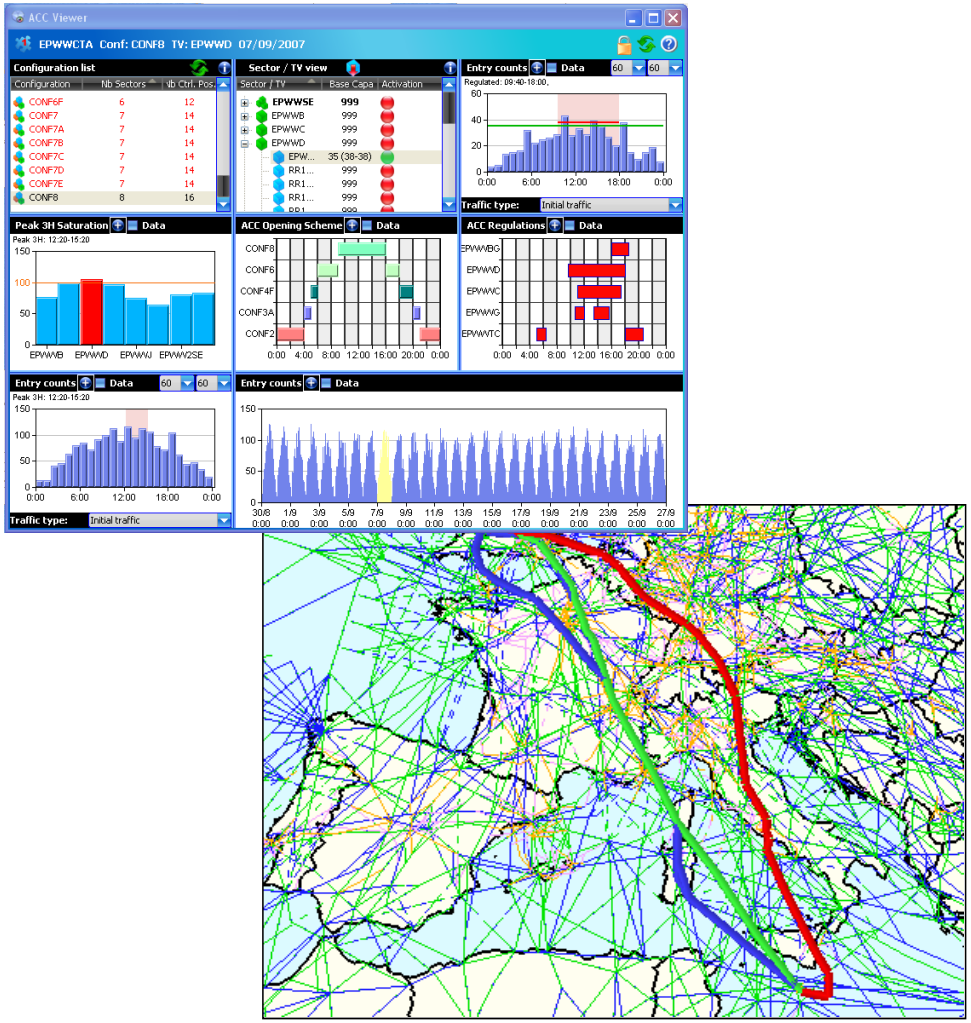
OF CENTRAL FLOW
MANAGEMENT

EUROCONTROL

Integrated Planning Toolset

NEST: Network Strategic Tool

Integrated & interactive support-airspace design & network capacity

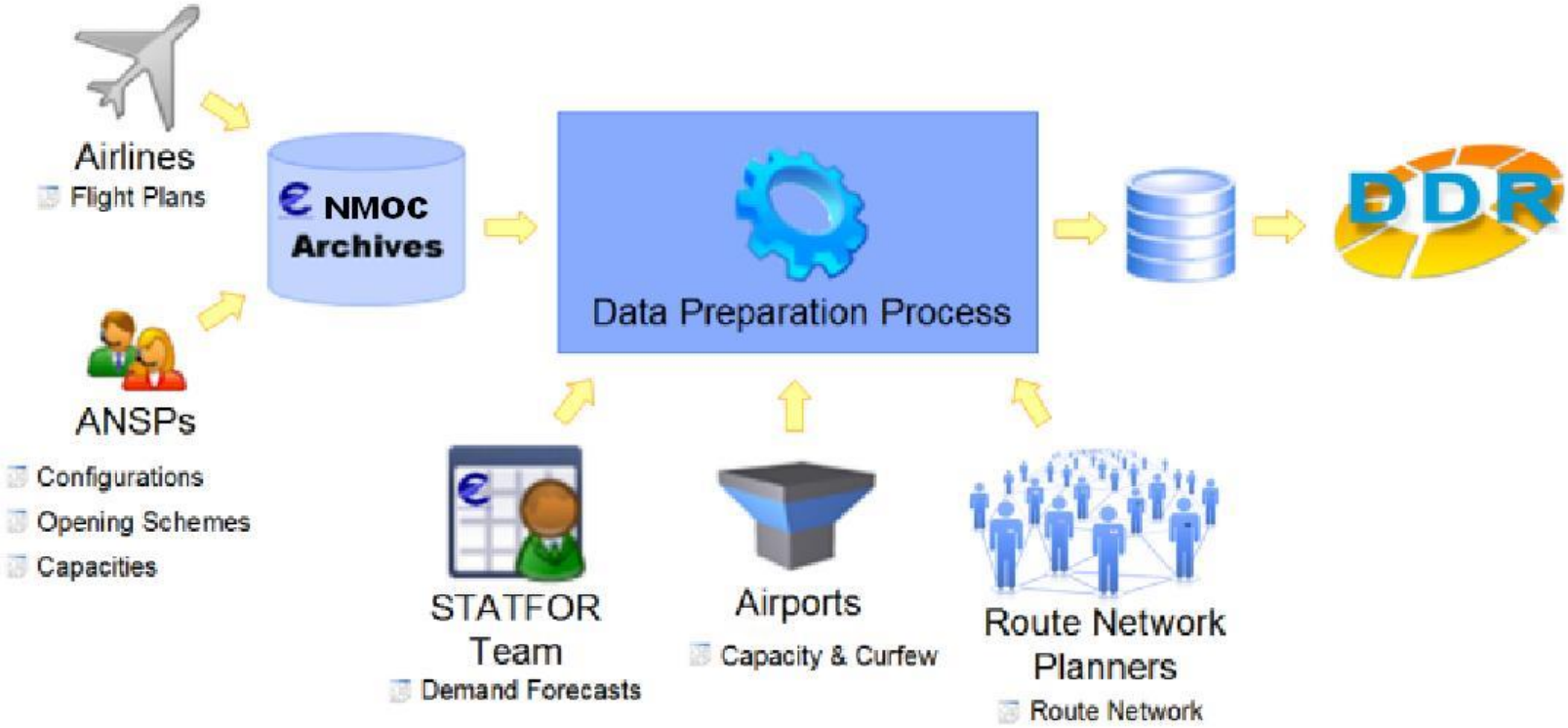


- It features:
  1. airspace structure design and development,
  2. capacity planning and post operations analysis
  3. strategic traffic flow organization
  4. scenario preparation for fast and real-time simulations
  5. ad-hoc studies at the local and network level.

NEST Input Data

Default datasets for NEST: consolidated pan-European airspace and route network, traffic demand and distribution as well as STATFOR.

All this data can be downloaded from the **Demand Data Repository (DDR)** web site.



Automated Data Preparation Process

Services and tools