



# FLEXIBLE USE OF AIRSPACE TODAY AND TOMORROW

Cornerstone for Civil-Military ATM co-operation

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ATM/CM/ATM

APAC 19 & 21 November  
2014

## SCOPE

### INTRODUCTION TO FUA

- The fundamental principle
- Who and how operates in European airspace

### CONCEPT

- Airspace organization and management
- Civil-military co-operation and co-ordination

### IMPLEMENTATION AND ENABLERS

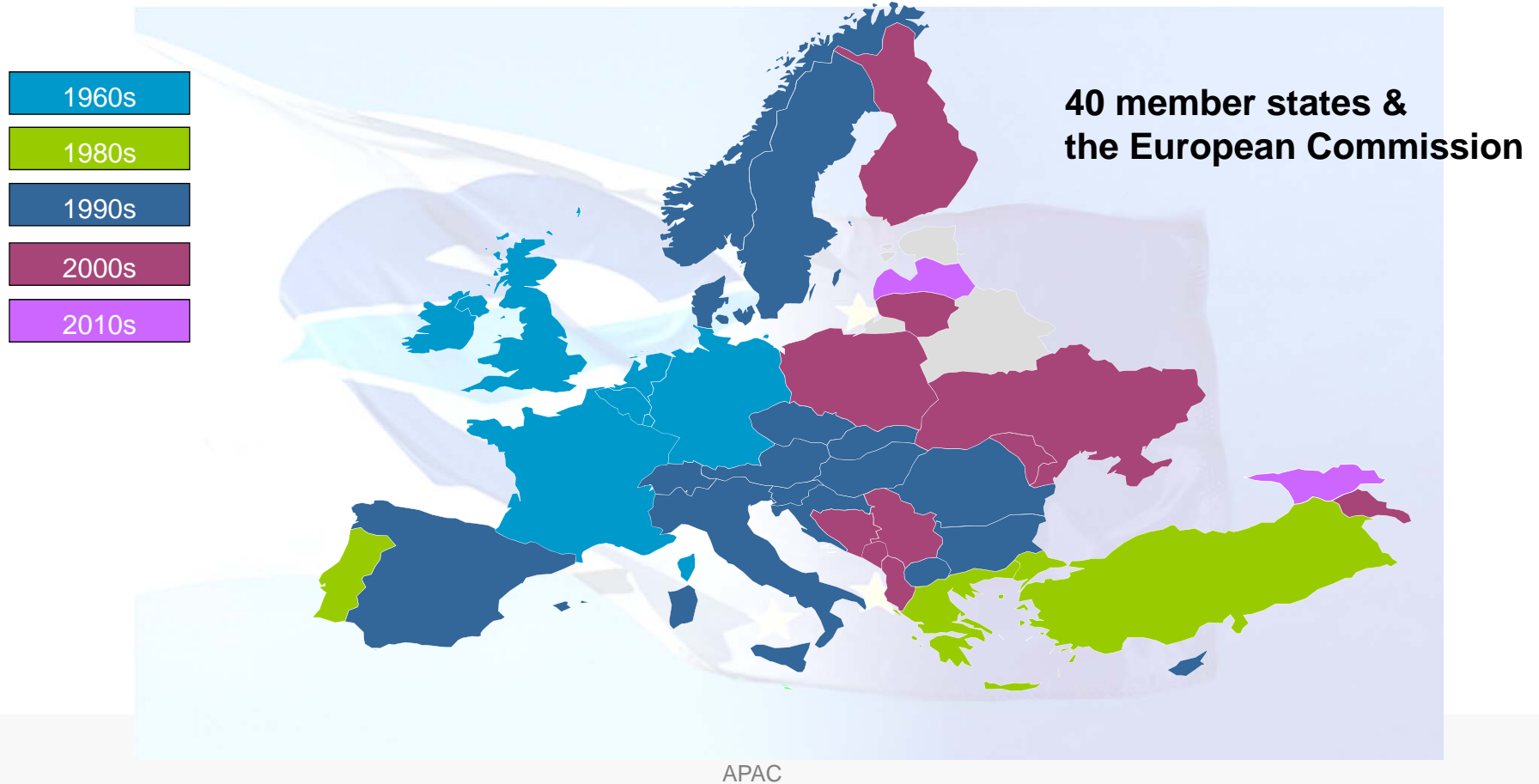
- Actors
- Support systems

### INTRODUCTION TO ADVANCED FUA CONCEPT

- Service oriented approach
- New approach to airspace design

# EUROCONTROL

a civil/military intergovernmental pan-European organization  
for safety of Air Navigation

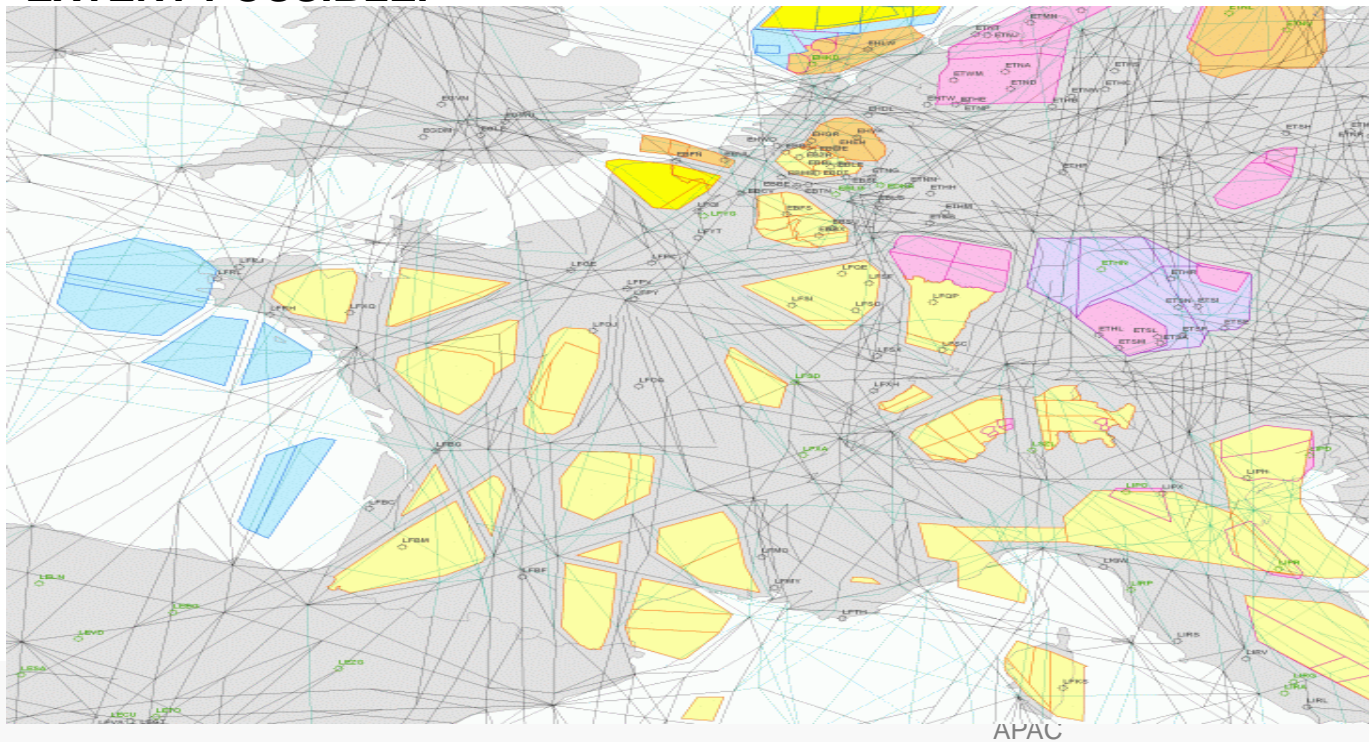


# FLEXIBLE USE OF AIRSPACE



## **FUNDAMENTAL PRINCIPLE OF FUA**

**AIRSPACE SHOULD NOT BE DESIGNATED AS EITHER PURELY CIVIL OR PURELY MILITARY AIRSPACE, BUT SHOULD RATHER BE CONSIDERED AS ONE CONTINUUM IN WHICH ALL USERS' REQUIREMENTS HAVE TO BE ACCOMMODATED TO THE MAXIMUM EXTENT POSSIBLE.**



**ANY NECESSARY AIRSPACE SEGREGATION SHOULD BE TEMPORARY, BASED ON REAL-TIME USAGE WITHIN A SPECIFIED TIME PERIOD**

## EUROPEAN AIRSPACE IS COMPLEX



**More than 11000 Military Aircraft  
are stationed in Europe**

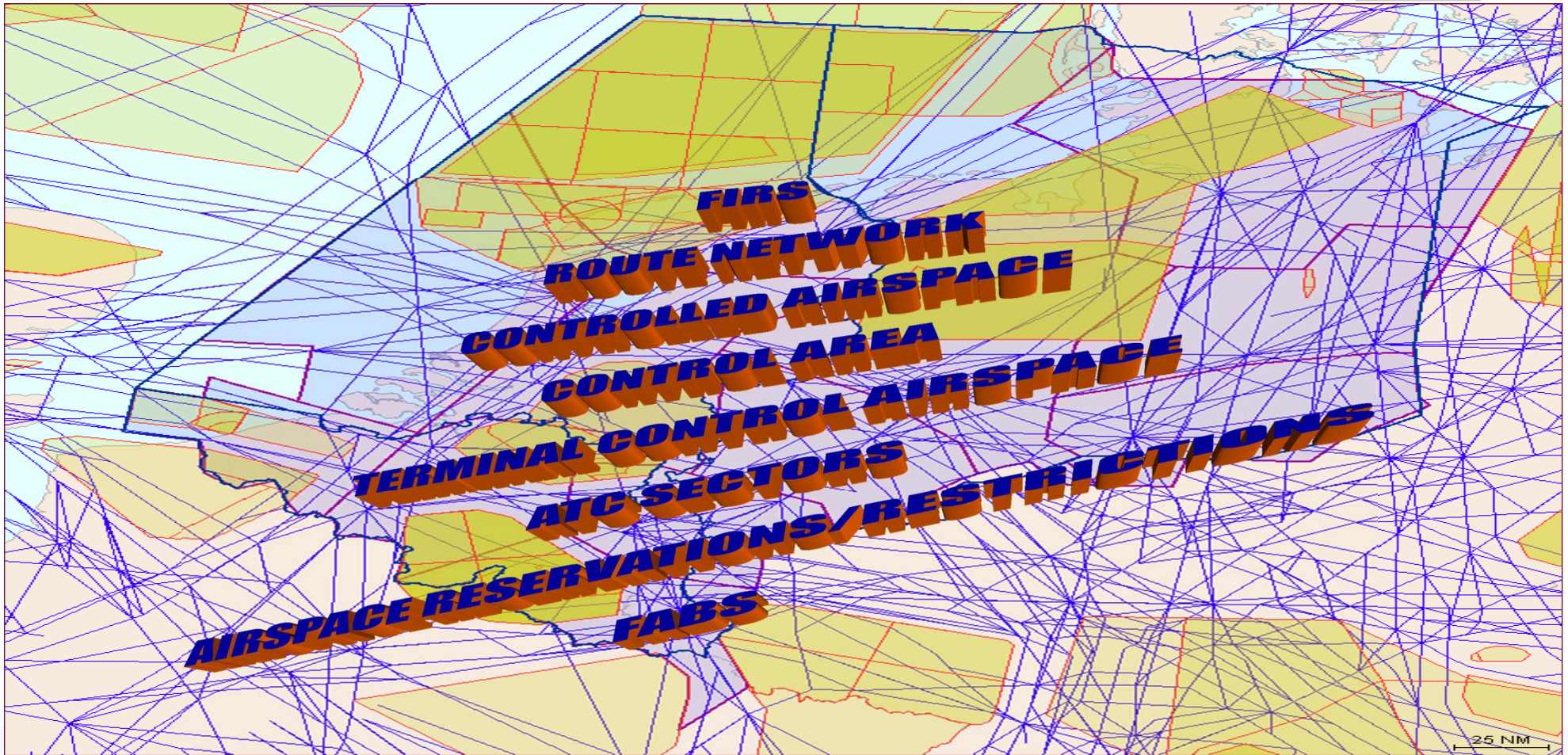


airtraffic.wmv



FUA concept-FLY 01.wmv

# AIRSPACE ORGANIZATION IN EUROPE



# AIRSPACE MANAGEMENT HANDBOOK



## - ICAO Provisions -

- Airspace Reservation
- Airspace Restriction
- Types of Airspace Restrictions
  - Danger Areas
  - Restricted Areas
  - Prohibited Areas
- Temporary Segregated Airspace (TSA)
- Temporary Reserved Airspace (TRA)
- Conditional Route (CDR 1 / 2 / 3)



# COLLABORATIVE MANAGEMENT OF AIRSPACE (ASM) ...AND CIVIL-MILITARY COORDINATION



## ***Strategic Level: ASM Level 1***

Definition and review of national airspace policy and organization  
(Establishment of pre-defined airspace structures)

High-Level  
Civil / Military  
Airspace Policy  
Body

## ***Pre-tactical Level: ASM Level 2***

Day-to day airspace allocation according to user requirements

Joint  
Civil / Military Cell  
(AMC)

## ***Tactical Level: ASM Level 3***

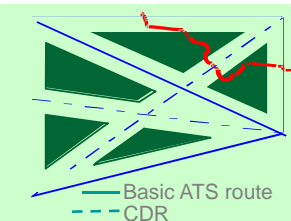
Real-time use of airspace allowing a safe separation  
between civil and military aircraft

Appropriate  
Civil / Military  
ATS Units

# FLEXIBLY MANAGING AIRSPACE STRUCTURES...

## Conditional Route (CDR)

Non-permanent ATS route or portion thereof which can be planned and used under specified conditions

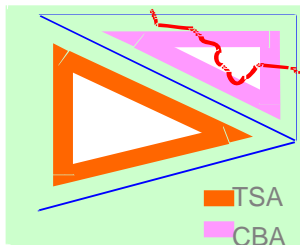


## Temporary Segregated/Reserved Area (TSA/TRA)

Airspace temporary reserved or segregated

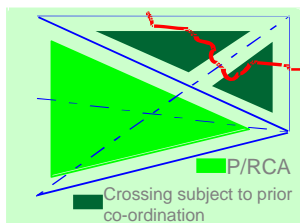
## Cross-Border Area (CBA)

TRAs or TSAs established over international boundaries



## Prior/Reduced Coordination Airspace (P-RCA)

Specified portion of airspace within which GAT is permitted “off-route” with or without requiring prior co-ordination.



TSA200\_Booking.mp4

## NETWORK MANAGER

- **THE BODY EXECUTING THE NETWORK MANAGEMENT FUNCTIONS**
  - DESIGN OF EUROPEAN ROUTE NETWORK
  - COORDINATION OF SCARCE RESOURCES (FREQUENCIES, SSR CODES)
  - ATFM
  
- **ENTRUSTED BY THE EUROPEAN COMMISSION**
  - 8 YEARS - 2 PERFORMANCE IR REFERENCE PERIODS
  
- **STATES PARTICIPANTS**
  - EUROPEAN UNION MEMBER STATES
  - EUROCONTROL MEMBER STATES
  - SINGLE EUROPEAN SKY AGREEMENT WITH EUROPEAN UNION
  
- **FINANCING**
  - BY THE PARTICIPATING STATES
  - TRANSPARENCY OF COSTS

# NETWORK MANAGER MAIN OBJECTIVES

## FUNCTIONS

- DEVELOP AN INTEGRATED ROUTE NETWORK DESIGN
- PROVIDE A CENTRAL FUNCTION FOR FREQUENCIES
- COORDINATE IMPROVEMENT OF SSR CODE ALLOCATION
- ORGANISE THE MANAGEMENT AND OPERATIONS OF THE FUNCTIONS INCLUDING ATFM

## MANAGER

- DEVELOP, MAINTAIN AND IMPLEMENT NETWORK STRATEGIC PLAN AND NETWORK OPERATIONS PLAN
- CONSOLIDATED APPROACH TO ALL PLANNING AND OPERATIONAL PHASES
- COORDINATION WITH OTHER REGIONS AND COUNTRIES

## SUPPORT

- SUPPORT CRISIS MANAGEMENT (EACCC)
- SUPPORT OPERATIONAL STAKEHOLDERS IN DEPLOYING ATM/ANS SYSTEMS/PROCEDURES AND SESAR
- SUPPORT ACCIDENT AND INCIDENT INVESTIGATIONS

***Operational stakeholders: the civil and military airspace users, civil and military air navigation service providers, Functional Airspace Blocks (FAB's), airport operators, airport slot co-ordinators and operating organisations and any additional stakeholder groups considered relevant for the individual functions***

## NETWORK MANAGER & FUA



- Facilitates the coordination and allocation of Civil and Military Airspace Users demand at Pan-European level

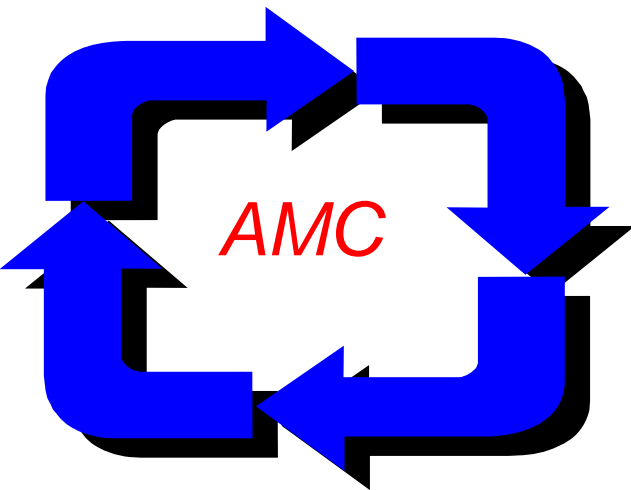


- Consolidates the National Airspace Use Plans into a European Airspace Use Plan (EAUP)

- Implements technical solutions in order to interface local ASM support systems with NM systems for sharing relevant ASM data

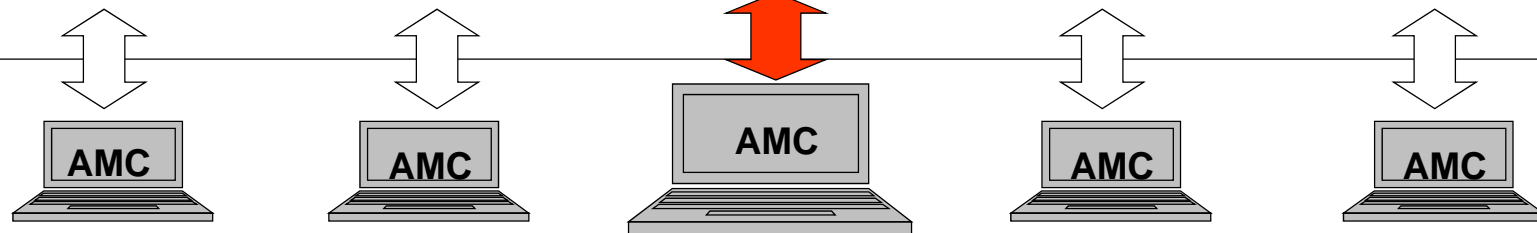
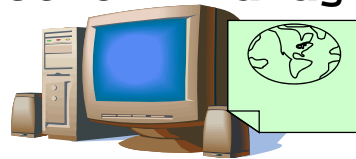
## AIRSPACE MANAGEMENT CELL (AMC)

- **Recognised as** a Joint Civil / Military state body
- **Established** by National Authority
  - **Deals** with the management of airspace structure (TRA, TSA, CBA or CDR) on a daily basis
  - **Collaborates** with different types of AU to optimise demands at national level and promulgate them to NM for allocation/reallocation/modification by means of Airspace Use Plan (AUP/UUP)
  - **Notifies** all relevant ATM actors about allocation /reallocation/modification of airspace





## Network Manager

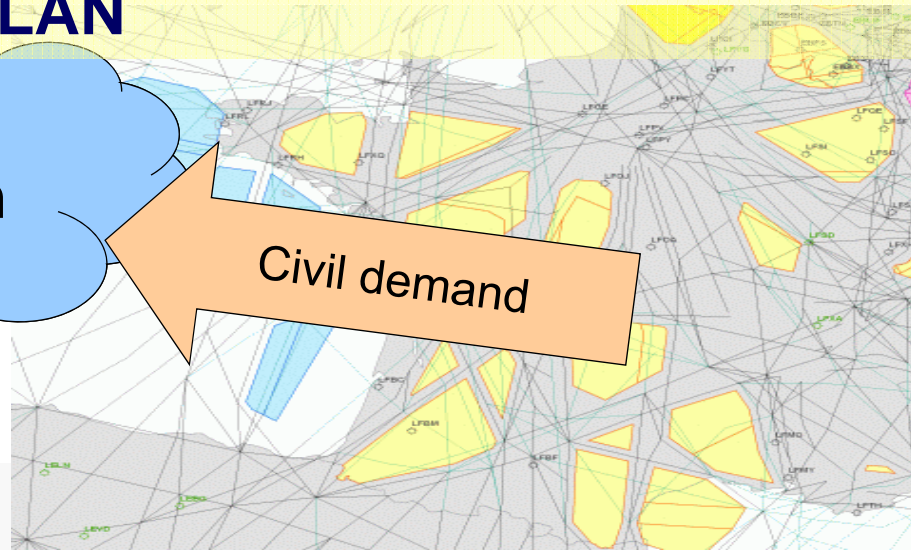


## NATIONAL PLAN

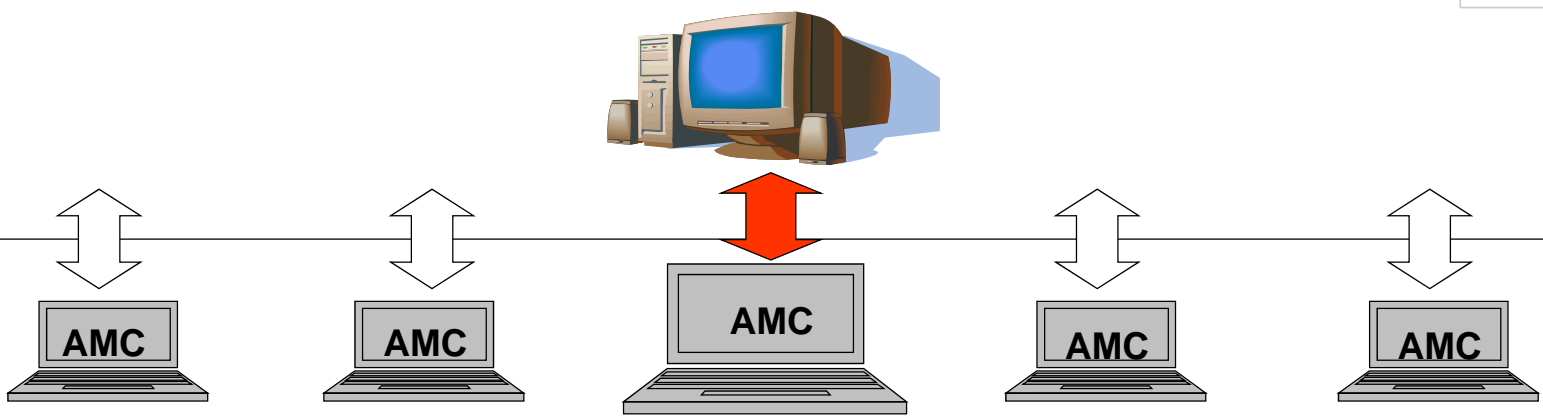
Negotiation

Military planning

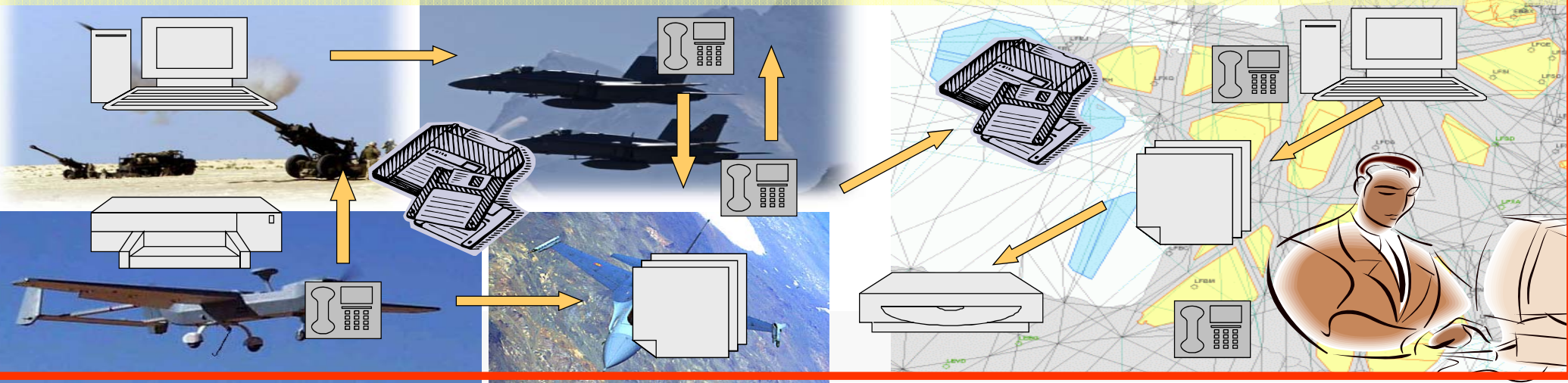
Civil demand



# N M S Y S T E M S



## NATIONAL PLAN



## AIRSPACE MANAGEMENT SUPPORTING SYSTEM

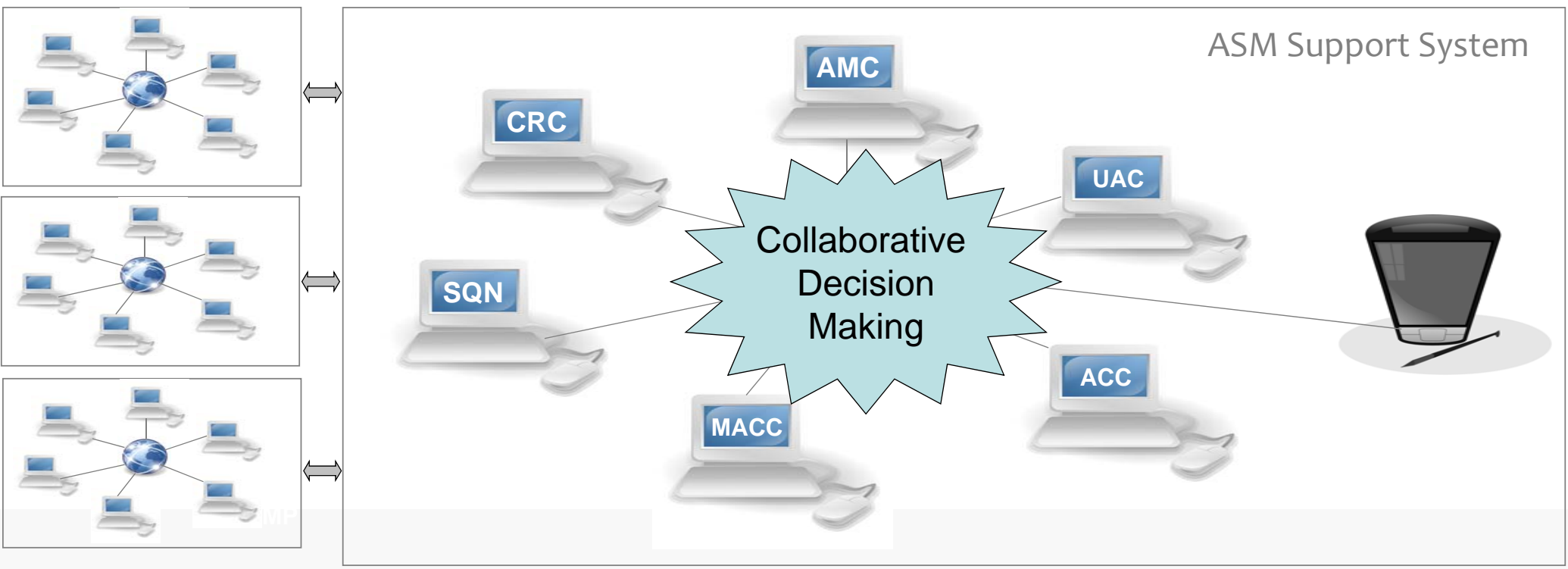
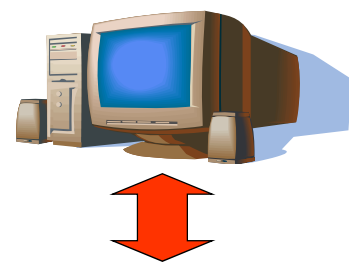


*Member states shall ensure that adequate supporting systems are put in place to enable the AMC to manage airspace allocation and to communicate in good time the airspace availability to all affected users airspace management cells air traffic service providers and all relevant partners and organizations*

**EC Reg. 2150/2005**

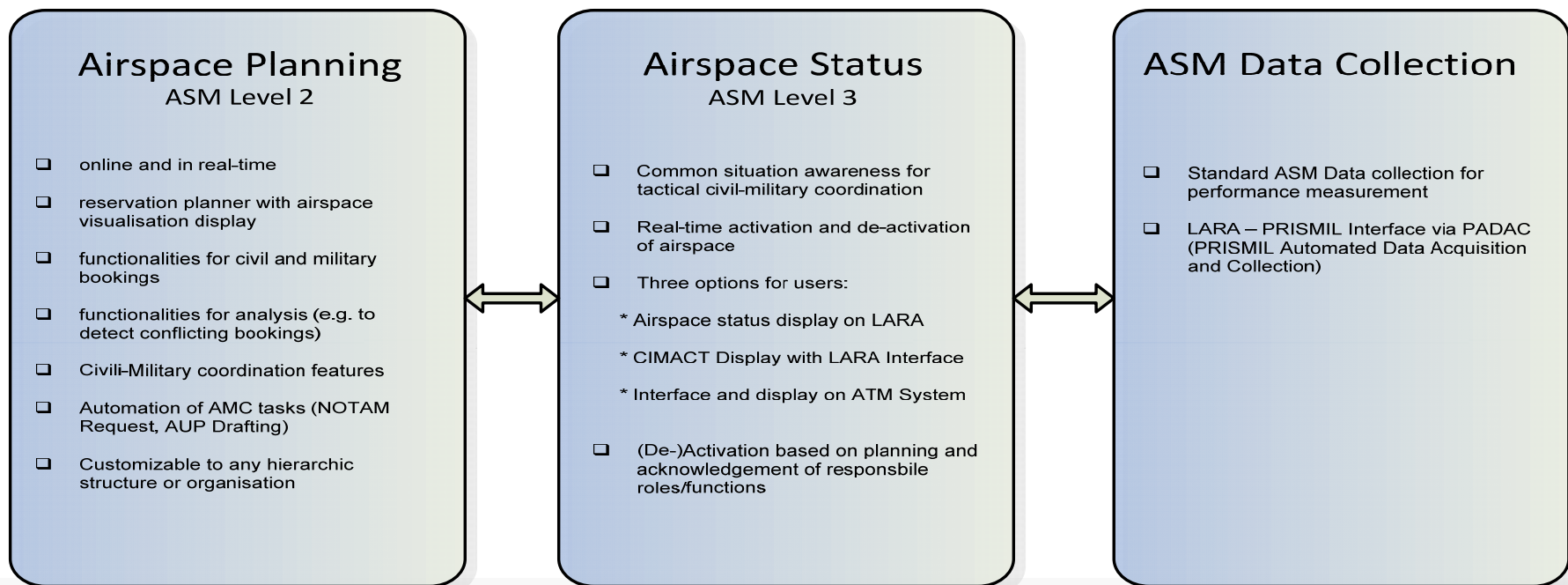
**laying down common rules for the flexible use of airspace**

# NM SYSTEMS

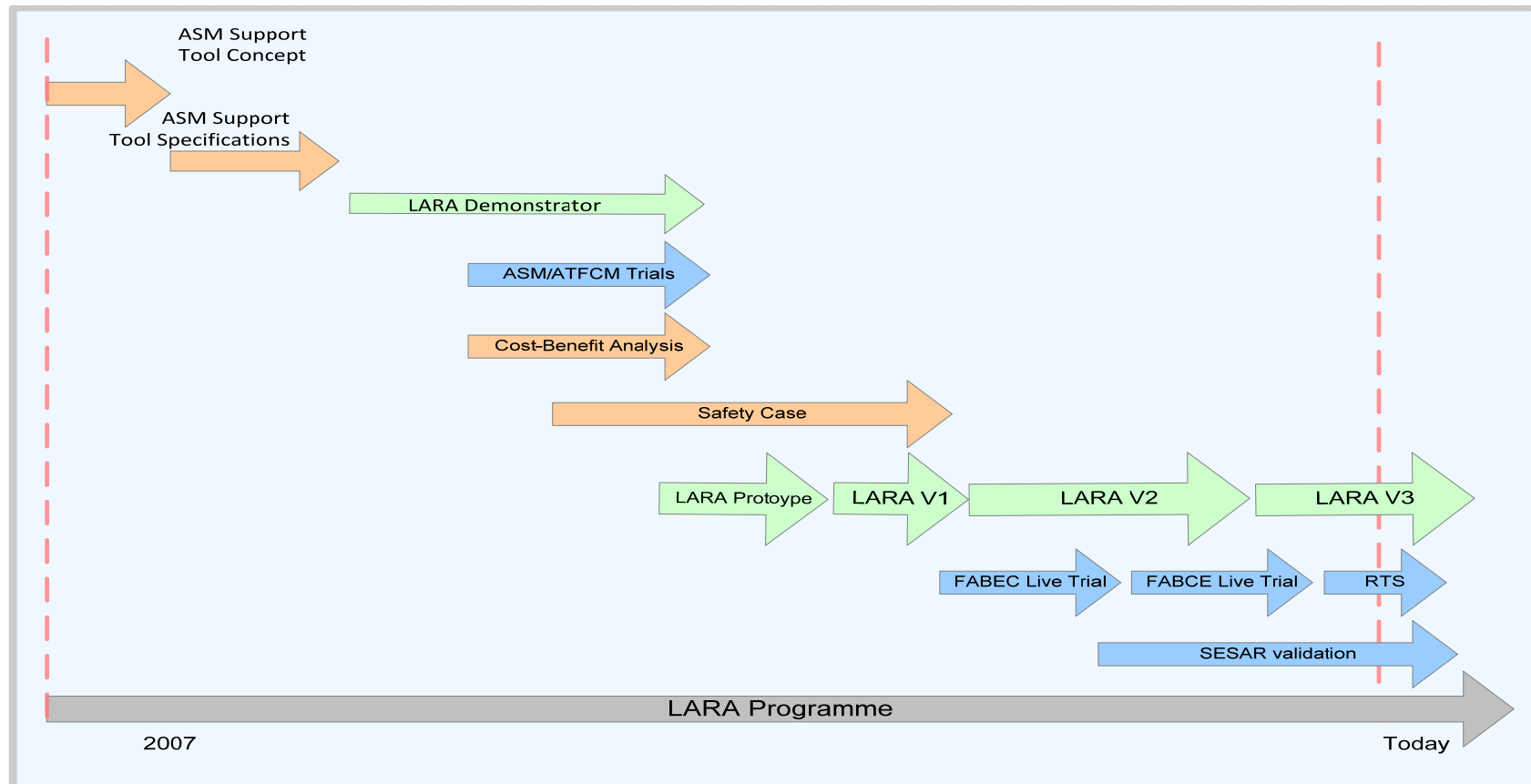


## LARA OVERVIEW

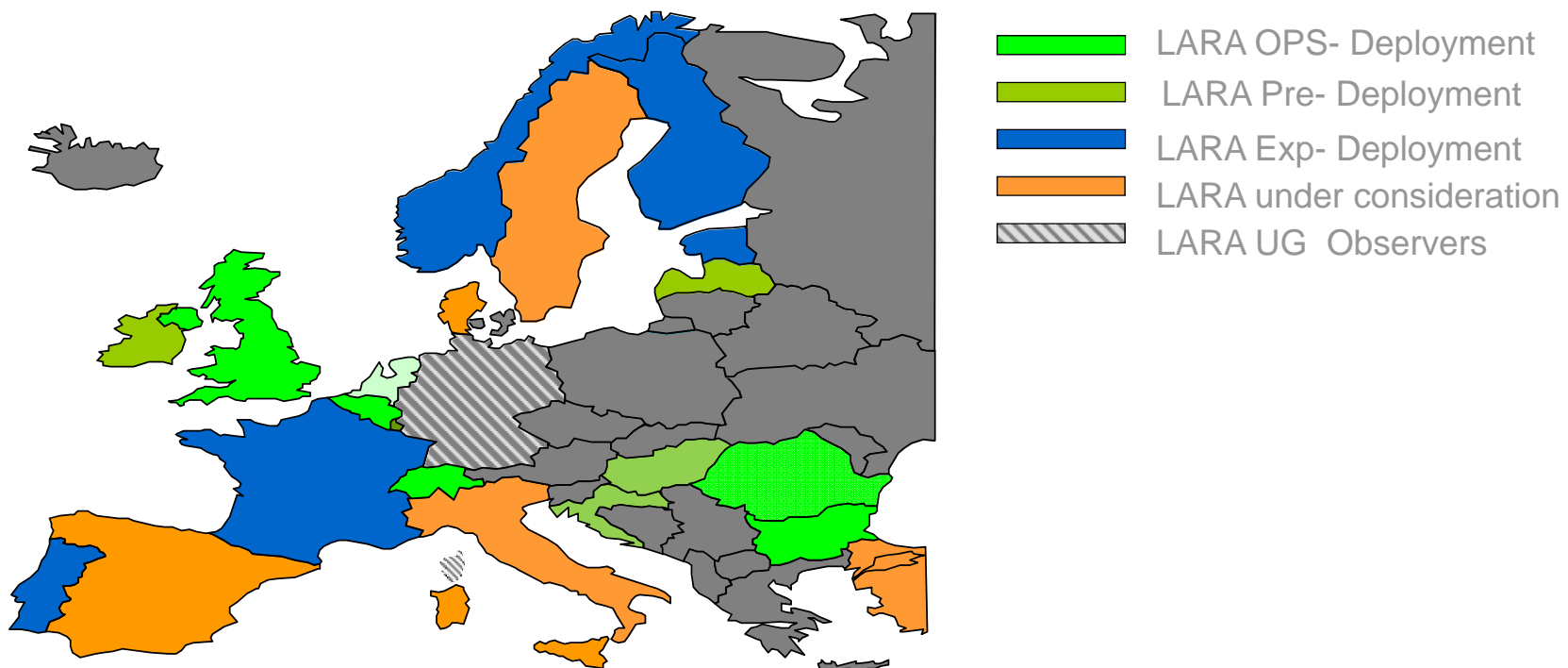
*LARA's functionality encompasses all phases of airspace management – from the airspace planning process to real-time airspace activation and de-activation. LARA also provides necessary data for performance measurement.*



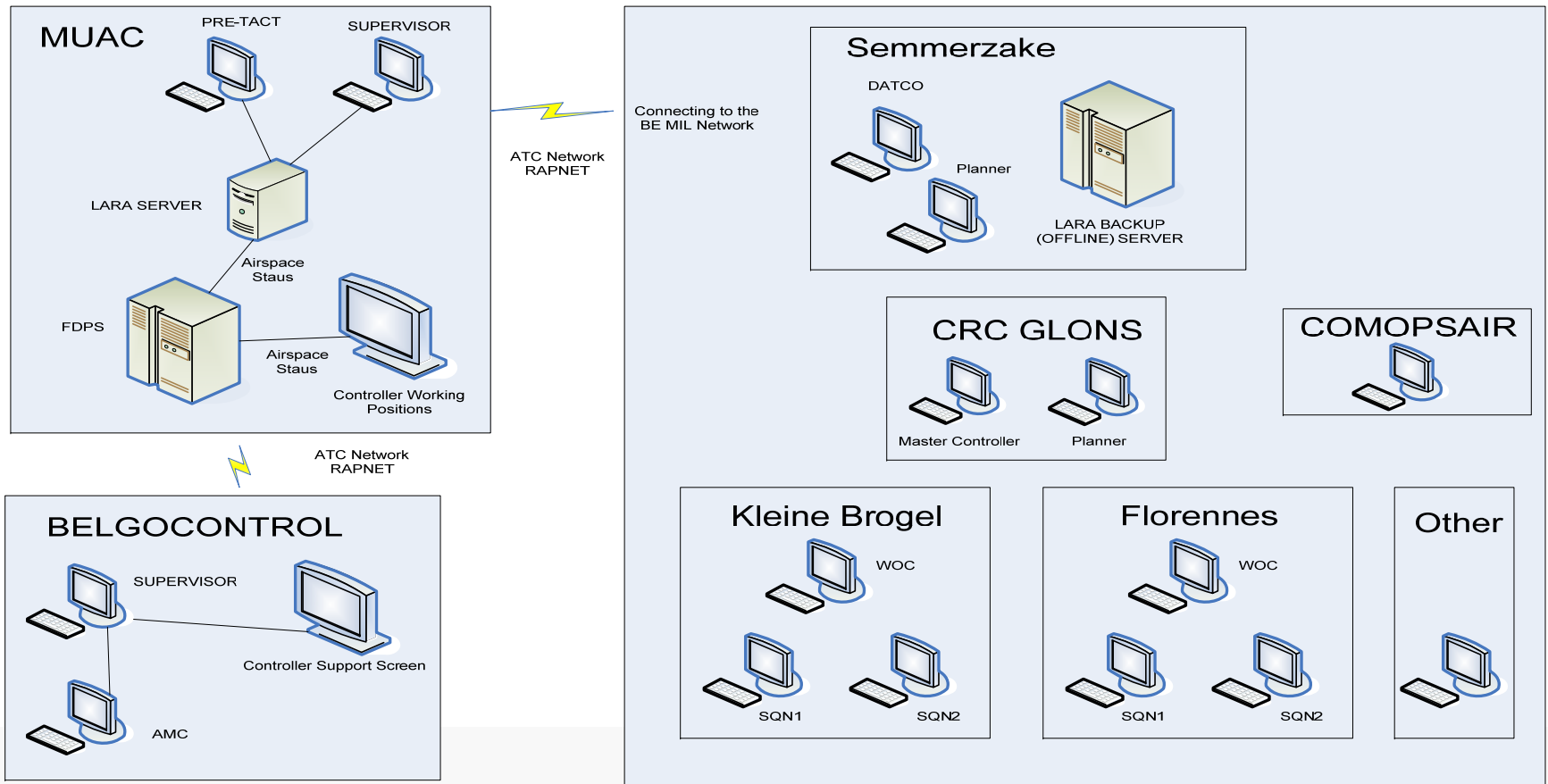
# LARA DEVELOPMENT



# LARA DEPLOYMENT OVERVIEW



# LARA DEPLOYMENT - Example Belgium



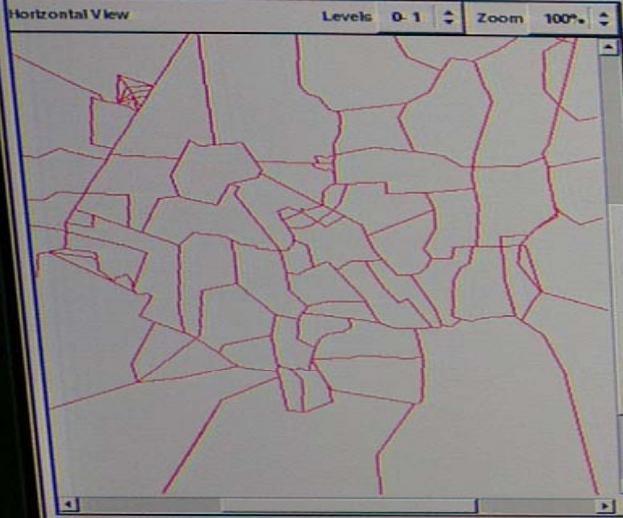
PRINT PRT UPD  
 SIGN IN OPER 0  
 DEFAULT MTCD LAM

13/12/2012 10:55:23 WARNING Controller Operational Sector not Logged on - VFR  
 13/12/2012 10:17:01 WARNING Controller Operational Sector not Logged on - VFR  
 13/12/2012 09:31:40 WARNING Controller Operational Sector not Logged on - VFR  
 13/12/2012 09:30:46 WARNING Controller Operational Sector not Logged on - VFR

OAT  
 BOTH  
 KLU

ACM

Consolidation Constraints MTCD TSA CDR Maps



Area ID	Class	QNH	Status	Forced Status	Next Change
EBTRAS	TRA		MILACTIVE	SCHEDULE	1212181630
EBTRAS1	TRA		FORCIVUSE	SCHEDULE	
EBTRAS2	TRA		FORCIVUSE	SCHEDULE	

Area ID: **AC**

Source:  Class:  QNH:  Status:  Forced Status:  Next Change:  V limit:  Lower:  Upper:

EBTRAS  NON TRA  MILACTIVE SCHEDULE 1630 FLV 670 999

Date Schedule

Num	Action	AS	Source	Start	End	V limit	Lower	Upper	Resid
1	Non	E	LARA	1212181230	1212181630	FLV	105	999	436811
2	Non								
3	Non								
4	Non								
5	Non								

Weekly Schedule

Num	Action	AS	Source	ALL	M	T	W	T	F	S	S	Start	End	V limit	Lower	Upper
1	Non	D	DMS	Y	Y	Y	Y	Y	Y	Y	Y	0000	2400	FLV	670	999
2	Non															
3	Non															
4	Non															
5	Non															

Graphical Display

Current Pattern:  Next Pattern:

Current Pattern TSA:  Next Pattern TSA:

Center:  Radius:

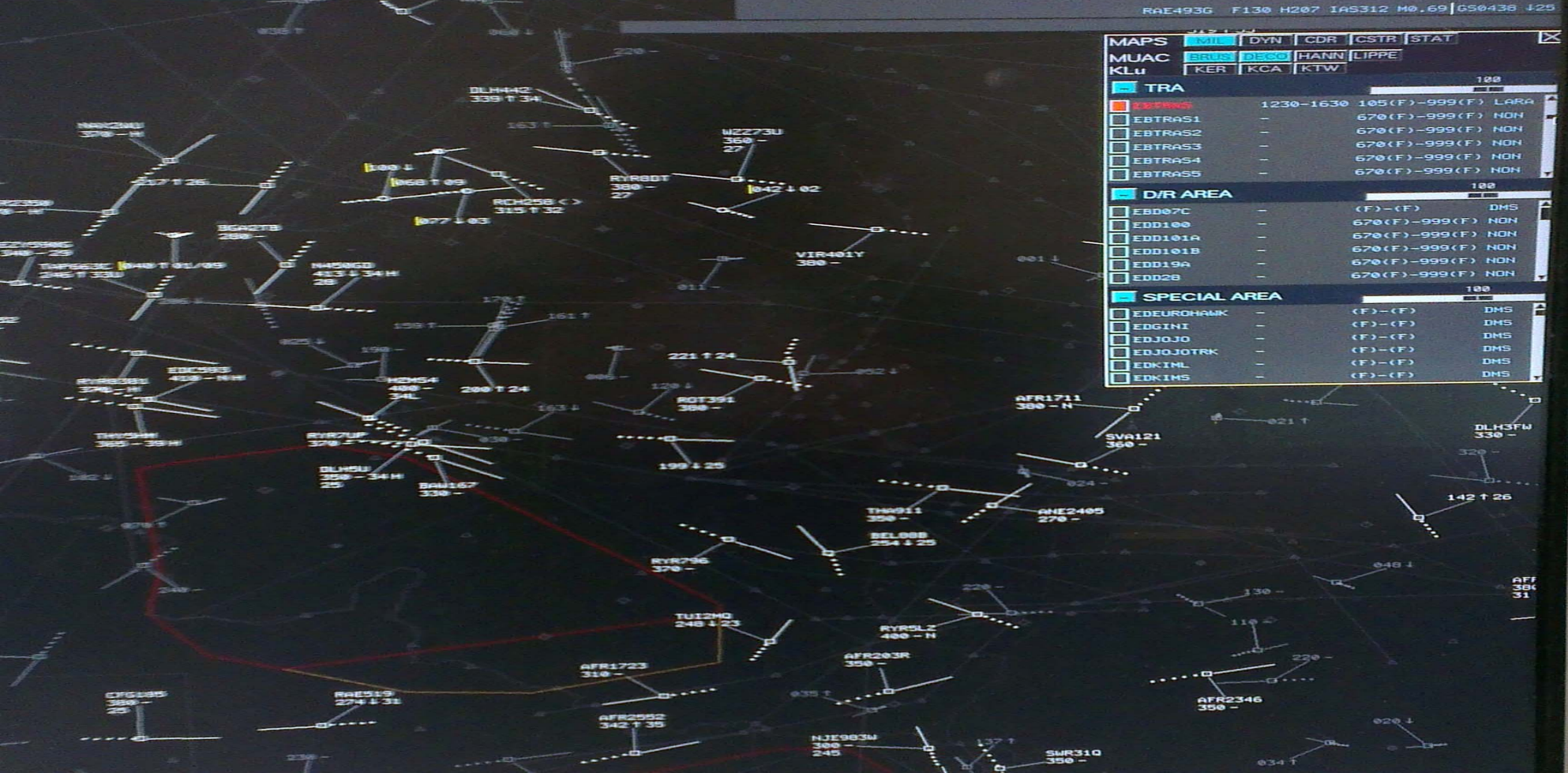
Polygon Elements

5032N00407E	5034N00412E	5038N00436E	5035N00451E	5001N00543E
4959N00543E	4946N00431E	4949N00419E	4959N00409E	5009N00410E

RETRIEVE MODIFY WND vVRD

✓ SUBMIT CLEAR

PRINT TXT HELP EXIT



MAPS	MIL	DYN	CDR	CSTR	STAT
MUAC	BRUS	DECO	HANN	LIPPE	
KLu	KER	KCA	KTW		
<b>TRA</b>					
<input checked="" type="checkbox"/>	EBTRAS	1230-1630	105(F)-999(F)	LARA	100
<input type="checkbox"/>	EBTRAS1	-	670(F)-999(F)	NON	
<input type="checkbox"/>	EBTRAS2	-	670(F)-999(F)	NON	
<input type="checkbox"/>	EBTRAS3	-	670(F)-999(F)	NON	
<input type="checkbox"/>	EBTRAS4	-	670(F)-999(F)	NON	
<input type="checkbox"/>	EBTRAS5	-	670(F)-999(F)	NON	
<b>D/R AREA</b>					
<input type="checkbox"/>	EBD07C	-	(F)-(F)	DMS	100
<input type="checkbox"/>	EDD100	-	670(F)-999(F)	NON	
<input type="checkbox"/>	EDD101A	-	670(F)-999(F)	NON	
<input type="checkbox"/>	EDD101B	-	670(F)-999(F)	NON	
<input type="checkbox"/>	EDD19A	-	670(F)-999(F)	NON	
<input type="checkbox"/>	EDD28	-	670(F)-999(F)	NON	
<b>SPECIAL AREA</b>					
<input type="checkbox"/>	EDEUROHAWK	-	(F)-(F)	DMS	100
<input type="checkbox"/>	EDGINI	-	(F)-(F)	DMS	
<input type="checkbox"/>	EDJOJO	-	(F)-(F)	DMS	
<input type="checkbox"/>	EDJOJOTRK	-	(F)-(F)	DMS	
<input type="checkbox"/>	EDKINL	-	(F)-(F)	DMS	
<input type="checkbox"/>	EDKIMS	-	(F)-(F)	DMS	

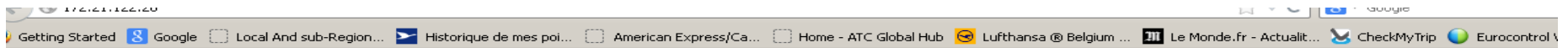


## LARA ENABLES

- COMBINED, CENTRAL DB FOR ALL AIRSPACE DEMANDS
  - ***requests and their state are shared with all roles/functions involved in the ASM/ATFCM process***
- ON-LINE AND IN REAL TIME ASM DATA AVAILABILITY
- COLLABORATIVE DECISION MAKING (CDM)
  - ***the decision makers are all connected, using the same data, taking informed decisions***
- COMMON SITUATIONAL AWARENESS
  - ***all updates are presented in real time to all users involved in the ASM/ATFCM process***
- CONSISTENT DATA
  - ***all users use a single source DB***
- INTERFACE WITH
  - ***NM systems, based on agreed B2B services using AIXM5.1***
  - ***ATC systems allowing timely updates of the airspace status on the ATCO working position***
- EXTENSION TO FAB FUNCTIONALITY



# LARA Web Application



## LARA WEB

[LARA Web Start](#) [LARA Public Web](#) [Web Basic Client](#) [Web APD](#) [LARA Light](#) [ASP - GML3.2](#) [ASD - Graphic](#) [ASD - Clouds](#)



# WEB Airspace Planning Display



LARA Airspace Usage at 17:46:10 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Local And su... myORBITe - ... myORBITe - ... LARA WEB LARA Airs... x Basic LARA ... http://...res=50 LARA Airspac... OpenLayers ... http://...erASD/ http://...res=50 LARA Lite

lara1-pc/WebAPD/listbookings.php

Getting Started Google Local And sub-Region... Historique de mes poi... American Express/Ca... Home - ATC Global Hub Lufthansa @ Belgium ... Le Monde.fr - Actualit... CheckMyTrip Eurocontrol W

### Airspace Planning Display for the

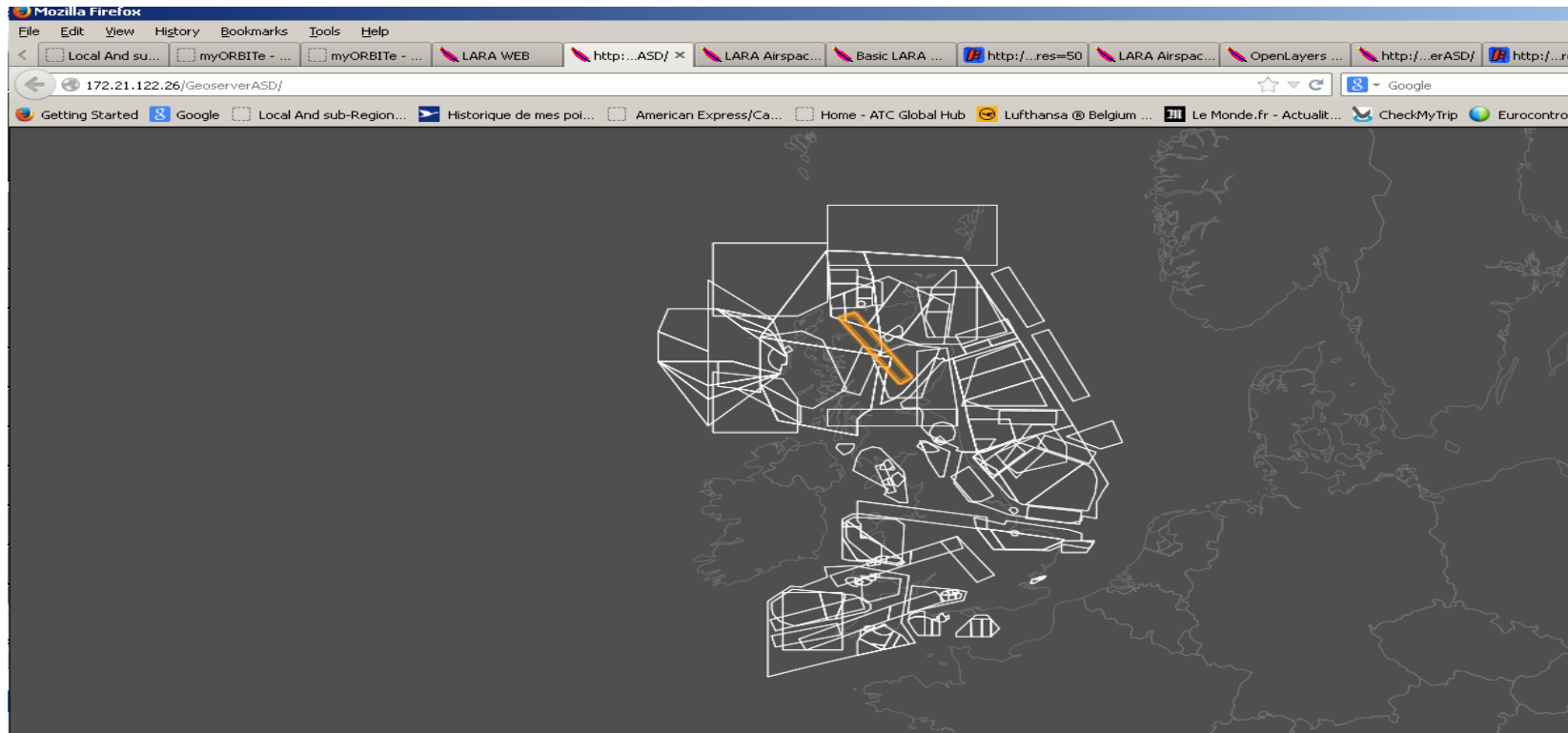
<< < 08/05/2014 > >>

Sector	BeginDTG	EndDTG	Base	Top	CallSign	Priority	Status	Type	Modify	Cancel
EGAARA1	08/05/2014 16:00:00	08/05/2014 17:00:00	175	285	AARA1	99	PENDING	AAR		

[Create a NEW booking](#)

Logout

# Airspace Situation Display Graphic



# ADVANCED FLEXIBLE USE OF AIRSPACE

## AFUA



- **Moving** airspace management from pre-tactical phase to the day of operation
- **Replacing** static airspace configuration by dynamic
- **Implementing** new airspace design principles **VPA/DMA** and ASM procedures for airspace allocation based on **Collaborative Decision Making**
- **Applying** a Service oriented approach in AFUA architecture
- **Increasing** interoperability and **enhancing** air situation awareness by sharing ASM data in real time
- **Facilitating** flight efficiency while **improving** mission effectiveness
- **Harmonizing** data models, interfaces and the use of standards



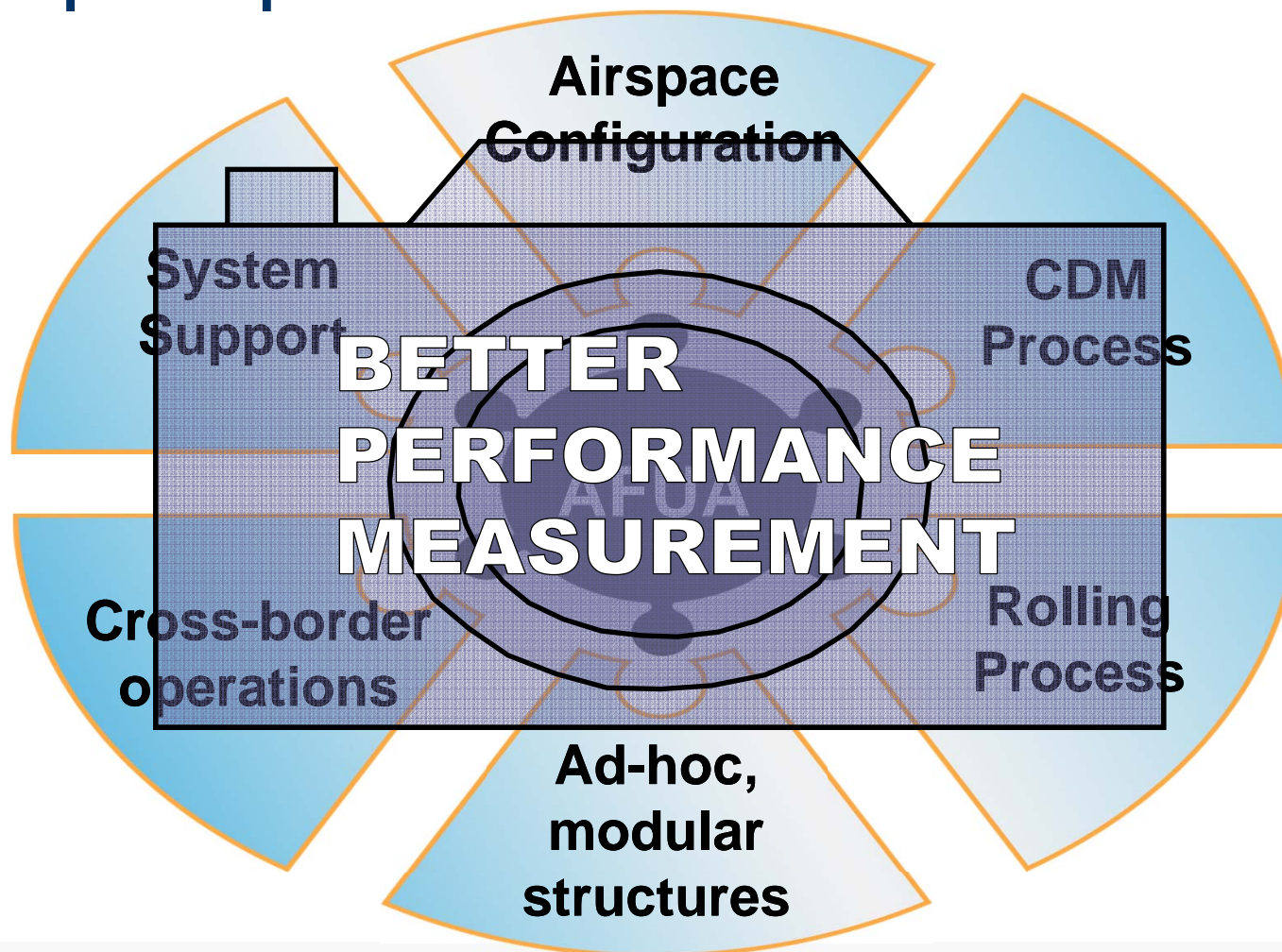
**FUA**

**FROM  
to**

**AFUA**

<b>Levels 1,2 &amp; 3 fixed in time</b>	<b>Levels 1,2 &amp; 3 coincides ATM phases</b>
<b>Independent national ASM</b>	<b>Consolidated Network approach CDM</b>
<b>Fixed ATS Route System</b>	<b>User Preferred Routings</b>
<b>Predefined Airspace Scenarios</b>	<b>Dynamic Airspace Configurations</b>
<b>Time constrained snapshots</b>	<b>Rolling process</b>
<b>AMC &amp; FMP separated</b>	<b>Integrated ASM/ATFCM/ATS processes</b>
<b>Predefined sector configuration</b>	<b>Dynamic configuration management</b>
<b>Fixed airspace structures TRA/TSA</b>	<b>New design principle VPA/DMA</b>
<b>CDRs</b>	<b>Direct route/Free route structures</b>
<b>CBO only between neighbours</b>	<b>Europe-wide CBO sharing</b>
<b>AUP, UUP, eAMI,.....</b>	<b>AFUA SERVICE &amp; NOP</b>

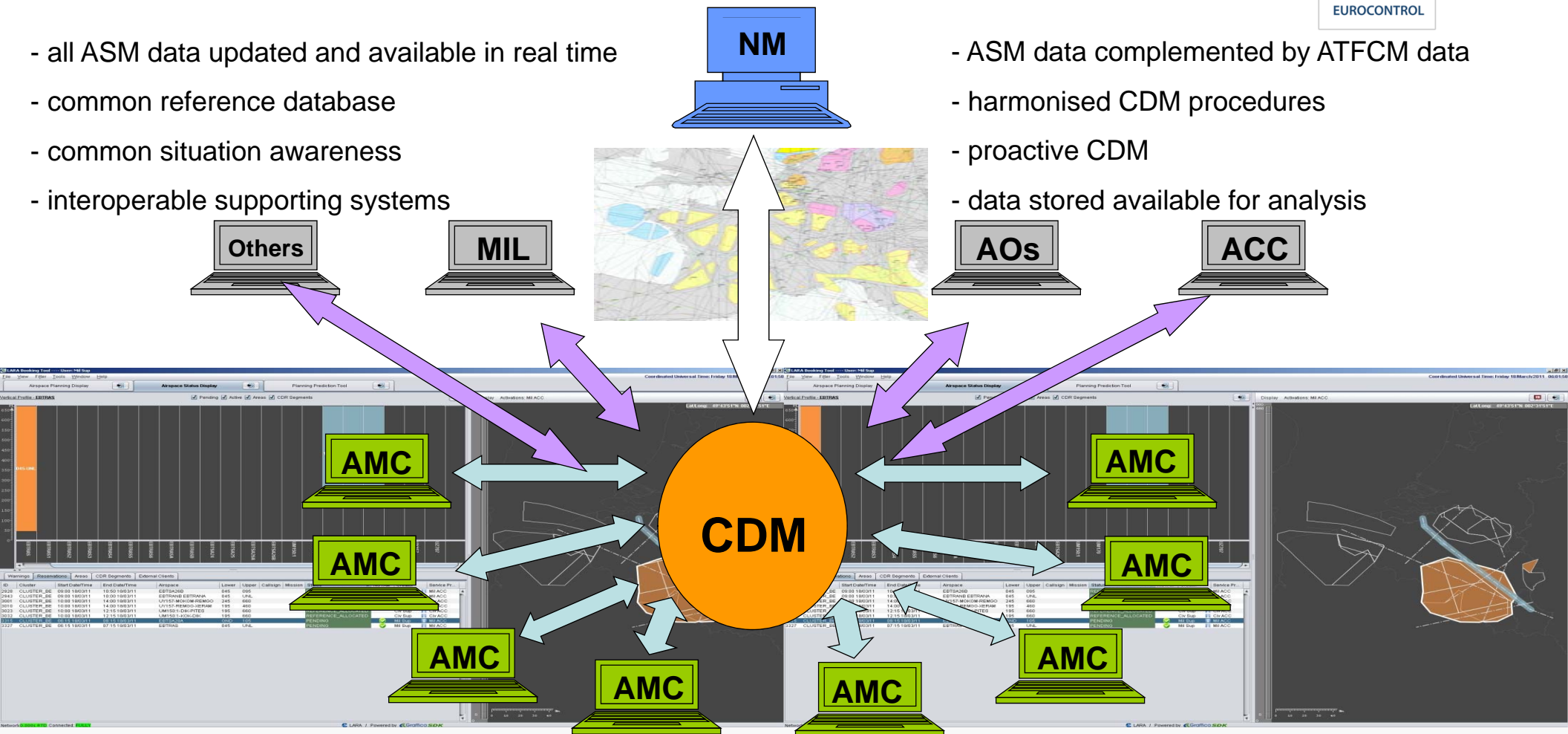
## AFUA Concept components



# AFUA Concept: Integrated CDM and rolling process

- all ASM data updated and available in real time
- common reference database
- common situation awareness
- interoperable supporting systems

- ASM data complemented by ATFCM data
- harmonised CDM procedures
- proactive CDM
- data stored available for analysis

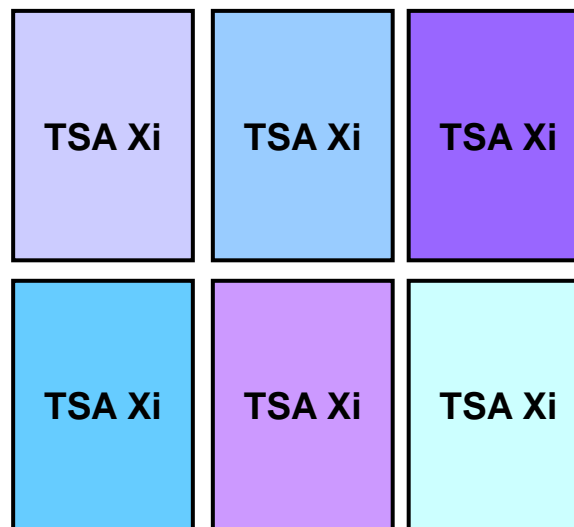


## VARIABLE PROFILE AREAS

***a new airspace design principle based on flexible allocation and management of small fixed predefined modules of airspace. These modules are designed to fulfil airspace users needs individually or as a combination of modules as an ARES, dependant on individual mission profiles.***



Fixed areas  
(TSA – CBA – TRA )



Variable Profile Area (VPA)

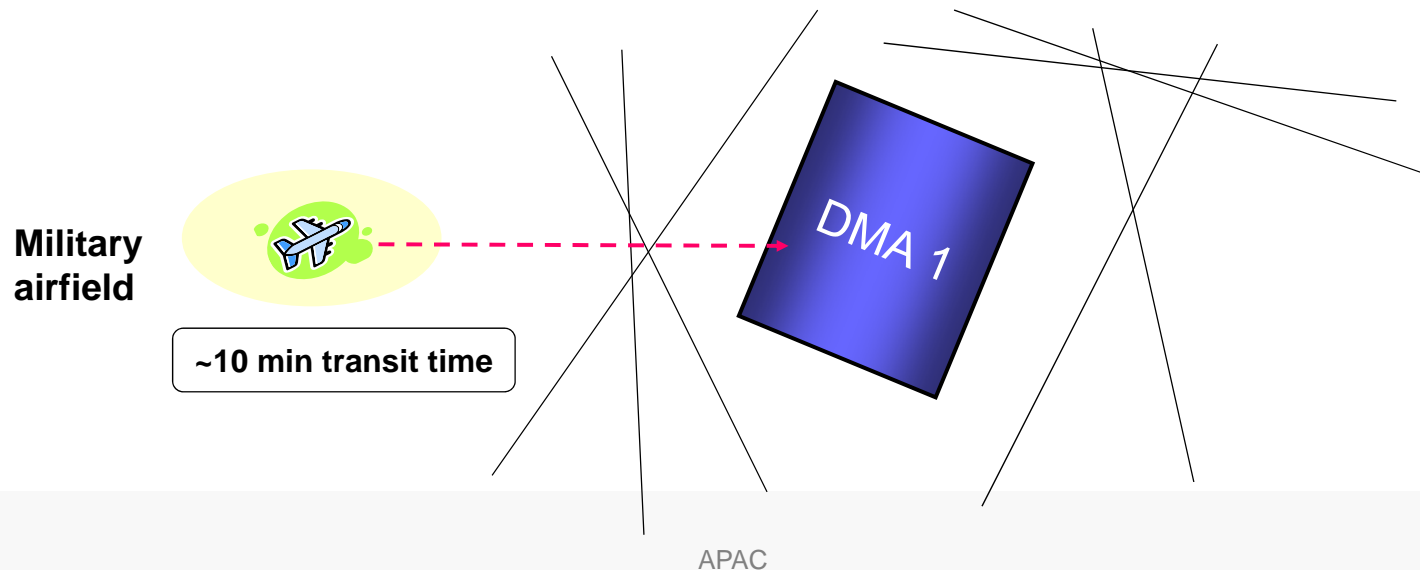


# ADVANCED FLEXIBLE USE OF AIRSPACE



## Dynamic Mobile Area (DMA 1)

- Needs are expressed in term of Airspace Design (Volume description)
- Volume with defined lateral/vertical and time dimensions (4 D data)
- Geographical location decided upon CDM facilitates the optimal DCB scenario
- Reference Mission Trajectory with integrated ARES

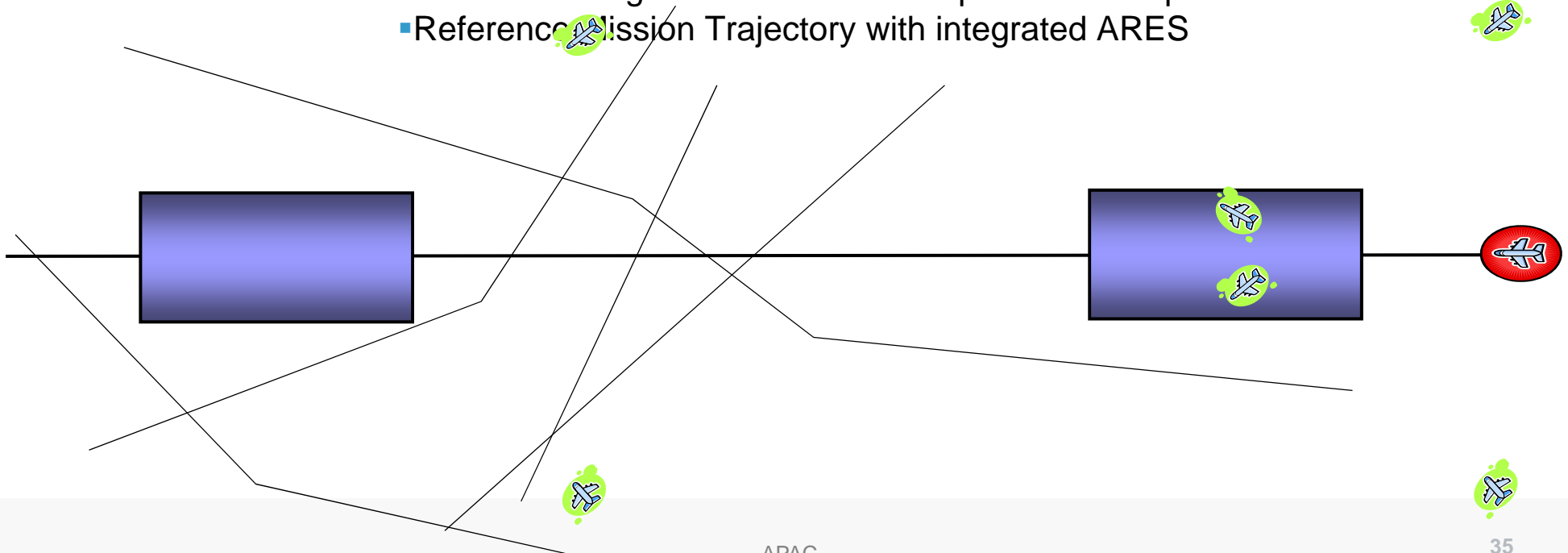


# ADVANCED FLEXIBLE USE OF AIRSPACE



## Dynamic Mobile Area (DMA 2)

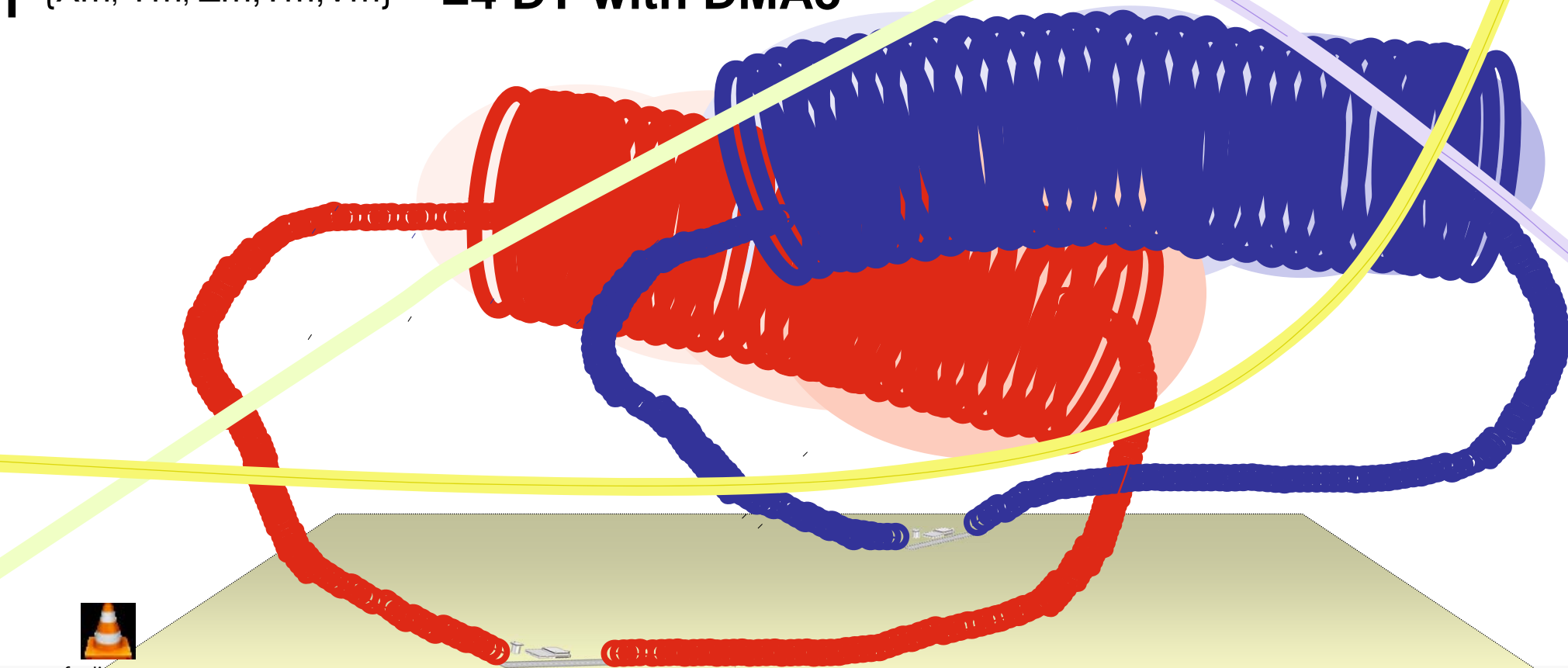
- Volume with defined lateral/vertical and time dimensions (4 D data).
- At variable geographical location according to the mission needs along the trajectory, “activated & de-activated” during specific timeframes to protect an activity
- Decided through CDM in order to implement the optimal DCB scenario
- Reference Mission Trajectory with integrated ARES



## ADVANCED FLEXIBLE USE OF AIRSPACE



**f** {Xm; Ym; Zm;Tm;Vm} =4 DT with DMA3



refueling.mov

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## AFUA ARCHITECTURE AND TECHNICAL SUPPORT

Cost-efficient solutions



## ARCHITECTURE PRINCIPLES

- SERVICE ORIENTED ARCHITECTURE
- INTEROPERABILITY BASED ON HARMONIZED INTERFACES
- HARMONIZATION OF DATA MODELS
- USE OF A COMMON REFERENCE DATA MODEL (AIRM) TO ENSURE SEMANTICS

## SYSTEM SUPPORT

- CENTRALIZED SERVICES
- NETWORK SYSTEMS
- LOCAL SUPPORT SYSTEMS

## CENTRALISED SERVICE

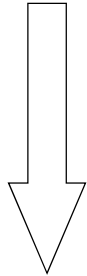


***THE ADVANCED FLEXIBLE USE OF AIRSPACE CONCEPT IS BASED ON THE INTRODUCTION OF A CENTRALISED DATABASE AND IMPLEMENTATION OF A SERVICE THAT ALLOWS CENTRAL COLLECTION, INTEGRATION AND PROVISION OF ASM DATA IN SUPPORT TO CONTINUOUS MANAGEMENT OF THE ATM NETWORK OPERATIONS WITH RESPECT TO AIRSPACE NEEDS, CONSTRAINTS, BOOKING AND ACTUAL USE OF THE PAN-EUROPEAN AIRSPACE***

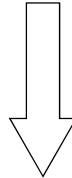


# AFUA SUPPORT SERVICES

## *Strategic planning*



## *Pre-tactical*



## *Tactical*



## *Post-ops*



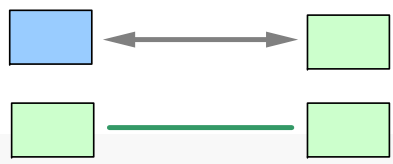
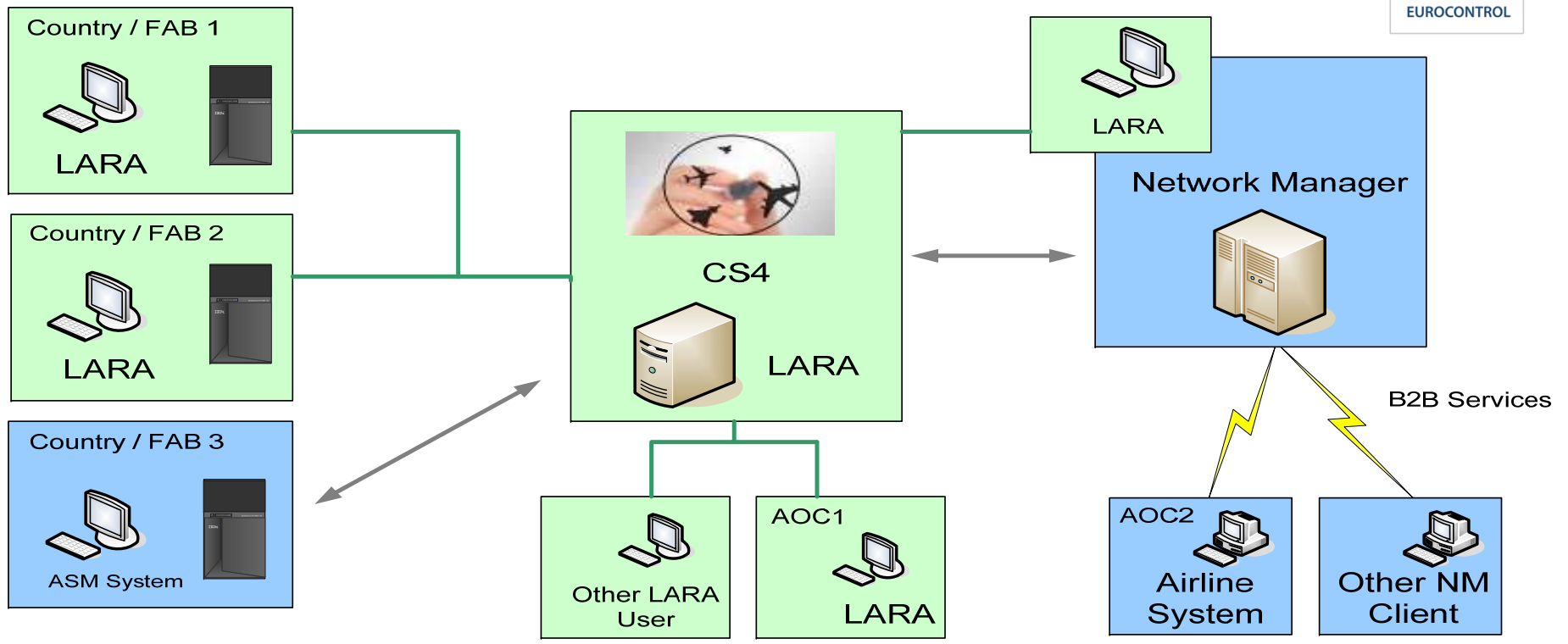
- Several years to D-7
- Information related to airspace reservations /military exercises known long time in advance:
  - New/temporary airspace reservations
  - Ad-hoc airspace reservations adaptations
  - Introduction of new ASM concepts

- D-7 to day of operations
- Information related to the planning of airspace for the following day/days, comprising:
  - national or FAB AUPs
  - national or FAB UUPs
  - EAUP and EUUP
  - All related updates supporting the rolling process when fully operational
  - Expected availability of CDRs/airspace reservations on the day of operations

APAC

- On the day of operations
- Information related to the short term planning and actual utilisation of airspace in real time:
  - airspace status (available, booked, used, released)
  - actual shape and location of considered portions of airspace
  - real time availability of CDRs/airspace reservations

- After the day of operations
- Information related to the booking and actual utilisation of airspace achieved :
  - airspace really booked, available, used, released
  - availability of the information related to the actual status and utilisation of airspace



1. Step "AUP/UUP Exchange"  
 2. Step "Reservation and CDM Services"

Full CS4 Services available today

## BENEFITS

- ❑ Provides a common ASM reference data source for all ATM actors
- ❑ Facilitates the optimization or the use of available airspace resources through the collaborative planning at all ASM levels
- ❑ Delivers a mechanism for NM function through interactive ASM/ATFCM/ATS processes in order to satisfy the civil and military AU demands while:
  - optimising airspace resources versus airspace demand;
  - enabling better information sharing and more efficient CDM
  - minimising adverse effects on network operations through the application of continuous impact assessment on the planning airspace recourses;
- ❑ Enhances synergies in the CDM process for a more efficient application of FUA, thus increasing the contribution to the overall network performance
- ❑ Raises significantly the level of harmonisation of ASM processes in Europe
- ❑ Provides the frame for the gradual implementation of the AFUA Concept and future SESAR operational improvements when mature and validated



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