FABEC Implementation Phase

FABEC Airspace Design

EC Information

Annex N

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

Document Summary

Objective : Provide evidence of optimal use of technical resources	
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Approvals

Name: Peter van Hoogstraten **Function:** Chairman OPS SC **Date:** 4/4/2012	**Signature:**

Quality Control

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ATTACHMENTS CONTAINED IN THIS ANNEX

ID	Origin	Status	Version	Date	Title
N.1	SC OPS	Draft	0.5	22.03.2012	FABEC Airspace Strategy
N.2	SC OPS	Draft	0.1	13.03.2012	FABEC ATM CONOPS
N.3	SC OPS	Draft	1.0	12.01.2012	Free Route Airspace CONOPS
N.4	SC OPS	Draft	1.0	11.01.2012	Extended Arrival Management OCD
N.5	SC OPS	Draft	1.0	12.01.2012	DMAN/A-CDM OCD
N.6	SC OPS	Draft	0.1	13.03.2012	NTM / DIK - SWAP RTS
N.7	SC OPS	Draft	0.1	13.03.2012	DOVER Phase II RTS
N.8	SC OPS	Draft	0.1	29.03.2012	LoA AMRUFRA

1 INTRODUCTION

Air Traffic Control is the backbone of civil aviation in the core area of Europe or FABEC. It provides the infrastructure for thousands of daily flights, flown by commercial planes between major airports. In view of the expected growth of aviation in the coming twenty years, the traditional strategy of piecemeal reactions is no longer deemed sufficient to deal with this challenge satisfactorily. Aviation is a quintessential cross-border activity. Air Traffic Management was organised in a fragmented way. Every time a flight enters the airspace of a FABEC State, it was serviced on basis of different rules and operational requirements. This fragmentation impacted on safety, limited capacity and added to cost. Moreover, it slowed down the decision making process necessary to tailor services to airspace users' needs. Like any other industry, Air Traffic Control therefore needed to be more functionally devised on a regional or FABEC basis. Airspace had to be organised following operational requirements regardless of national boundaries in 'Functional Airspace Blocks'.

This demonstrates the importance of the concept of Functional Airspace Block and the work done on airspace design. A FAB is a toolbox with operational instruments to tackle fragmentation of airspace at its roots to meet users' expectations. This implies that functional airspace blocks involve a collaborative decision making exercise where all ANSPs have a role to play. While FABEC States provide the continuous political backing, the bulk of the operational work is performed by the ANSPs. Experts are involved in airspace design to make best use of their expertise and to manage change. FABEC as such is conceived as a continuous defragmentation process whereby ANSPs gradually tend to a more optimal scale for their operations. This opened possibilities for tackling different aspects of fragmentation in differing timeframes.

Under the current wording of the FABEC Implementing Rule, it is necessary to establish a functional block which shall enable optimum use of airspace, taking into account air traffic flows and be justified by their value added whilst ensuring compatibility between configuration of upper and lower airspace. As a consequence, there was a responsibility to bring about defragmentation with the agreed 'bottom-up approach' methodology.

The whole exercise is about increasing performance levels. The integration of airspace is a gradual process that must and will take its time. The establishment of FABEC means at first a strategic rethinking of the organisation of airspace at a FABEC level to bring about added value, as required by the single European sky legislation and requested by users. Users rightfully expect that defragmentation will lead to a significant increase in performance in terms of safety, capacity and flight efficiency

FABEC has to deliver an airspace roadmap towards a more integrated integrated airspace with concrete measures and firm timetables. In addition, there is considerable scope for immediate action . Indeed, FABEC ANSPs are progressing significantly in harmonization of a FABEC operational ATM concept and undelying concepts.

Overall, it appears to be important to stress how related performance indicators are put in perspective. This is work done by FABEC Performance Management and ongoing CBA work. In order to estimate the benefits, changes are assessed in view of increase of service quality in FABEC airspace and starts by e.g. elimiationg known choking points or hotspots.

All developments done by FABEC fit into and contribute to the Action Plans undertaken by the European Network Manager.

2 FABEC Airspace Design

FABEC has developed and deployed a cooperative and partnership approach between civil and military partners facilated by the FABEC Standing Committee Operations. It is the coordination forum for FABEC Airspace Design during the implementation phase. It plans and implements an improved FABEC ATS route network which is optimised for civil and military airspace structures.

The successful deployment of an agreed FABEC Airspace Strategy (Annex N.1) is achieved through:

- The implementation on an advanced ATM Concept of Operations (Annex N.2) and underlying operational concepts (Annex N.3, N.4 and N.5);
- A FABEC view considering the FABEC airspace as one continuuum irrespective of national boundaries, designed following main traffic flows and airspace preferred routes and profiles with optimised ATC sectorization unconstrained by national or FIR boundaries;
- Gradual elimination of bottlenecks or identified hotspots in 4 areas of FABEC to improve flight efficienc (Real Time Simulation Reports in Annex N.6 and N.7);
- Optimised procedures between civil and military partners to enhance the use of FABEC airspace;
- A balanced approach between European network requirements, FABEC and national/local requirements;
- A coordinated and integrated collaborative approach for the collective benefit of the airspace users, FABEC States, civil and military FABEC ANSPs, civil and military authorities deployed through an integrated planning process.

Different FABEC airspace design initiatives are in parallel in different phases of either development or implementation (e.g. AMRUFRA project is implemented and extract of cross border arrangements available in N.8).

All FABEC initiatives are aligned solutions identified in the Flight Efficiency Plan agreed by IATA, CANSO and EUROCONTROL in 2008. These solutions lead to operational actions which lead to considerable fuel and emissions savings.

3 FABEC Airspace Design Initiatives

The adoption and gradual implementation of FABEC initiatives will over time provide the performance benefits expected. In terma of airspace design efficiency (if all flights would have used the improved European route network and underlying FABEC network without any route restrictions and with all CDRs available) then FABEC already considerably contributes to a decrease of the route extension.

These achievements came as a result of the implementation of AMRUFRA, Night Network and City Pairs.

FABEC Airspace Design work will continue to address main areas of improvement:

1. **Enhancing FABEC en-route Airspace Design**

- Implementation of a coherent package of yearly improvements and shorter routes (e.g. Night Network)
- Improving flight efficiency for most penalised city pairs (e.g. City Pairs)

- 4 FABEC Hotspots Airspace Design Projects (i.e. SWAP, West I & II, CBA-L/CW and IP LUX).
- Supporting implementation of FABEC Free Route Airspace (e.g. FABEC FRA project)

2. Improving airspace utilisation and route network availability

- Improving the utilisation of civil/military airspace structures (described in Annex on ATFCM/ASM)

3. Efficient en-route airspace design and utilisation

- Implementing advanced navigation capabilities (e.g. to West II project implementation)
- Implementing improved arrival/departure routes, optimised departure profiles, etc. e.g. (XMAN/AMAN, PMS, DMAN/A-CDM)

4. Improving awareness of performance within FABEC

- Every airspace design project being supported by a positive Performance Case

FABEC closely cooperates with the Network Manager to ensure that the FABEC airspace can accommodate additional capacity needs and seamlessly integrates airports into its network.

FABEC initiatives are aligned with the European Route Network Improvement Plan for the safe and efficient operation of air traffic, taking due account of the environmental impact.

FABEC supports the ERND function in facilitating, within the European Route Network Improvement Plan, the development of an airspace structure offering the required level of safety, capacity, flexibility, responsiveness, environmental performance and seamless provision of expeditious air navigation services, with due regard to security and defence needs.

FABEC ensures FABEC interconnectivity and interoperability of the European route network.

FABEC fosters the development of an initiatives relying on a cooperative decision-making process.

FABEC ANSPs give due consideration to the fact that FABEC States remain responsible for the detailed development, approval and establishment of the airspace structures for the airspace under their responsibility and closely cooperate with the FABEC States Airspace Committee.

The following paragraphs describe the work related to Airspace Design accomplished or under development during the FABEC Implementation Phase (2008 – 2012).

4 FABEC AIRSPACE POLICY

The FABEC Airspace Policy will provides the framework for FABEC Airspace Design and guiding principles to overcome the divergent rules and procedures in FABEC States and ANSPs for the purpose of facilitating the implementation of airspace changes.

Regulation (EU) N0 677/2011 lists the Airspace Design Principles that apply to any FABEC airspace change.

5 FABEC AIRSPACE STRATEGY

FABEC ANSPs have adopted a FABEC Airspace Strategy as the baseline to define projects and initiatives to improve the Network Performance and provide benefits to the users in an overall FABEC Airspace Program. The FABEC Airspace Strategy document is used within the FABEC ANSPs to improve the airspace structure and airspace utilisation. The document encompasses the timeframe between 2012 and 2025 focussing on the Airspace Strategy to cope with the foreseen traffic demand both within, and transiting all FABEC Airspace.

The airspace strategy is intended to ensure a better connection between the FABEC airports and the entire European Route Network, including those free route initiatives in the FABs surrounding FABEC.

The FABEC Strategy is the framework to define airspace projects and initiatives for the purpose of improving the Network Performance and providing benefits to the users in an overall FABEC Airspace Program. The airspace strategy centres on the introduction of a three volume airspace organisation for all FABEC airspace, based on a common FABEC OPS concept :

- Free Route Airspace Volume
- Transition Airspace Volume around the top five airports (Paris, Frankfurt, Amsterdam, London and Munich);
- Fixed Route Airspace dealing mainly with evolving traffic from/to FABEC airports, or airports close to FABEC airspace, in the most efficient way whilst optimising the use of the lower airspace to improve arrival and departure routes.

Different layers are organised in sectors with dedicated procedures and working methods. The management of sectors is organised in such a way to maximize OPS performance and traffic throughput. The combination of sectors shall be organised through the different layers according to a set of Performance Criteria specific to the traffic demand characteristics, irrespective of national boundaries and other non-operational constraints.

6 FABEC OPERATIONAL CONCEPTS

The implementation of the FABEC Airspace strategy requires the development of operational concepts at FABEC level. These concepts describe at high level how FABEC operations are organized and executed. More detailed descriptions of parts of the FABEC ATM CONOPS were as well developed. Concepts are being uplifted as development work continues. FABEC conceptual documents are compatible with the ICAO Global Plan, the SESAR CONOPS, and the EUROCONTROL OCD.

As such, following operational concepts are available:

- FABEC Implementation Phase ATM CONOPS;
- FABEC Free Route Airspace (FRA) CONOPS;
- FABEC eXtended AMAN (XMAN) CONOPS;
- FABEC DMAN / A-CDM CONOPS.

These operational concepts agreed at FABEC are an essential pre-condition for future successful implementation at FABEC level.

7 FABEC SHORT TERM AIRSPACE DESIGN INITIATIVES

7.1 AMRUFRA

AMRUFRA named after the AMsterdam East sector, the RUhr sector and the Langen sectors surrounding FRAnkfurt - aims to optimize the main civil air traffic flows from/to a pair of major expanding European hubs - Frankfurt and Amsterdam airports - and to balance both civil and military airspace requirements in the Netherlands and Germany. The airspace structure was in-sufficient to support the expected growth of civil aviation and significant delays were likely to be incurred due to capacity limitations.

The basic principle of the AMRUFRA project was to split Amsterdam and Frankfurt departures laterally and to rearrange surrounding flows in a more effective way. In order to optimise the main traffic flows, a common airspace re-design was developed by the main partners: DFS, LVNL, MUAC and the Dutch & German military.

AMRUFRA was implemented on 11 March 2010.

Shortly after its implementation, the new airspace design was applauded by the Association of European Airlines who publicly welcomed the efficiencies, cost savings and rationalisation of the airspace achieved. AEA Secretary commented that "*Increased capacity – fewer delays – lower costs – lessened environmental impact – these are the benefits which AMRUFRA will unlock. This is an important first step towards fixing the legacy of the patchwork European air traffic management system, and it is encouraging that by this summer the first beneficial effects will be felt*."

7.2 Night Network

This Early Implementation Package for a night network is to make it possible for airspace users to plan tactical direct routings at night, thereby reducing flight distance, increasing fuel predictability and contingency fuel uplift. At the end of 2010 some 115 new routes have been implemented from a proposal of 189 (one hundred eighty nine) solutions to the night network.

The FABEC Night Network is continuously improved.

7.3 City Pairs

In 2009, FABEC started to work on improving the so-called 50 most penalised City Pairs. Based on a list provided by EUROCONTROL, civil and military experts investigated solutions for specified routes connecting major airports which deviate significantly from the ideal great circle routings. Most prominent examples are Amsterdam/Madrid or Paris/Munich as they have been notorious for decades and are often used by aircraft operators to illustrate the inefficiency of ATC.

FABEC experts proposed several shorter routes given the situation in which the core area is affected by a combination of main civil en-route flows, a large amount of vertical movements and many segregated military areas.

8 FABEC MEDIUM TERM AIRSPACE DESIGN INITIATIVES

Airspace Design projects within a FABEC context are by default complex projects because of numerous civil and military stakeholders being involved looking for optimal solutions accommodating both civil and military airspace user requirements.

During the Feasibility Study bottlenecks or 'hotspots' were identified in the FABEC area for consideration as these areas contain some of the busiest and most complex airspaces in the region as both the north-south and the east-west axis traffic flows cross through this airspace.

FABEC ANSP's decided after the Feasibility Study Phase to initiate without delay 4 Medium Term Airspace Design projects :

- AD South-East (TRA Hotspot)
- AD West (FABEC/DVR interface
- AD CBA-Land/Central-West (ARKON/RKN Hotspot)
- AD LUX (NTM/DIK Hotspot)

These 4 Medium Term Airspace Design projects will achieve performance improvements in formerly identified hotspot areas with a sequence of implementations bringing step-wise airspace improvements over the coming years. The projects will bring performance improvements in both flight efficiency, capacity and environment, while maintaining or improving military mission effectiveness. The main capacity improvements are expected after RP1 and full implementation of RNP1.

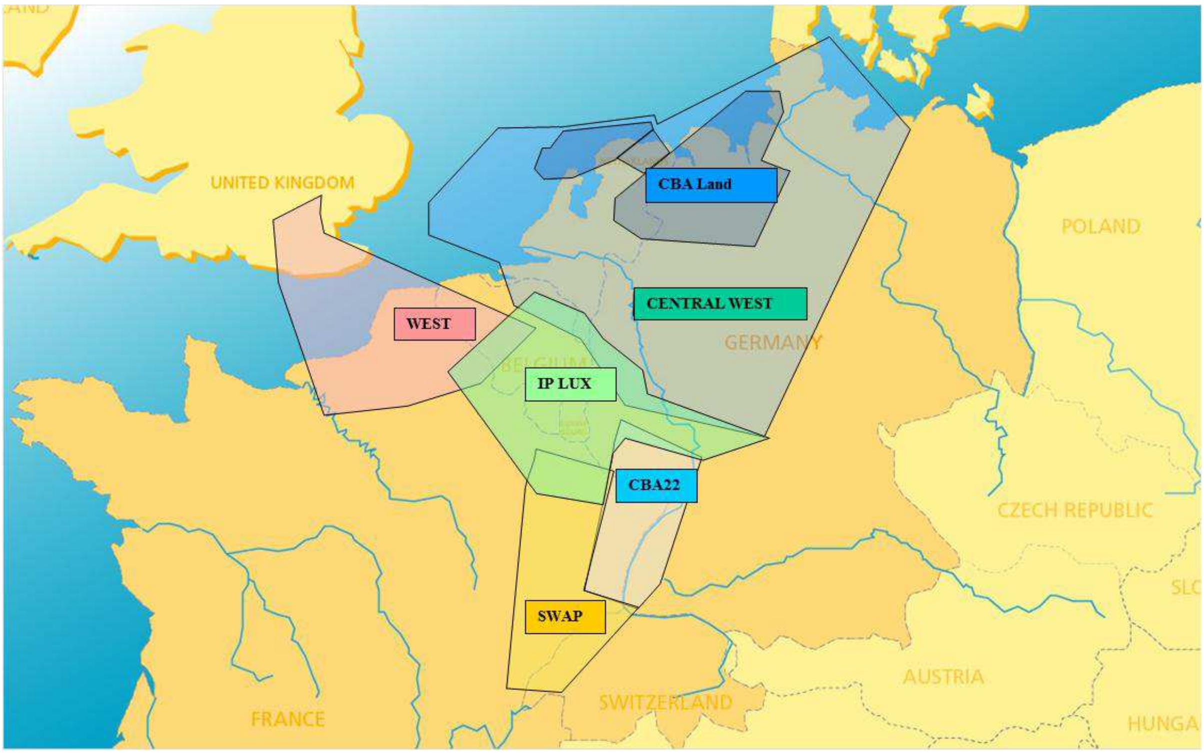

Figure: 4 Medium Term FABEC Airspace Design Projects

8.1 Airspace Design South-East project

The objective of the South East airspace project is to achieve the CBA 22 and the SWAP however given that parts of the SE airspace project are closely linked with the LUX airspace project, it was envisaged to implement the airspace changes in two phases:

Phase 1: SWAP

- Swap the one way traffic flows on routes UN852 and UN853
- Create duplicate parallel routes to allow for segregation of over flights from climbing and descending flights
- Target date for implementation: 1st Quarter 2013

Phase 2: CBA 22

- Establish a new Cross Border Area (CBA) 22 for use by the French, German and United States Air forces
- Merge the current French TSA 22, R322 and R323 military areas with the German TRA Lauter (R205 and R305) military areas
- Modify the shape (lateral and vertical boundaries) of the merged areas to allow for optimization of the Civil route network whilst continuing to satisfy Military requirements
- Target date for implementation: 1st Quarter 2014.

8.2 Airspace Design West project

Package handling the interface between FABEC and the UK/IRL FAB in the Dover area and is one of the busiest and most complex interfaces in Europe. Due to this complexity it was agreed that development and implementation will be carried out in three separate phases.

Phase 1: Reims/NATS interface

- Improves the interface between Reims and NATS
- Has positive effects on the performance of NATS
- Implemented in 2011

Phase 2: UK/BE interface

- Improves the interface between the UK and Belgium
- Provides for 3 new eastbound GAT routes between UK & Belgium and the re-shaping of CBA1.
- Target date for implementation: first quarter 2013

Phase 3: Divisional Flight Level (DFL)

- Reviews the current airspace structure of sectorisation and routes
- Supports better flight profiles and cross border operations introducing an optimised DFL and the connection with the Airspace Design Lux Project
- Target date for implementation: first quarter 2015+

8.3 Airspace Design CBA-Land/Central-West project

The objective of the CBA Land/Central West airspace project is to create and validate an airspace design for the Central-West area and the North area including across-border area (CBA) - Land.

- Project design phase till 2015
- Implementation planned in 2 steps: quarter 4 2015 and quarter 4 2016

8.4 Airspace Design Luxembourg Project

This project addresses the key bottleneck in the core area around Luxembourg. The 3 main objectives are:

- To realise GAT route network connections for the other 3 projects connecting with the LUX area;
- to alleviate the persistent GAT route network bottleneck in the LUX area and to realise adequate capacity improvements to absorb increased GAT traffic demand, enabled by the other FABEC and local ANSP airspace projects;
- In addition, a military Cross-Border Area CBA116 across France and Belgium shall be created replacing existing military areas.

9 FABEC MEDIUM TO LONG TERM AIRSPACE DESIGN INITIATIVES

9.1 Free Route Airspace

The main objective of FABEC Free Route Airspace (FRA) implementation is to offer opportunities for the users to improve efficiency of plannable direct routes / preferred trajectories within FABEC airspace and between FABEC and neighbouring FABs. A roadmap for the implementation of this concept was agreed in Jan 2012.

FRA will contribute in the environmental domain to a better performance in distance flown, in time savings and fuel consumption reduction. FRA will also provide sufficient capacity for airspace users while ensuring a high level of safety. An advanced FABEC FUA concept will provide an utmost balanced solution between civil and and military requirements.

The FABEC FRA project can build on 2 FABEC Free Route Airspace related projects already ongoing within FABEC:

- FRAM in MUAC airspace
- FRAK in Karlsruhe airspace

It is considered that there is a need for different steps for the optimised introduction of FRA in each FABEC Control Centre.

The FABEC FRA project will have 3 major steps:

- Step 1: Implementation of direct connections in a defined airspace outside military activity
- Step 2: Permanent (H24/7) implementation of direct connections in a defined airspace with active military areas, supported by implementation of advanced FUA
- Step 3: Introduction of Business trajectories (using SESAR deliverables).

The stepwise implementation – with different pace for the FABEC ANSPs will have major milestones in 2013, 2016 and 2019.

9.2 Point Merge (PMS) project

Point Merge presents a method to merge arrival flows of aircraft without using heading instructions. The principle is to achieve the aircraft sequence on a point with conventional direct-to instructions, using predefined legs at iso-distance to this point for path shortening or stretching.

In the context of SESAR, FABEC set up a project to implement the principle for the approach to Paris Charles-de-Gaulle. This project is called PMS TE (Point Merge System Terminal Extended).

9.3 Extended Cross Border Arrival Manager (XMAN)

FABEC provides a unique opportunity to develop a harmonised approach to arrival management in the core area of Europe.

Within the Core Area, DFS (serving Frankfurt and Munich airports), NATS (serving London airports), LVNL (serving Amsterdam airport), DSNA (serving Paris airports) and Belgocontrol (serving Brussels airport), i.e. the ANSP's serving the major Hubs, have implemented or intend to implement Arrival Management techniques within their Technical Systems and Operational Procedures.

These implementations are currently limited to the responsible Approach/ACC Units, except for Munich, where an extension of arrival management operations into the adjacent Vienna En-Route centre has been implemented.

By extending the time-horizon of such Arrival Management (AMAN) techniques into adjacent and/or Upper Airspace, it is envisaged that the effects on the environment will be minimised, and at the same time, that controller workload in lower airspace will be reduced.

The necessary extension of arrival management operations is expected to reach out to a horizon of about 200 NM around the major airports. Together, these horizons will cover almost the entire FABEC airspace. Therefore, most of the FABEC control centres will be affected by extended AMAN operations, some of which will need to feed several arrival streams for different airports/TMAs.

The arrival and departure management needs to be implemented as a prerequisite for the full implementation of the FRA CONOPS.

9.4 Airport Collaborative Decision Making /Departure Manager (A-CDM/DMAN)

Airport CDM is an operational overall process (concept/procedure) supporting an optimised turn-round process at an airport. It covers the period of time between the estimated off-block time (EOBT) -3hrs and take-off and is a coherent process from flight planning (ATC flight plan) to landing and the subsequent turn-round process on the ground before the next take-off.

Airport CDM will become an operational process at secondary airports . (Brussels, Zurich, Berlin, Dusseldorf) in addition to the 5 major TMAs (Paris, Amsterdam, Frankfurt, Munchen, London), as these airports have an important impact on major TMAs.

Within the FABEC region A-CDM is already implemented at Frankfurt, Munchen, Paris CDG, and Brussels. At all other airports A-CDM implementation is planned for 2014.

FABEC

FABEC Implementation Phase

FABEC Airspace Strategy

EC Information

Attachment N.1

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

DOCUMENT SUMMARY

Objective :	Airspace Strategy		
Origin :	Chair SC OPS	**Audience** :	SC OPS

Title :	FABEC Airspace Strategy
Reference :	*FABEC Airspace Strategy V0_5*

Version : 0.5	**Date** : *01/03/2012*	**Status** : ☑ Draft ☐ Released	**Classification** : ☐ Public ☑ FABEC limited ☐ Addressees limited

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0.3	27/02/2012	Layout	P. van Hoogstraten
0.4	06/03/2012	Input CM SG AIM	P. van Hoogstraten
0.5	22/03/2012	Input and agreement SCO	P.van Hoogstraten
1.0	TBD	Endorsement by ASB	

1 TABLE OF CONTENT

2 INTRODUCTION

The ANSP Strategic Board conducted two Workshops to define a FABEC Airspace Strategy. This document describes the FABEC Airspace Strategy, as it has been adopted by the FABEC ANSPs and as it will be used within the FABEC ANSPs to improve the Airspace structure and the Airspace utilisation. It is the baseline to define projects and initiatives to improve the Network Performance and provide benefits to all users in an overall FABEC Airspace Program. This document should be considered as a living document, which will be updated regularly.

Abbreviations used in this document:

RP1	– Reporting Period 1
STRATFOR	– Strategic Forecast
ACC	– Area Control Centre
UAC	– Upper Area Control Centre
ATCO	– Air Traffic Control Officer
DFL	– Division Flight Level
AMAN	– Arrival Management
XMAN	– Cross Center Arrival Management
DMAN	– Departure Management
A-CDM	– Airport Collaborative Decision Making
PBN	– Performance Based Navigation
ETSI	- European Telecommunications Standards Institute
RNP1	- Required Navigation Performance 1 (NM)
FRAM	- Free Route Airspace Maastricht
FRAK	- Free Route Airspace Karlsruhe
ARN	- ATS Route Network
ATFCM	- Air Traffic Flow and Capacity Management
ASM	- Airspace Management
AIM	- Aeronautical Information Management
NMF	- Network Management Function

3 OBJECTIVES

FABEC is focussing the Airspace Strategy to cope with the foreseen traffic demand within FABEC and transiting the FABEC Airspace.

<u>Safety</u>

The FABEC development shall take all efforts necessary to ensure an improved safety level. This means that, despite the civil traffic growth, the current absolute number of ANS-induced accidents and risk bearing incidents shall not increase or will even decrease.

RP1

EU-wide KPI	FABEC PI - objectives	To Be Developed
Minimum level of effectiveness of safety management for Air Navigation Services Providers and National Supervisory Authorities respectively.	Effectiveness of safety management as measured by a methodology based on the ATM Safety Maturity Survey Framework.	Baseline for 2012. Objectives for 2013-2014.
Percentage of application of the severity classification of Risk Analysis Tool for Separation Minima Infringement, Runway Incursions and ATM Specific Technical Events	Application of the severity classification of Risk Analysis Tool for Separation Minima Infringement, Runway Incursions and ATM Specific Technical Events at all Air Traffic Control Centers and airports with more than 150 000 commercial air transport movements per year. Implementation of the Risk Analysis Tool at all FABEC ANSPs. Harmonization of working methods, definitions, and historical data building.	
		Cost Benefits Analysis and an Initial Feasibility study for the implementation of automated reporting tools, to be completed at the end of RP1.
Minimum level of the measure of Just Culture at the end of the reference period.	Reporting of Just Culture	

<u>Capacity</u>

Develop the airspace capacity so as to meet the demand of increased civil air traffic in the range of 50% by 2018 based on EUROCONTROL STATFOR forecasts, taking into account the current agreed delay target of 1 minute per flight and taking into account the military needs.

RP1

EU-wide KPI	FABEC KPI/PI	PIs To Be Developed
Average en route ATFM delay per controlled flight (EC 691/2010)	KPI#1: Average en route ATFM delay per controlled flight	Total of air traffic flow management (ATFM) delays attributable to terminal and airport air navigation services
	PI#1: percentage of controlled flights with an en route ATFM delay of 15 minutes or more	Additional time in the taxi out phase,
	PI#2: Percentage of controlled flights with any en route ATFM delay	Additional time for arrival sequencing and metering area (ASMA) for airports with more than 100.000 commercial movements per year.

<u>Flight efficiency</u>

The FABEC development shall significantly contribute to improve the flight efficiency by improvements of routes, flight profiles and distances flown. In 2006 the average extension of flights in the EUROCONTROL area related to the Great Circle distance has been around 48 km. The target will be a reduction in the FABEC area in the average route extension of two kilometres per annum until 2010, increasing to an accumulated total of 10km by 2018.

RP1

Not defined. This KPA belongs to the Network Manager and will be covered in the Network Management Performance Plan.

<u>Environment</u>

The FABEC development shall contribute to reduce the impact on environment by improvements of routes, flight profiles and distances flown.

RP1

EU-wide KPI	FABEC KPI/PI	To Be Developed
Average horizontal en-route flight efficiency (EC 691/2010)	KPI #1: % of route extension represented in distance flown compared to great circle distance	Effective use of civ/mil airspace structures (EC 691/2010)
	KPI #2: Approach procedures in place supporting CDO operations (ICAO Doc 9931)	KPI addressing the specific airport air navigation services (ANS)-related environment issues (EC 691/2010)
	PI #1: % of route extension of intra FABEC flights represented by last filed flight plan compared to great circle distance	Continuous Descend Approach (CDA) conformity

<u>Military Mission Effectiveness</u>

The FAB EC development shall significantly contribute to improvement of military mission effectiveness by improvements of training capabilities and readiness postures as required by States.

RP1

FABEC KPI #1

Published SUA structure vs Optimum SUA dimension

This KPI demonstrates percentage-wise how closely the published SUA dimensions conforms to the Optimum SUA dimensions per mission type for the most penalizing mission in that SUA.

FABEC KPI #2

Percentage of SUA capacity Allocated

This KPI should indicate how much airspace can be allocated after taking the civil constraints into account, compared to the requested SUA.

FABEC KPI #3

Total Training Time vs Total Airborne Time

The result provides a measure of the time actually spent in the SUA compared to the total time airborne.

	BELGIUM	FRANCE	GERMANY	THE NETHERLANDS	SWITZERLAND
KPI #1	To improve if smaller than 100%	Monitored (*)	The current situation shall not be degraded	The current situation shall not be degraded	Monitored (*)
KPI #2	100% which is the current situation	Monitored (*)	100% which is the current situation	The current situation shall not be degraded	Monitored (*)
KPI #3	Minimum 85%	Monitored (*)	The current situation shall not be degraded	The current situation shall not be degraded	Monitored (*)

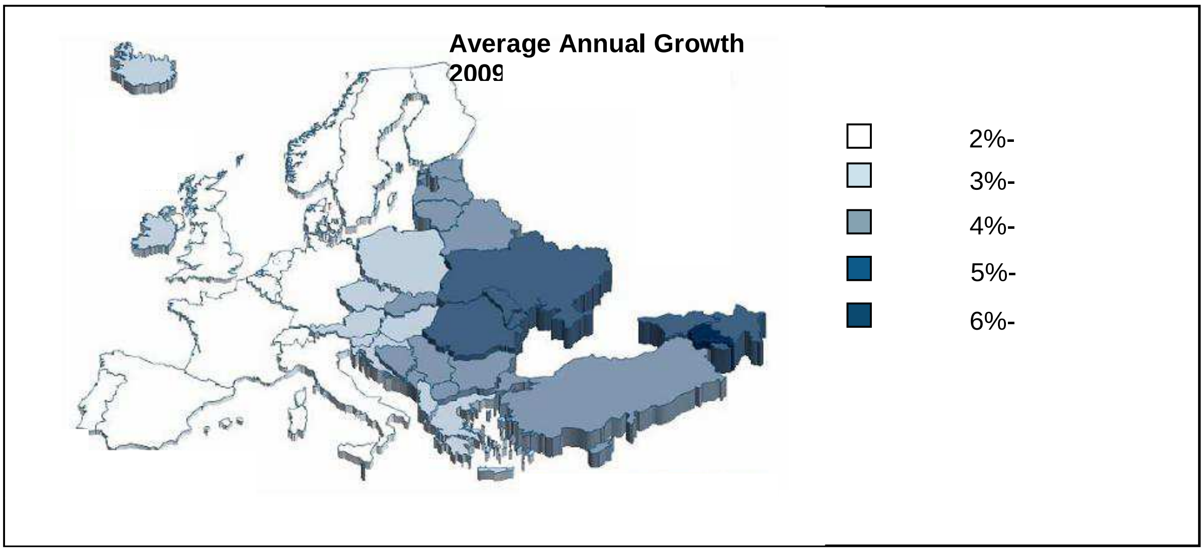
(*)The current situation of MME shall not be degraded

4 SCOPE

The FABEC Airspace Strategy encompasses the timeframe between 2012 and 2025 and includes all FABEC airspace. The FABEC Strategy is the baseline for current projects and new initiatives to improve the Network performance.

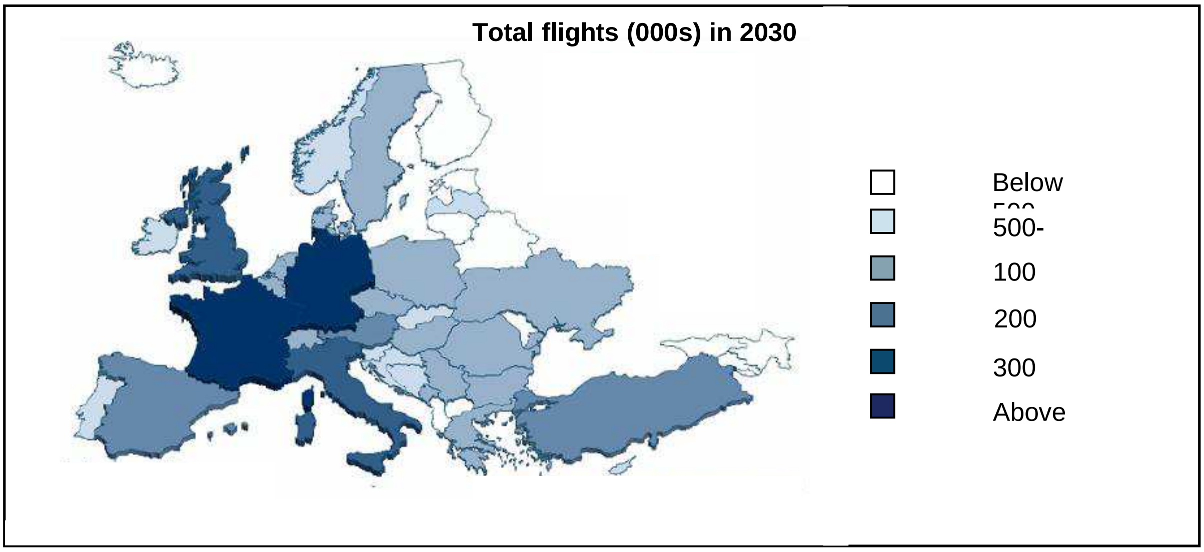
5 TRAFFIC FORECAST 2030

Based on Eurocontrol figures, it is expected that traffic in the FABEC airspace will grow substantially (average 2,4% annually) until 2030. This traffic growth is mainly concentrated in the upper airspace, caused by growing markets in Eastern Europe (3-7% annually) and a stronger position of the Middle-East hubs. This traffic will mainly use the FABEC airspace to cross to/from the Atlantic airspace.



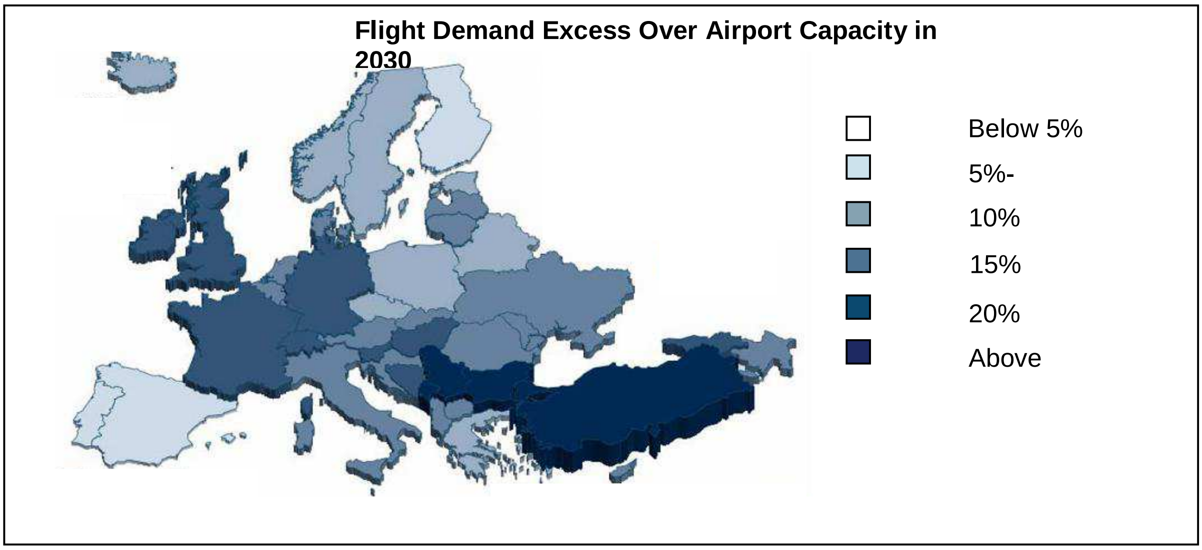
Source: Eurocontrol/SAAM

The effect on current traffic streams within FABEC airspace is a growing constraint within the Swiss, France and the German airspace on the East-West route-structure. Substantial growth is expected on the North-South axis. The picture below provides an indication of the traffic demand and distribution within the FABEC airspace.



Source: Eurocontrol/SAAM

Furthermore, it is expected that hubs and major airports in France, Germany, Switzerland and the UK will generate substantially more traffic, exceeding the airport capacity with 20-30%. Less growth is expected for airports in the BeNeLux, but still exceeding airport capacity with 10-15%.



Source: Eurocontrol/SAAM

The total effect for the upper airspace is a non-homogeneously growth within FABEC. The table below provides an indication for the FABEC ACCs/UACs in 2030.

ANSP	Centre	Code	Capacity 2010	Capacity 2030	Growth (%)
Belgocontrol	Brussels ACC/FIC	EBBU	112	181	62%
DFS	Langen ACC/FIC	EDGG	239	378	58%
	Munchen ACC/FIC	EDMM	222	314	41%
	Rhein UAC	EDUU	310	594	**92%**
	Bremen ACC/FIC	EDWW	151	190	26%
MUAC	Maastricht UAC	EDYY	306	534	**75%**
LVNL	Amsterdam ACC/FIC	EHAA	130	183	41%
DSNA	Bordeaux FIC/ACC/UAC/CCER	LFBB	170	306	**80%**
	Reims FIC/ACC/UAC/CCER	LFEE	171	280	64%
	Paris FIC/ACC/UAC/CCER	LFFF	244	387	59%
	Aix-en-Provence (Marseille) FIC/ACC/UAC/CCER	LFMM	216	411	**90%**
	Brest FIC/ACC/UAC/CCT/CCER	LFRR	169	310	**83%**
Skyguide	Geneva FIC/ACC/UAC	LSAG	137	218	59%
	Zurich FIC/ACC/UAC	LSAZ	157	258	64%

Source: Eurocontrol/SAAM

The traffic is expected to be 1.6 times the total amount of traffic in 2009. The table below provides an indication of the annual expected traffic growth.

The average Annual Growth is expected as follows:

Years	Average annual growth (%)	Cumulative growth per timeframe (%)
2010/2016	2.7	16.2
2017/2020	2.0	8
2021/2025	2.5	12.5
2026/2030	2.3	11.5

For military traffic, no hard figures are available, but based on current expectations it is foreseen that less military training flights will be conducted, requiring - at times – more airspace. This is due to the fact that military training missions become more complex, where different military functions are required for an effective execution of the mission.

The main conclusions are:

- Traffic will grow substantially, but not homogeneously;
- Traffic will grow particularly in the upper airspace (crossing FABEC airspace);
- Substantial traffic growth (40%) is expected in the lower airspace for arrivals and departures from major airports and hubs;
- Total IFR movements within FABEC airspace will grow from 10.5 million annually to 16,9 million in 2030;
- The Western part of FABEC will see the largest capacity demand;
- The Southern part of FABEC will see severe traffic growth in the upper airspace (above 75%);
- Less military training missions, but requiring more airspace at times.

Uncertainty remains on the traffic expectations, due to uncertain economic growth, military requirements and other factors. The latest traffic expectations (February 2012) of STRATFOR are not considered yet, but it is expected that the traffic growth will be delayed with some years.

6 THE AIRSPACE VISION

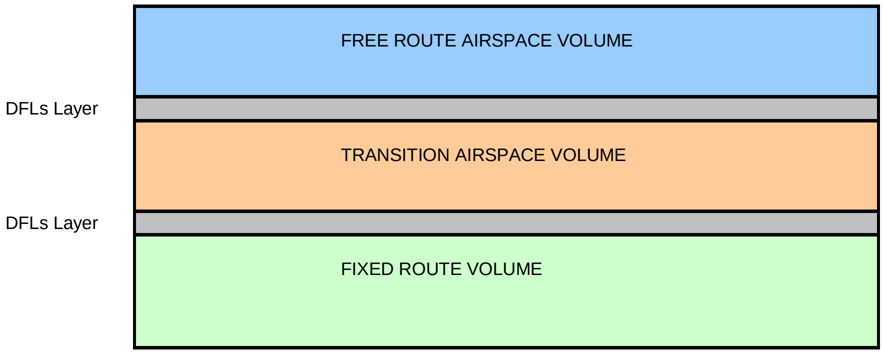
The FABEC Airspace vision is based on the outcomes of the FABEC Feasibility Study Report, the current developments of some airspace concepts like Free Route Airspace, Cross-border Arrival Management and SESAR projects.

The main objective of this vision is to set the appropriate framework on how airspace should be organized to achieve a high performing continuum airspace throughout the FABEC. This airspace shall also fulfill the military obligations.

The picture below depicts how FABEC airspace should be organized in the future. Contrary to the current two layer structure (Upper and Lower airspace), there is a need to enable an operational focus on managing the transition between these layers in order to make the best possible connection between the differences in traffic management, operational procedures, system support, etc. For this reason, a Transition Layer has been introduced. As a result, three volumes of airspace are identified:

- **The Free Route Airspace Volume**: This volume of airspace will mainly focus on the efficiency of managing en-route traffic within the FABEC airspace. This volume supports eventually a Free Route Airspace concept, and all other operational concept aspects (Traffic Management procedures, ATCO working methods, etc.) are optimized for efficient high throughput of en-route traffic.
- **Transition Airspace Volume**: This volume of airspace is characterized by the transition between en-route and arrival/departure operations. Without disregarding en-route traffic in this volume, it will mainly be determined by the requirements of the management of traffic inbound and outbound of the major hubs, or any other airport if operational efficiency requires so. Transition between a Free Route system and a Fixed Route system is one of the required design aspects, which may result in any type of route system(s). However in a more general view, also all other design factors shall be optimized to enable the best performance on respectively integrating departure traffic into the Free Route Airspace and the facilitation of arrival traffic into arrival management operations.
- **Fixed Route Airspace volume**: This volume will mainly deal with evolving traffic from/to FABEC airports or airports close to FABEC airspace in the most efficient way. It contains a Fixed Route type of operations, but more generally its operational concept is focused on supporting improved handling of flows to/from major hubs, clustering of airports directly impacting each other, gate to gate operations etc.

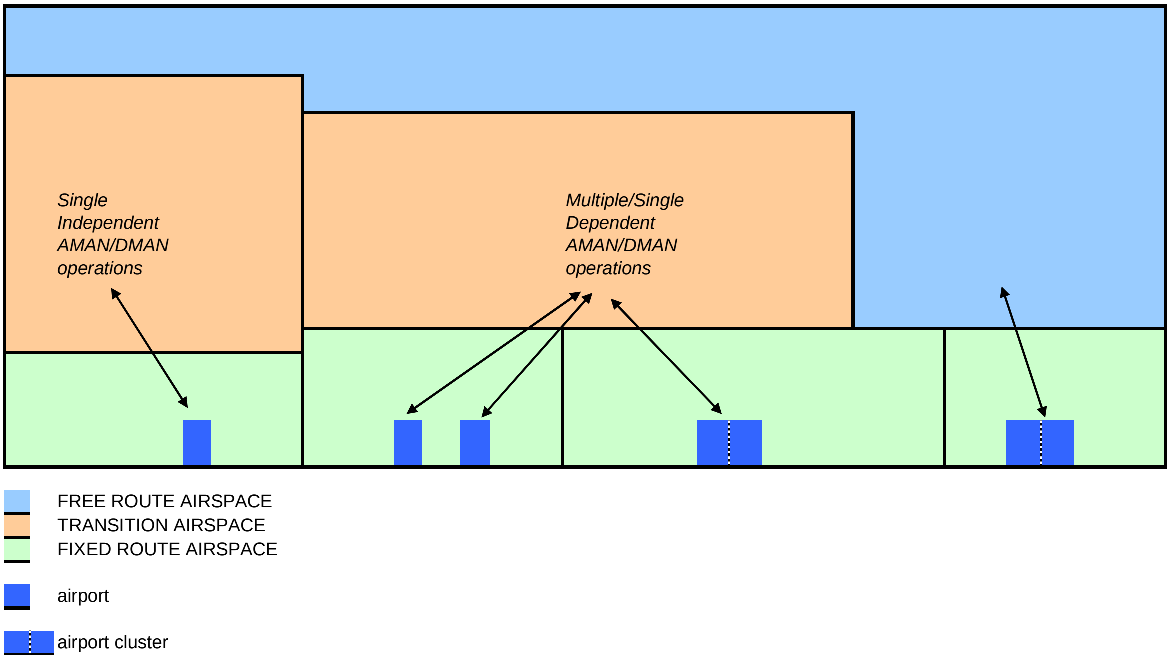
Note: The DFLs Layer only identifies that following the Performance to be achieved the DFL between the volumes as defined above may vary.



Note: Segregated airspace is embedded in the above organization.

The different layers are organized in sectors with dedicated procedures and working methods. The management of sectors should be organized in such a way to maximize OPS performance and traffic throughput. The combination of sectors should be organized through the different layers according to a set of Performance criteria specific to the traffic demand characteristics, irrespective of national boundaries and other non-operational constraints. Consequently, e.g. current practice of super-imposed design of sectors in the different layers should not be a limiting factor. This is relevant for both the horizontal and vertical dimension, even extending into the time dimension. Where required for best performance, combination of sectors across the different layers should be possible, preferably flexibly over time as traffic characteristics vary. Similar or harmonized operational concepts are needed along a combination of sectors.

For illustration purposes, a possible layout of FABEC airspace structures could look like the following:



The different blocks represent airspace volumes whose limits (vertical and horizontal) are only defined by OPS requirements (Civil and Military). The grouping of the different airspace should lead to an OPS concept that will deliver maximum performance.

The figure above also depict, depending on how the grouping of airspace volumes is conducted, the probability of one center be confronted with multiple AMAN operations within complex areas as the higher part of the transition layer will most probably handle traffic towards the major FABEC hubs.
In areas of less complexity and/or periods of low traffic demand, a direct transfer between Terminal Airspace and Free Route airspace could be envisaged without any requirement for a transition airspace volume.

7 FABEC AIRSPACE STRATEGY CONSIDERATIONS

The FABEC strategy will focus to take the necessary steps to evolve the FABEC airspace structure towards the vision described above by:

- Taking into account FABEC airspace as a continuum;
- Given that FABEC airspace is a continuum airspace, the grouping of sectors into operational units should support maximization of the overall FABEC performance in a context of growing traffic demand;
- Harmonisation of design methods;
- Harmonization of operational procedures;
- Supporting and integrating new airspace concepts or new ATM technologies (PBN concepts, Dynamic Sectorization, Multiple AMAN operations etc.).

This airspace strategy will take into account:

- The forecasted growth of traffic within the FABEC airspace;
- The expected change of flows with the foreseen development of traffic in the Eastern countries;

- The SES Framework.

8 KEY ENABLERS

To support such an airspace strategy, some key enablers have been identified. The first three are considered crucial for the FABEC Airspace Strategy:

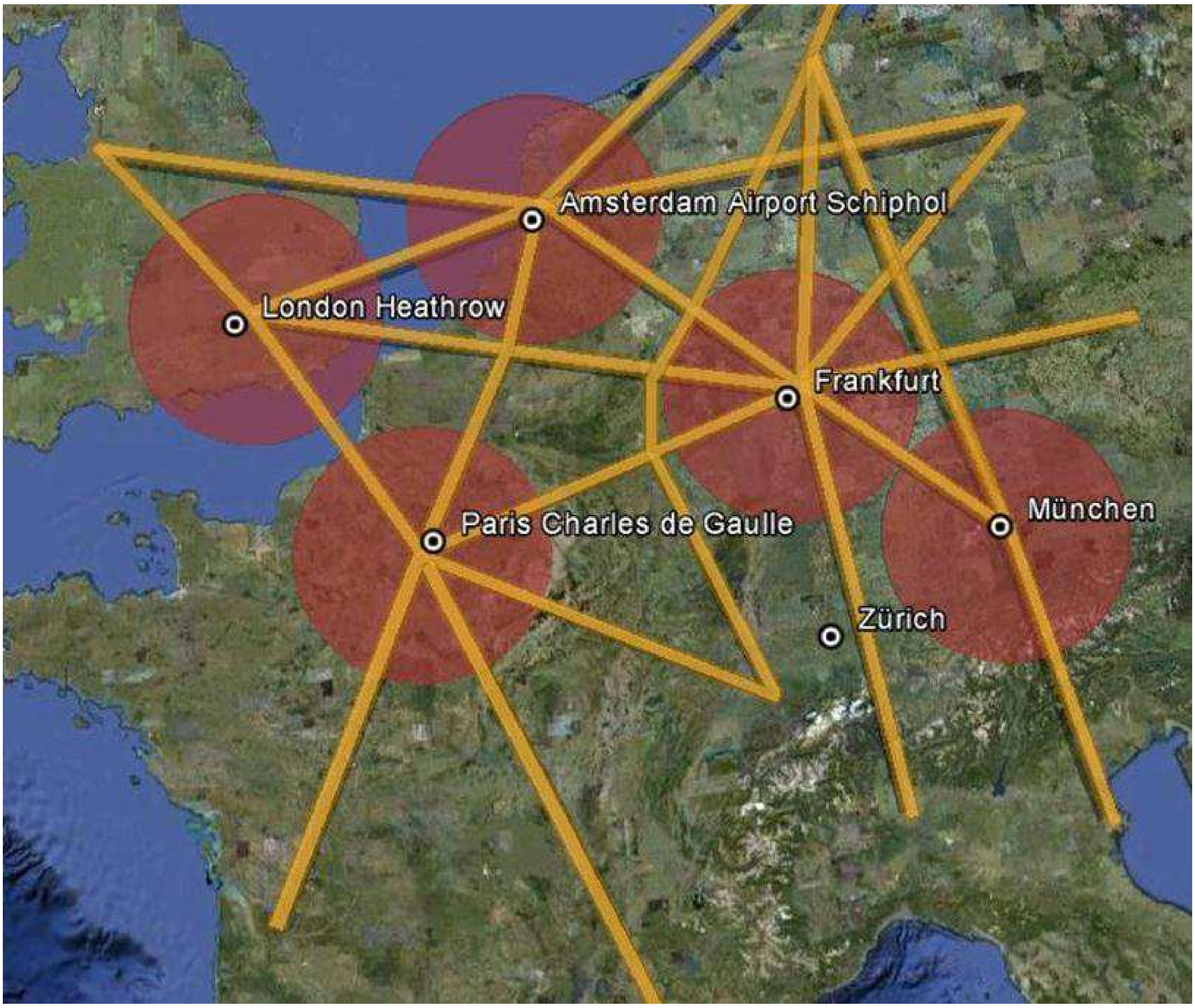
- **Consistent performance plans at Network level, FABEC level and local ANSP level;**
- **The financial framework supporting cross-border operations;**
- **The required and harmonized implementation of all levels of Flexible Use of Airspace, including booking principles and priority rules.**

- The legal and institutional framework supporting cross-border mechanisms;
- The technical facilities both on-ground and in-the-air supporting the concepts;
- Arrangements to fulfill local procedures for noise abatement;
- A harmonized “lead-in” time for approval of Airspace changes, close to the implementation date;
- The appropriate framework supporting CIV/MIL integration/collocation.
- RNP1 mandatory implementation in the European Region.
- Mandatory implementation of the ETSI Communication specification for Airport CDM.

9 FOCUS

The airspace strategy centres on the introduction of a three volume airspace organisation for all FABEC airspace, based on a common FABEC OPS concept:

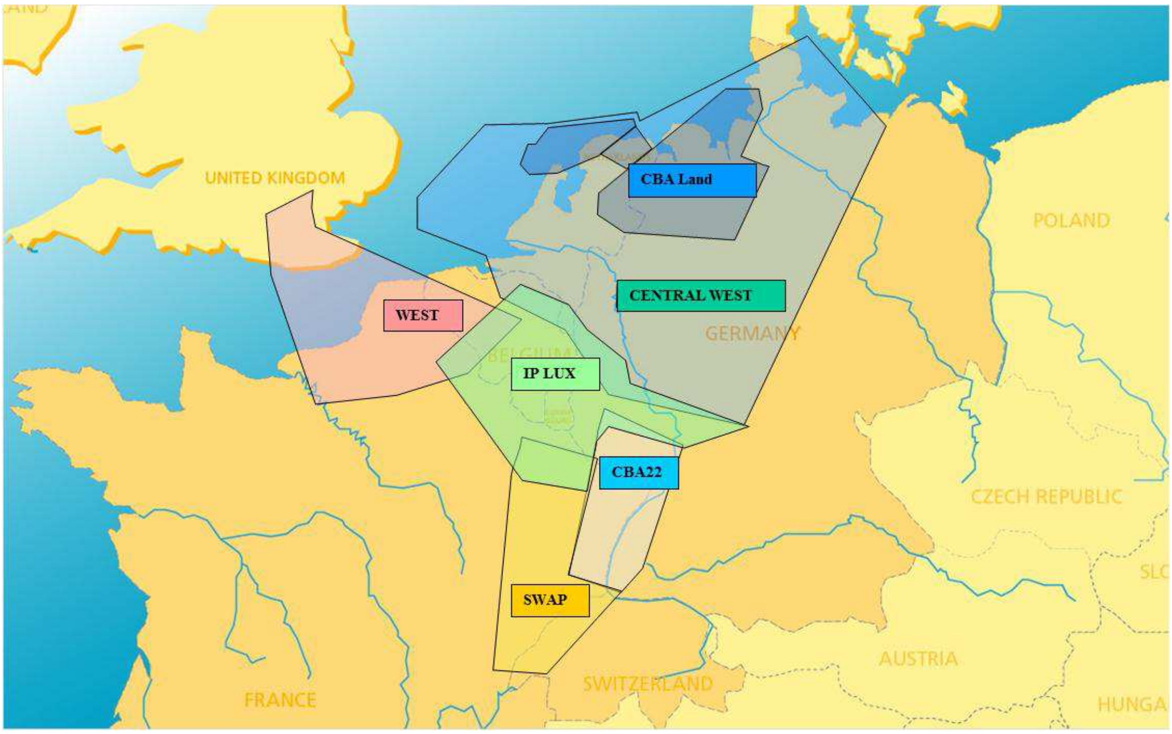
- a free route airspace volume over the greatest possible FABEC area;
- a transition airspace volume in which the transition from free route to fixed route airspace and vice versa will take place, focusing on the harmonised development of airspace to support traffic flows around the top five airports (Paris, Frankfurt, Amsterdam, London and Munich);
- a fixed route airspace volume intended to optimise the use of the lower airspace to improve arrival and departure routes.



The airspace strategy is intended to ensure a better connection between the FABEC airports and the entire European Route Network, including free route initiatives in the FABs surrounding FABEC.

10 CURRENT AIRSPACE DESIGN PROJECTS

Current FABEC Airspace Design Projects are focussing on bringing benefits to the users by optimization of the current route network in areas with high traffic complexity. These Airspace Design projects will be developed and implemented, taking note of the FABEC Airspace Vision. The AD Projects are considered as an integrated part of the FABEC Airspace Strategy. The AD Projects will bring performance improvements in both flight efficiency, capacity and environment, while maintaining or improve military mission effectiveness. The main capacity improvements are expected after full implementation of RNP1.



11 NEW INITIATIVES

FABEC will start three new initiatives to develop and implement the Airspace Strategy (FRA):

1. FABEC wide development and implementation of Free Route Airspace;
2. Development and implementation of Cross center arrival management, including current arrival management initiatives at local level (XMAN/AMAN);
3. Development and implementation of Departure management, including Airport Collaborative Decision Making (DMAN/A-CDM).

A common FABEC Concept of Operation (CONOPS) will be the basis for the harmonized development and implementation of new initiatives and overall consistency with current projects.

12 FREE ROUTE AIRSPACE

The main objective to develop Free Route Airspace within FABEC is to optimise the major traffic streams within the FABEC area. The purpose is to provide direct routings for Airlines through FABEC Airspace, which will improve flight efficiency and reduce emissions. Furthermore, FABEC will be able to connect to other Free Route initiatives within other FABs. Moreover, Free Route Airspace will enable re-distribution of traffic flows, to relieve the most congested airspace within FABEC.

A Concept of Operations (CONOPS) for FABEC Free Route Airspace has been developed and agreed. Furthermore, a high level Roadmap for Free Route Airspace (including system enablers) and a performance indication for FABEC Free Route Airspace has been agreed.

The CONOPS is based on the Eurocontrol ARN V7 deliverable and matches current Free Route activities within FABEC (FRAM (MUAC) and FRAK (Karlsruhe)) and the SESAR ATM Concept.

The FABEC Roadmap for Free Route Airspace describes three steps for FABEC wide development and implementation of Free Route:

1. Step 1 encompasses implementation of Free Route outside military activities. It focuses on extending the Night Network and Weekend direct routings. No substantial requirements for system upgrades are foreseen for this phase. Cross border and FABEC wide implementation will be favoured.
2. Step 2 encompasses implementation of Free Route in an airspace with military activity. Where possible cross center/border or FABEC wide implementation will be favoured too. It is envisaged that some essential system upgrades are required to facilitate this phase. Most of those system enablers are already planned for implementation in current system upgrade plans at Center level to facilitate other operations. For step 2, it is required to implement and execute all levels of Flexible Use of Airspace, including booking principles and priority rules for military training areas in a harmonised way.
3. Step 3 encompasses the development and implementation of FABEC wide business trajectories within the FABEC Free Route Airspace Volume. The deployment of SESAR deliverables for this phase is required. It is required that current system upgrades are implemented before Step 3 could start.

Free Route Airspace will be implemented FABEC wide at a minimal flight level 365 and lower where appropriate. The lower limit for Free Route Airspace is dependent of the complexity of the airspace.

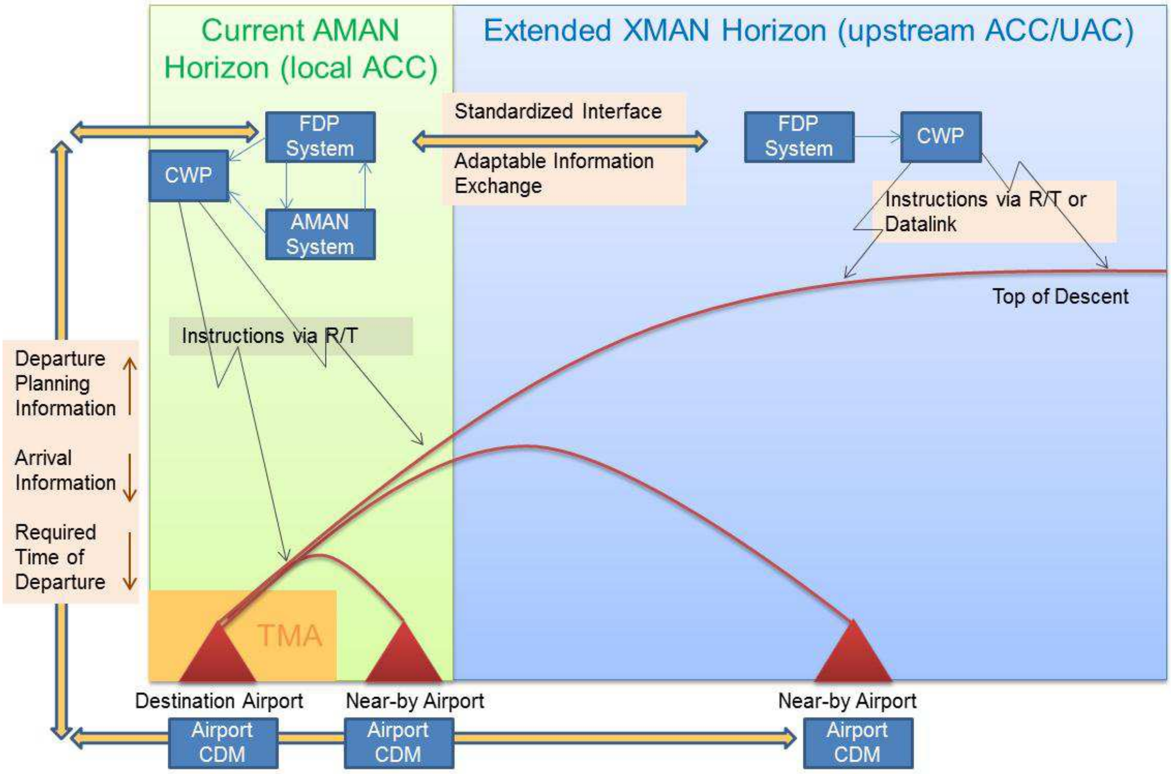
13 XMAN/AMAN, DMAN/A-CDM

The main objective for the development of XMAN/AMAN, DMAN/A-CDM is to manage the traffic in and out TMAs and transition interfaces - where necessary- and link with the FRA Volume. Upstream sectors will manage traffic to the Top 5 airports, based on requirements in the (extended) TMAs. Optimising the traffic streams to/from the major airports, does not only require arrival management optimisation, but also require Departure management. The average flight time within FABEC is 50 minutes. Arrival management sequencing will start at the departure airport with Departure management. Since Arrival Management and Departure Management are linked via Airport-CDM, this part was taken into consideration too. By doing so, a gate-to-gate management circle of the airports and corresponding airspace will be implemented. Information exchange between AMAN, DMAN and Airports will become available. Major performance improvements for all stakeholders are to be expected, including substantial improvements for the network.

Arrival Management is available with FABEC for all major airports. It is now required to extend the Arrival Management to Cross Border Arrival Management, streamlining the traffic in the transition airspace to prevent interference of individual traffic streams to/from the top 5 airports. Cross Center Arrival Management (XMAN) will be developed for this purpose.

XMAN

- Extends the planning horizon of AMAN systems into the airspace of upstream ACC/UAC up to 200 NM, including economical Top of Descent (ToD),
- Provides upstream ACC/UAC with information for pre-sequencing of the arrival stream,
- Utilizes current AMAN systems operated at the top 5 TMAs within FABEC (and at intermediate FABEC airports),
- Relies on existing infrastructure for information exchange,
- Accommodates flights from airports within the extended horizon of arrival management.



The CONOPS for XMAN/AMAN is consistent with ongoing activities within several ANSPs for the development of AMAN at local level and is in line with SESAR developments for Cross Border Arrival Management. This is also valid for the CONOPS DMAN/A-CDM.

Both Roadmaps define the steps to be taken for a phased implementation at local level and for cross center developments to allow upstream management of traffic to/from the major airports.
Next steps are foreseen to connect other airports via XMAN.

System Requirements are described for XMAN/AMAN implementation. For DMAN/A-CDM system requirements were described, using the ETSI community specification for Airport CDM.

14 AIRSPACE ORGANIZATION

To effectively deliver capacity to airspace volumes when required, airspace and sector structure have the ability to adapt to predicted traffic flows and workload without delay or restriction: the airspace design allows sectorisation to be flexibly modified, and to allow that resources are allocated where the traffic demands.

The Airspace Strategy in particular covers following areas:

- Military training areas which could be established regardless of the national boundaries of the FAB partners (Support inter-FAB CBA's).
- Creation of modular and dynamic areas.
- Fixed route system.
- Free Route operation in certain areas.

Areas in which free route operations or dynamic areas for military training could be beneficial for the overall performance will be determined, considering the factors complexity and density of traffic. Potential performance improvements will be assessed (i.e. capacity increase, cost/benefit analysis, safety case).

Airspace design shall meet the military operational requirements and civil requirements. Areas for military training or mission purposes shall not be restricted by national boundaries (CBA).

A new airspace design will incorporate cross-border sectors that go considerably further than the existing delegations. Similarly, vertical borders (i.e. Division Levels between ATS-Units) may also be altered to allow operational improvements.

Airspace re-design in the core area will:

- Focus on addressing operational issues;
- Define performance driven solutions to be assessed at Network Level;
- Provide the required capacity according to SES IR;
- Support vertical and horizontal improvements in flight efficiency;
- Support optimal traffic flows to / from the HUB airports in the FABEC airspace;
- Aim to distribute the workload evenly throughout the airspace structure;
- Disregard national boundaries when designing sectors.

The concept of Sector Families incorporates larger sectors, along the main FABEC Route Network and boundaries of sector families are in areas of low interaction. These facts will improve productivity and consequently will be used to improve flight efficiency and/or capacity in a balanced way.

Development and implementation of a sector Family Concept will allow to create sectors tailored to the expected traffic flows. Sector families will be developed and implemented by analysis of the traffic density and the conflict density with different level bands in the FABEC area.

To effectively deliver capacity to airspace volumes when required (both at strategic and pre-tactical level), airspace and sector structure must have the ability to adapt to predicted traffic flows and workload without delay or restriction: the airspace design should allow sectorisation to be flexibly modified, and to allow that resources are allocated where the traffic demands.

15 ATFCM/ASM

The available airspace within FABEC is limited and additional steps are required to maximize the utilization of the available airspace for all users. For this purpose a FABEC ATFCM/ASM function is foreseen. Initial trials were executed in 2009 and 2011 and a next phase is foreseen in 2013 with an initial implementation. Close cooperation between the civil- and military partners is required, as well as with the Network Management Function.

The FABEC ATFCM/ASM function will enable prioritization of airspace utilization and provides full flexibility of airspace allocation via the Flexible Use of Airspace (FUA) concept. Full harmonization and application of all levels of FUA is foreseen within the FABEC airspace.

The planning of ATFCM/ASM at FUA level 2 is based on negotiation and shall take into account the required booking of military activity and the expected traffic demand. The available military pre-planning is taken into account. This implies the use of a “rolling” use plan to inform - up to date - all relevant parties.

If a change occurs that makes activities in terms of ATFCM unavoidable, short term measures supported by fast-time simulations will be initiated to react to this change by finding the most satisfying solution for all parties involved, according to predefined performance criteria for the FAB. Potential impacts to adjacent partners or neighbouring units / FABs / aerodromes will be identified and coordinated.

Pre-tactical ATFCM/ASM processes will take place closer to the time of operation to identify early in advance ASM solutions to overcome capacity shortfalls while allowing late revised airspace allocation (minimum: 3 hours).

16 CONCEPT OF OPERATION

FABEC will define a Concept of Operation –CONOPS- which will connect the CONOPS Free Route Airspace to the CONOPS XMAN/AMAN and DMAN/A-CDM. This overarching FABEC CONOPS will serve as the leading CONOPS for the development and implementation of new initiatives and will be used for further development within the current FABEC Airspace Design Projects. Essential elements identified during the FABEC Feasibility Study and the SESAR Masterplan will be incorporated into the FABEC CONOPS. Furthermore, the results of the FABEC ATFCM/ASM Live Trial, including requirements for a future FABEC ATFCM/ASM function, will be used to finalise the FABEC CONOPS.

17 AIM SERVICES

FABEC is defining an AIM Strategy with the main objective to support the overall Airspace Strategy. Decisions on the way forward will be based on a Business case, which is currently being developed taking into account four major elements:

- Business Proposition;
- Services/Customers (ATM);
- Financial Assessment/Results;
- Implementation.

At the same time FABEC is working on a FABEC-wide harmonization of aeronautical data with priority on the data sets needed for the different Airspace Design Projects. In addition

a common planning and FABEC-wide synchronised publication process will be defined, with the focus on timely and synchronised cross-border AD Project publications.
The objectives are to provide direct support to the FABEC Airspace initiatives.

18 SESAR

Currently, FABEC is participating into the SESAR program at individual ANSP level. The FABEC CONOPS is consistent with the SESAR ATM Masterplan. FABEC will take initiatives to align the activities with the foreseen SESAR deliverables. Particularly Free Route step 3 development is strongly dependent on these deliverables. Other developments within the context of the Airspace Strategy, will support the SESAR deployment and FABEC Airspace Strategy i.e.:

- Airspace Management tools;
- Point Merge System development;
- Dynamic sectorization;
- DMAN/A-CDM implementation;
- Datalinks and data exchange;
- …

19 COOPERATION

Cross FABEC operations require close cooperation with MIL ANSPs, neighboring FABs and the Network Management Function. FABEC will play an active role to set up arrangements with required partners. These arrangement will focus on bringing performance improvements to the FABEC costumers and to streamline the harmonized implementation of Free Route and other initiatives.

20 OTHER INITIATIVES

Harmonized implementation of the FABEC Airspace Strategy requires that safety will be managed at FABEC level. Cross FAB initiatives require the use of a harmonized safety assessment methodology. FABEC will take the necessary steps to develop this safety methodology and implement this at FABEC level.

21 EXPECTED BENEFITS

FABEC expects that:

Safety will improve through the closer cooperation between all stakeholders, wider distribution of available information and better use of the available scarce resources.

Capacity will improve through optimization of the fixed route network, optimization of the airspace structure and use of new technologies (e.g. RNP1). Furthermore, Airports and extended TMAs will be efficiently integrated with the European Route network, resulting in optimized Network performance and Airport capacity.

Flight efficiency will improve due to shorter and direct routes, while implementing continuous descent/climb operations. Delays will be reduced and absorbed at Airports and will not use scarce airspace.

Environment will improve due to reduced fuel consumption through shorter routes and avoiding airborn delays.

Military mission effectiveness will improve due to planned and agreed military operations within the preferred military training areas via the concept of Flexible Use of Airspace harmonized application and implementation of a FABEC Airspace Management Function.

22 NEXT STEPS

Based on the agreed Airspace Strategy, the following steps are envisaged:

1. Define a detailed Project plan for the development of Free Route Airspace;
2. Define a detailed Project plan for the development of XMAN/AMAN;
3. Define a detailed Project plan for the development of DMAN/A-CDM;
4. Align the FABEC Airspace Strategy with the FABEC Airspace Policy;
5. Development of an overarching FABEC Concept of Operations;
6. Development of Technical Roadmaps to support the development and implementation of the FABEC Airspace Strategy;
7. Development and implementation of a FABEC Safety Assessment methodology;
8. Implementation of the current FABEC AD projects;
9. Define a detailed Project plan for the implementation of the FABEC ATFCM/ASM function;
10. Develop a Business case for the AIM Strategy.

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FABEC Implementation Phase

FABEC ATM CONOPS

EC Information

Attachment N.2

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

DOCUMENT SUMMARY

Objective :	ATM Concept of Operations		
Origin :	SC OPS	**Audience** :	FABEC

Title :	FABEC ATM Concept of Operations
Reference :	*FABEC ATM CONOPS v04*

Version : 0.4	**Date** : *10/04/2012*	**Status** : ☑ Draft ☐ Released	**Classification** : ☐ Public ☑ FABEC limited ☐ Addressees limited

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0.4	10/04/2012	Editorial	P. van Hoogstraten

0 CONTENT

Abbreviations used in this document:

OCD	- Operational Concept Document
ACC	– Area Control Centre
UAC	– Upper Area Control Centre
AMC	- Airspace Management Cell
AUP	- Airspace Use Plan
UUP	- Updated Use Plan
ATCO	– Air Traffic Control Officer
DFL	– Division Flight Level
AMAN	– Arrival Management
XMAN	– Cross Center Arrival Management
DMAN	– Departure Management
A-CDM	– Airport Collaborative Decision Making
PBN	– Performance Based Navigation
ETSI	- European Telecommunications Standards Institute
RNP1	- Required Navigation Performance 1 (NM)
ARN	- ATS Route Network
ATFCM	- Air Traffic Flow and Capacity Management
ASM	- Airspace Management
NMF	- Network Management Function

1 INTRODUCTION

The FABEC ATM Concept of Operations – FABEC ATM CONOPS - describes at high level the way the FABEC Operations will be organised and executed. More detailed descriptions of individual parts of the FABEC CONOPS are available or will be developed. This document should be considered as a living document and will be updated on regular intervals.

The FABEC ATM CONOPS is based on the agreed FABEC Airspace Strategy (Annex N.1, FABEC EC file).

In addition the required focus on the ATM components and the alignment with the SESAR concept are taken into account.

The FABEC ATM CONOPS comprises of a high level description of the way the FABEC Operations will be organised and developed. Some parts will be described in more detail in specific CONOPS documents for specific operations. Other parts will be added in due time.

The main part of this document, the FAB ATM CONOPS in chapter 4, is developed from an operational point of view.

The CONOPS will focus on the following areas:

- Airspace design and airspace management including sector design and flexible use of airspace;
- Regional air traffic flow and capacity management;
- Civil/military, civil/civil and military/military co-operation and co-ordination;
- Airspace organisation;
- Air Traffic Control.

1.1 Main challenges

Eurocontrol expects for FABEC until 2030 a 75% increase of air traffic compared to 2009. The FABEC ATM CONOPS is developed in order to contribute significant performance improvements in line with its expected contribution to the FABEC objectives, with priorities adapted to the main challenges of the core area in terms of safety, flight-efficiency, capacity and military missions effectiveness. It should be noted that the latest STATFOR figures (Feb 2012) show a significant downfall of air traffic in the EUR Region. This implies that the FABEC objectives shall be reviewed in the context of these latest developments and traffic expectations.

1.2 Purpose

The FABEC ATM CONOPS shall be considered as common strategic operational direction of the FAB Europe Central partners. It shall guide the operational developments and improvements of the FAB Europe Central.

The FAB ATM CONOPS will be subject to a continuous strategic update process. This process shall be aligned with the deployment phase of SESAR where appropriate.

1.3 Links to other concept initiatives

The FABEC ATM CONOPS is required to be compatible with agreed initiatives e.g. ICAO Global Plan, SESAR, EUROCONTROL OCD and to identify the main differences and commonalities of the ATM concepts of the different ANSPs involved.

2 THE FABEC ATM CONOPS

2.1 *Airspace Strategy*

The FABEC Airspace Strategy focuses on the implementation of a layered Airspace structure, with specific emphasis on providing performance improvements for the Top 5 airports (Paris, Frankfurt, Munich, Amsterdam and London). At the same time, new concept elements will be implemented:

- Free Route Airspace;
- Cross Center Arrival Management and Arrival Management systems;
- Departure management and Airport Collaborative Decision Making.

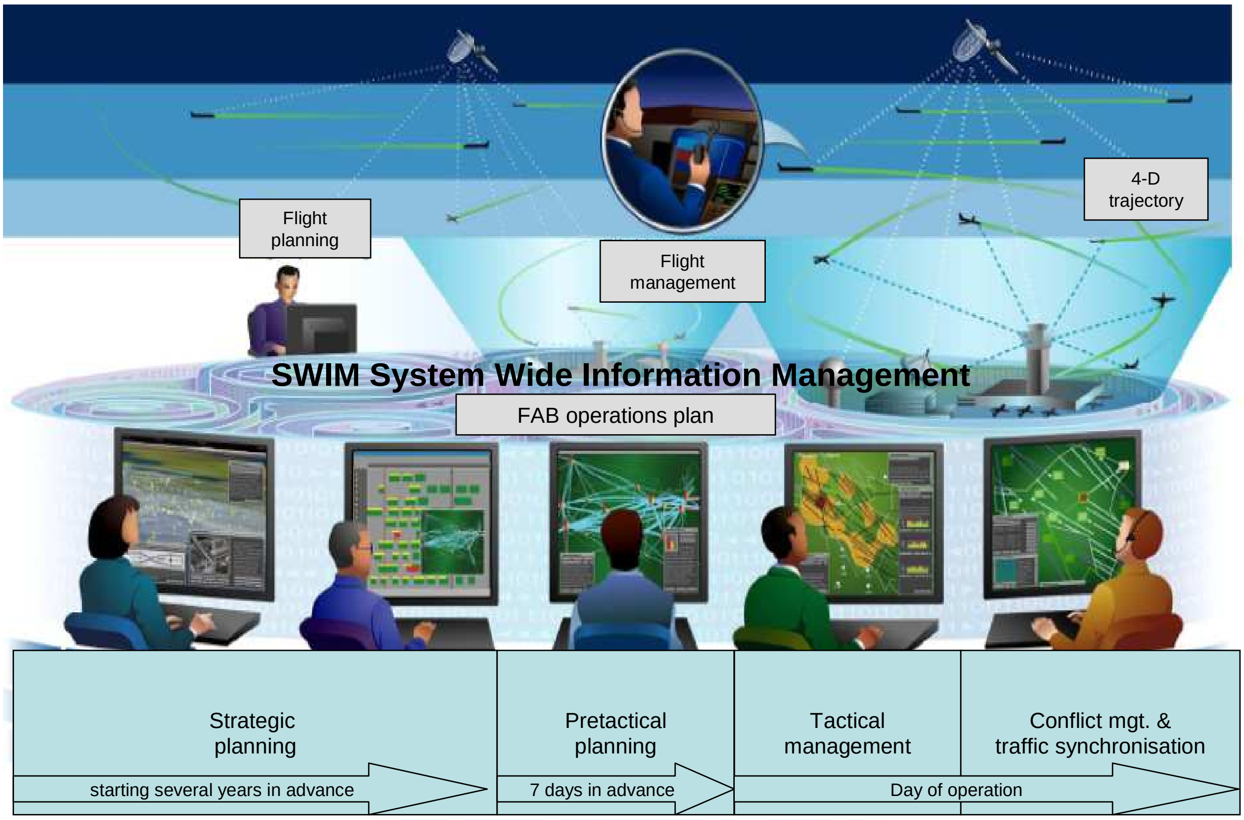

Figure 1: FABEC ATM CONOPS - Overview

2.2 *Principles for the provision of ATM within the FAB*

The provision of ATM within the FAB consists of the components Airspace Management (ASM), Air Traffic Flow and Capacity Management (ATFCM) and Air Traffic Services (ATS), which are interrelated. ATS include conflict management and traffic synchronisation.

They will be undertaken in 3 phases: strategic (level 1), pretactical (level 2), and tactical (level 3).

Additionally there will be review processes, giving feedback as well from one phase to the previous one, as from post analysis results to all phases concerned.

Information Management will ensure the delivery of timely and accurate data to support the FAB ATM functions.

Air Traffic management will develop from a reactive management of traffic flows to a more pro-active management of traffic flows in the FABEC airspace.

Active customer relation management is required to facilitate and agree business trajectories and service provision tailored to user requirements.

2.3 Harmonised working methodology

Harmonising the procedures and working methods will simplify operations and is thus the basis for less complex and more efficient ATM.

A strategic aim is to compare the procedures of all aviation stakeholders, identify the best practises, and to agree on best practices as common solution wherever possible. This will contribute to a more uniform ATM service, as well as bringing local service improvements and shall result in common operational documents. In addition procedure and processes for future challenges shall be developed commonly.

Close cooperation with the States to facilitate harmonisation of procedures is required, primarily through the Harmonisation Taskforce and should encompass the implementation of SERA A/B/C.

2.4 The FAB layered planning process

The FAB ATM CONOPS follows the principles of the Layered Planning Process; this will be achieved following the strategic, pre-tactical and tactical layers/phases:

- a strategic demand and capacity determination process in the strategic planning layer,
- a demand and capacity balancing and optimisation process in the pretactical planning layer,
- a refinement planning and monitoring process in the tactical planning layer.

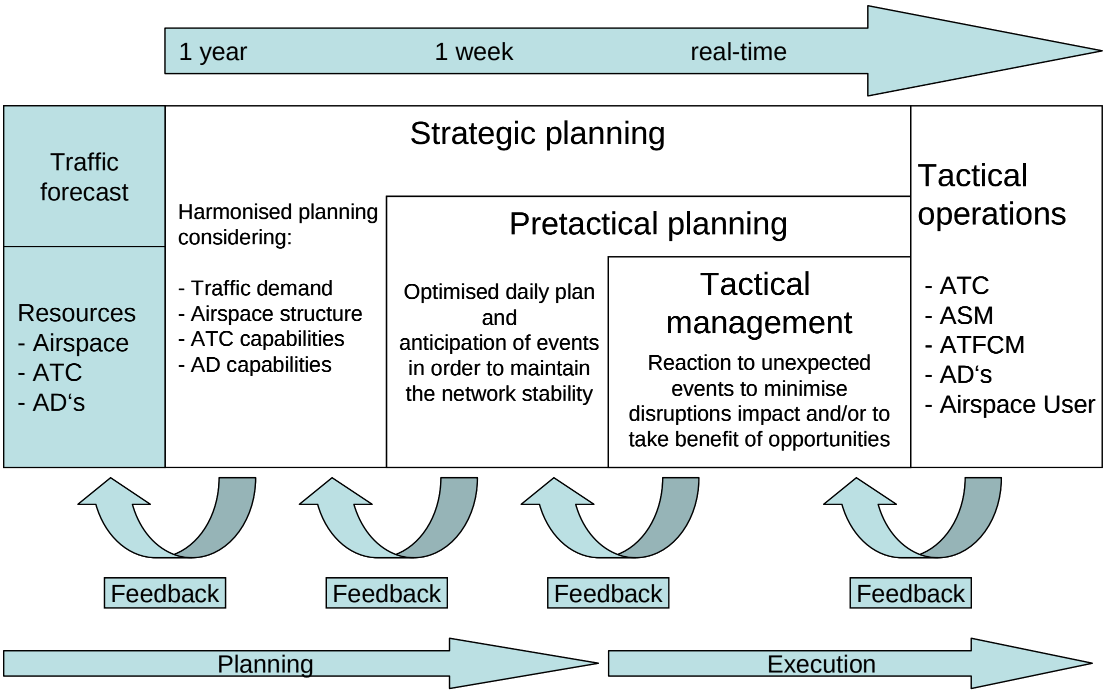

Figure 2: Layered planning process

This is an iterative process, continually being refined with more accurate data as the "now" time approaches. The process is supported by the FAB Information management and the Central EUR Network management.

2.5 Integration of ATFCM and ASM

2.5.1 Introduction

The dynamic management of airspace and the application of the flexible use of airspace (FUA) concept are subject to close civil-military cooperation and coordination processes within the FAB ATFCM/ASM function in order to best satisfy civil and military user demand. FUA ensures that multi-dimensional military training areas are collaboratively pre-defined and located at an economic distance from airbases to ensure optimal training conditions for military users. If problems are envisaged, military operations may be subject to reiteration processes between the Airspace Management Cells (AMC) and the air defence planning and coordinating authorities (PCA) and / or the appropriate tactical air command and control service (TACCS). Agreed military area reservation data for the following day and the day of operation is published in the FAB operations plan and shall be incorporated in the Network Plan, which is transferred in an airspace use plan (AUP) and updated use plan (UUP).

2.5.2 Strategic planning

At Strategic Level, a joint civil-military ATFCM/ASM/ATC co-ordination process will ensure consistency between the planning and use of Airspace Volumes and associated sectorisation in respect of relevant military airspace requirements. This process will rely on the validation of different sector configuration options, available direct routings and fixed route network consisting SIDs and STARs associated with clear identification of the assumptions used.

2.5.3 Pretactical planning

At Pretactical Level, a Coordination process established between a newly established FAB ATFCM/ASM function, the Flow Management Positions (FMPs), the Airspace Management Cells (AMCs) and the Central ATFCM function will facilitate the resolution of expected capacity shortfalls with ASM solutions based on all FUA levels with appropriate Conditional Route (CDR) and Reduced Co-ordination Airspace (RCA) or TSA/TRA and Operational Air Traffic – Compatible (OAT-C) route scenarios established at the Strategic Level.

2.5.4 Tactical planning

At Tactical Level, a Coordination process will be progressively established to react to any short notice and/or real-time event in order to allow the implementation of tactical CDR/RCA scenarios, the re-allocation of airspace and a re-consideration of the sector capacities in co-ordination with the ACCs/FMPs and Military ATS units concerned. Later on, dynamic route and airspace availability to accommodate optimum flight profiles and short notice military requirements will be considered in the overall context of dynamic airspace management based on all FUA levels with a Tactical CDM process involving civil and military ATS units or the Airspace Management Cells (AMCs), the FAB ATFCM/ASM function and the Central ATFCM function. The FAB ATFCM/ASM function will play a coordinating in close coordination with the Central ATFCM function and the local FMPs.

2.6 Co-ordination and collaboration Processes

Co-ordination across an ATM network is a concept that addresses the need for active collaboration of all ATM actors. The goal is to enable the concerned actors to improve mutual knowledge of the forecast/current situations, of each other’s constraints, preferences and capabilities, and to pro-actively resolve any areas of potential conflicts of interest. The actor best able to make the decision is the one who does so – after effective co-ordination.

Fundamental to the process is that each actor involved in the co-ordination process must have access to a common situational awareness. This is enabled through System-Wide Information Management.

For the FAB main partners are: Airspace Users, ANSPs, Central ATFCM Function and major aerodromes.

3 THE COMPONENTS OF THE FABEC ATM CONOPS

ICAO defines seven interdependent concept components that will be integrated to form the future ATM system. They comprise airspace organisation and management, aerodrome operations, demand and capacity balancing, traffic synchronisation, conflict management, airspace user operations, and ATM service delivery management. The order of these components implies no priority. The management, utilisation and transmission of data and information are vital to the proper functioning of these components.

The FABEC ATM CONOPS refers to this, but uses the terms ATFCM for demand and capacity balancing and information management as a part of ATM service delivery management. Traffic synchronisation and conflict management are parts of Air Traffic Control (ATC).

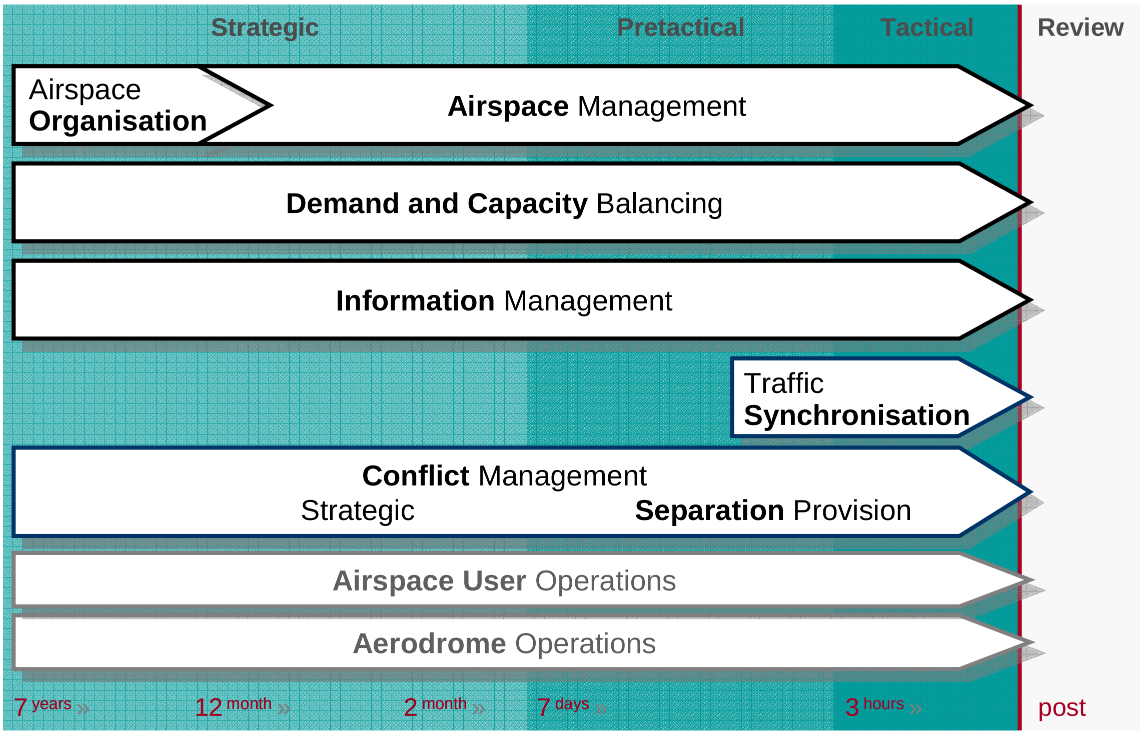

Figure 3: The Components of the FAB ATM CONOPS

4 INFORMATION MANAGEMENT

Common information sharing is a prerequisite for the optimization of the provision of coordinated ATFCM, ASM and ATS within the FAB.

The seamless information exchange is achieved at a FAB level. The airspace structure and pre-defined ATM scenarios are available through the System Wide Information Management System, which will provide an up-to-date consolidated demand flow and capacity overview of the FAB ATM network. Through the timely availability of information all airspace users are able to operate safely and cost effectively in a European airspace organisation, optimised for any given scenario on any given day.

The progression towards a harmonised and integrated European ATM System requires the most effective interaction between Airspace Management (ASM), Air Traffic Flow & Capacity Management (ATFCM), and Air Traffic Services through a coherent and efficient airspace structure:

- A pro-active management of sectorisation and military areas;
- Flexibility in their route selection (vertical, horizontal, time) for aircraft operators.

5 AIRSPACE DESIGN AND ORGANISATION

Airspace within the entire FAB will be designed regardless of national boundaries to fulfil civil and military user requirements. Innovative airspace design and ASM procedures to make most efficient use of the airspace will be applied.

In principle the entire airspace should be manageable and made available for civil and military airspace users.

Airspace re-design in the core area will:

- Focus on addressing operational issues;
- Define performance driven solutions to be assessed at Network Level;
- Provide the required capacity according to SES IR;
- Support vertical and horizontal improvements in flight efficiency;
- Support optimal traffic flows to / from the Top 5 airports in or close to the FABEC airspace (Paris, Frankfurt, Munich, Amsterdam and London);
- Aim to distribute the workload evenly throughout the airspace structure;
- Disregard national boundaries when designing sectors.

5.1 Enhanced FUA Level 1

Implementation of enhanced FUA procedures on level 1 is achieved through the

- Establishment of military training areas regardless of the national boundaries of the FAB partners.
- Creation of modular and dynamic areas.
- The support inter-FAB CBA's (Cross-Border Areas between different FABs).

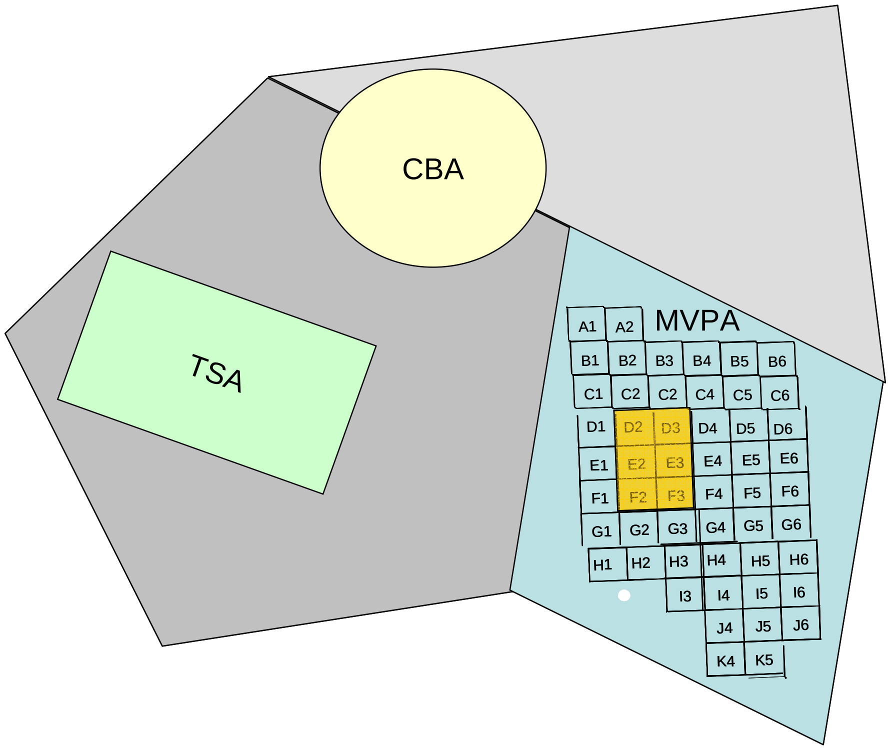

Figure 5: FAB airspace FUA level 1

Airspace design shall meet the military operational requirements and civil requirements. Areas for military training or mission purposes shall not be restricted by national boundaries.

In areas, where a very dynamic management of the airspace / military training areas could not be implemented and which require FUA level 1 coordination (in accordance with the current ASM Handbook) the airspace design shall be planned in order to accommodate the variation in expected traffic demand.

Procedures and process for the very dynamic management in the context of “enhanced” Level 1 applications are agreed in “level 1”. The planning of available direct routings and the traffic distribution at strategic ATFCM level shall be developed in close correlation.

Route system

The route structure in the FABEC Free Route Airspace will no longer be used, although direct routings now depends primarily on area navigation technologies with the ground based transmitter infrastructure existing as a backup

More direct route options and a greater freedom in profile selection are offered. In the longer term, business trajectories within the FABEC Free Route Airspace will be implemented. Cross-border sectorisation is enabled where appropriate to meet changing traffic flows across FIR boundaries reflecting the move towards Functional Airspace Blocks envisaged within the Single European Sky. The Free Route Airspace will provide connectivity with major TMAs and accommodates expected traffic demand. The airspace design and predetermined scenarios provide viable options to airspace users with multiple route options and modular temporary airspace structures.

The airspace structure changes to a Free Route Airspace, supplemented by suitable planned alternatives, and co-existing with temporary airspace structures meeting all potential specific use airspace requirements. For the lower airspace a fixed route network will be maintained to accommodate SIDs and STARs.

5.2 Layered Airspace structure

The FABEC airspace will be organized in a layered airspace structure, where different kinds of operations are envisaged.

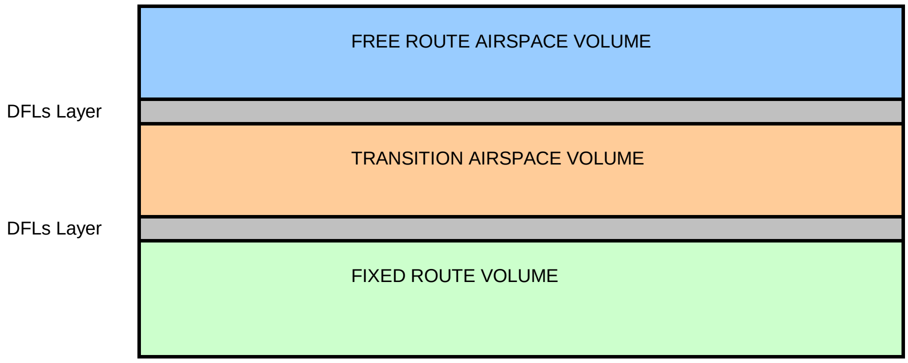

Figure 6: FABEC layered airspace

The different layers are organized in sectors with dedicated procedures and working methods. The management of sectors should be organized in such a way to maximize OPS performance and traffic throughput. The combination of sectors should be organized through the different layers according to a set of Performance criteria specific to the traffic demand characteristics, irrespective of national boundaries and other non-operational constraints. Consequently, e.g. current practice of super-imposed design of sectors in the different layers should not be a limiting factor. This is relevant for both the horizontal and vertical dimension, even extending into the time dimension. Where required for best performance, combination of sectors across the different layers should be possible, preferably flexibly over time as traffic characteristics vary. Similar or harmonized operational concepts are needed along a combination of sectors.

5.3 Areas with a fixed route system (SIDs and STARs)

Fixed routes shall predominantly be used to manage the sequencing of traffic in congested areas, around major aerodromes and cater for less capable aircraft. This shall enable a most flexible use of available airspace capacity that is fully aligned with the airspace user requirements in terms of business trajectories. The availability of more accurate flight data will enhance the traffic predictability and significantly increase the capacity management instruments.

5.4 Free Route Operation in certain areas

Operations in Free Route Airspace can be seen as a development of the current practice of direct routing clearances issued by ATC. In this airspace aircraft will be able to flight plan their own user-preferred trajectories (subject to any overriding airspace restrictions) within a known environment (their identity, position and intentions are known) and with links to the structured routes at both ends. ATM intervention will be more frequent at pretactical level than currently and will utilise coordination principles to determine and agree the best course of action for flights.

The preferred trajectory may change from day-to-day because of changing airspace restrictions, the differing strategic options of the flight operator and by the vagaries of the weather and other traffic. The development of support systems in the air and on the ground, coupled to new procedures and working arrangements in ATM, will permit the use of Free Route Operations in Managed Airspace and so provide significant benefits in flight economy and flexibility for users. Military Aviation has a vital role to play in the security of each State. Free Route Airspace will support the level of military effectiveness required by each State.

5.5 Transition Airspace

The transition from the fixed route network towards the free route airspace will take place within the Transition Airspace Volume. This volume of airspace is also characterized by the transition between en-route and arrival/departure operations. Without disregarding en-route traffic in this volume, it will mainly be determined by the requirements of the management of traffic inbound and outbound of the major hubs, or any other airport if operational efficiency requires so. Transition between a Free Route system and a Fixed Route system is one of the required design aspects, which may result in any type of route system(s). However in a more general view, also all other design factors shall be optimized to enable the best performance on respectively integrating departure traffic into the Free Route Airspace and the facilitation of arrival traffic into arrival management operations.

5.6 Aircraft capabilities

The percentage of Required Navigation Performance for Area Navigation (RNP-RNAV) capabilities fleet will increase and improve the use of these capabilities. However, even without improved navigation infrastructure (air and ground) and more reliable data exchange between air and ground, the concept of Free Route Airspace will be implemented FABEC wide above a minimum of FL 365.

5.7 Airspace Design principles

During the FABEC FSR and the FABEC Implementation phase, the discrepancies between the different procedures of each ANSPs have been highlighted.

A strong need for harmonisation is claimed for the FABEC Airspace Design principles. This harmonisation can contribute to performance and safety increase in the FABEC network. Military training areas, as well as the sectorisation, will be cross-border and the rules, principles and procedures should be consistent.

Throughout the FABEC the network should be developed with a clear set of harmonised FABEC rules regarding spacing between routes from one hand and spacing between routes and MIL areas on the other hand.

Advanced RNP is expected to include requirements for scalable navigation accuracy i.e. a different accuracy requirements for different phases of flight. The accuracy value expected for the en route phase of flight for Advanced RNP 1 is expected to be 1 NM; whilst a 0.5 or 0.3 NM accuracy value could be required for terminal/approach operations.

FABEC will use the following principles for the Airspace Design:

1) ATS Routes will be spaced by a minimum of 7 NM between centre lines and are considered to be separated in case of:
   - Parallel opposite direction routes with evolving traffic catering for different flight level allocation on each route (i.e. odd and even flight levels),
   - Parallel same direction routes without FL allocation conditions.
   - Turns on ATS Routes are limited to a maximum 90 degrees and the Fixed Radius Transition (FRT) functionality will make it possible for parallel routes to maintain a constant distance between parallel ATS routes on the turn.
2) Adequate safety assurance is met, based on a required Advanced RNP approval with at least a demonstrated 1 NM lateral navigation accuracy, supported by the appropriate safety case. A generic safety assessment for minimum route spacing for Advanced RNP routes on different sectors would be needed.
3) In other cases the spacing between centre lines of ATS Routes would need to be determined whilst ensuring that adequate safety assurance is met.

4) Where an ATS route spacing has not been determined, adequate provisions (including radar vectoring or radar monitoring) must be in place to meet adequate safety assurance.

5) Between Centre Line of ATS Routes and OUA: minimum 1 NM.

Notes:

1. Airspace in between ATS routes and up to the GUA boundary is available for radar vectoring.
2. In case of a CDR or Crossing Clearance through an OUA, the CDR respectively Cleared Flight Path, or at least the separation airspace around the aircraft, is GUA.

When agreed by States Regulatory Authorities, these principles will have to be put into practice by the Airspace Authority of each state concerned.

For advanced application of these principles, changes in procedures, ATC system support and/or licensing of ATCOs (CIV/MIL ATC and Air Defence) for certain States / ANSPs may be required.

Airspace design work done in FABEC shall be reviewed, and shall be adapted where required or may be improved where additional benefits can be achieved.

5.8 Sector design

In term of sectorisation, tendency is going from a today fixed sectors towards dynamic – scaleable – sectors.

Elements:

- Dynamic, flexible, sector management irrespective national boundaries.
- Enhanced sector management based on traffic flows and workload.
- Exchange of sectors / airspace volumes between FAB partners (units and centres) depending on resources or traffic.

5.8.1 Generic sectors

Although the framework of geography (airfield initial approach fixes, neighbouring areas of responsibility etc) remains constant, every other part of the airspace structure can be rebuilt dynamically to maximise efficiency, without necessitating fixed network of routes or sectors.

5.8.2 Dynamic sectorisation

To effectively deliver capacity to airspace volumes when required, airspace and sector structure must have the ability to adapt to predicted traffic flows and workload without delay or restriction: the airspace design must allow sectorisation to be flexibly modified.

Changes to the sector configuration and/or changes to flow shall be coordinated with the neighbouring units within the FAB or to the FAB ATFCM/ASM function depending on the impact. The exchange of information between FAB partners, and with the FAB ATFC/ASM function, regarding sector configurations will take place in real time. Adjacent units shall know the sector configuration of all the surrounding FAB partners.

5.8.3 Sector Families

The concept of Sector Families incorporates larger sectors, along the main FABEC Route Network and boundaries of sector families are in areas of low interaction. A Sector Family will consist of sectors accommodating similar traffic flows and complexity, based on the same detailed ATM CONOPS. These facts will improve productivity and consequently will be used to improve flight efficiency and/or capacity in a balanced way.

Development and implementation of a sector Family Concept will allow to create sectors tailored to the expected traffic flows. Sector families will be developed and implemented by analysis of the traffic density and the conflict density with different level bands in the FABEC area.

6 AIR TRAFFIC CONTROL

Although ATM will shift from a reactive to a pro-active management of traffic flows, Air Traffic Control will not change fundamentally in the short term but will move gradually from executive conflict detection and resolution to a more reactive mode of traffic monitoring and active control of exemptions. ATC will continue to be an important element of ATM due to the safety implications of the services provided however it is recognised that phased and layered planning will gain in importance. ATC will benefit from advanced and integrated data information exchange and computer support.

In spite of technical systems that are continuously being improved, ATC will always be an activity driven by human beings. Tools will only be implemented if they decrease workload or enable capacity gains without increasing workload. Continuous Training is an essential part.

New computer-based support tools and new systems progressively contribute to evolve the nature of ATM job requirements.

Elements:

- MTCD.
- Conflict resolution assistant.
- Monitoring aids.

Regardless of the technological changes, the human element is paramount in the ATM System. The new tools permit earlier detection and resolution of potential conflict, which results in less radical changes in trajectory for the aircraft. Minor course deviations are generally sufficient to guarantee separation: leading to the phrase “tactical intervention by exception”.

6.1 Communication

The radiotelephony (RTF) frequency load is currently one of the main factors limiting ATM capacity. There are technical solutions needed especially for the flexible Sector Design if the Sectors are enlarged and spread over national boundaries. This problem can be partly overcome in the future by transmitting information via ground-ground data link. Furthermore, it is expected that direct ground-air datalink communication will reduce excessive ground-ground data exchange requirements.

6.2 Interoperability

In order to achieve a seamless exchange of information, there is a need for an increased level of interoperability between the FAB partners based on maximum use of the exchange of electronic coordination (SYSCO). All FAB partners operate with a common standardised base of flight data and the data and exchange of data between FAB partners should be standardised and consistent.

6.3 Conflict Management

The task of conflict resolution will progressively move from tactical air traffic control to pretactical conflict management as powerful traffic prediction and accurate medium-term conflict detection tools become available. The amount of potential conflicts will be minimised and upstream deconfliction will allow the workload of the tactical controller to be reduced.

Automated Support for Conflict Detection will become essential as within a free route environment, conflict detection would become very cumbersome without high-performance conflict detection tools. These tools introduce a systematic detection of potential conflicts between flows, pairs of aircraft and area proximity warnings in sufficient timeframe before the occurrence. The exact timeframe is subject of further simulation and verification. The system parameter should be adjustable. Relevant data from adjacent centres concerning the predicted trajectory should be exchanged automatically. Information on potential conflicts should be exchanged.

Based on future innovation in operational environment traffic planning and conflict management in the FAB is extended following the 4-D trajectory over two or more ATC sectors. Synchronisation of traffic flows is performed in collaboration with other traffic management roles. (Multi-sector-) planning enables also to balance the 'constraints' put on flights by various nearby destination aerodromes.

The controller remains responsible for separation, while the pilot is responsible for the safety of the aircraft.

6.4 Traffic synchronisation – Arrival/Departure Management

Arrival management means sequencing and metering within a certain distance (approx. 200 NM) from the airport, while observing different conditions and characteristics, such as weight categories. In addition traffic on the ground at other aerodromes within the FAB should be considered. Typically, for average flights within the FABEC area, the link between arrival- and departure management will allow intra-FABEC traffic synchronisation. For long-haul flights, ground-air information exchange at a large distance from the destination, will enable traffic synchronisation, with a minimum of upstream sector participation.

Arrival and departure management is moved from tactical control to preventive control with the extending horizon of traffic synchronisation.

This will support maximum airport throughput and will increase predictability.

Elements:

- Increased predictability, accuracy and information sharing.
- Multi-unit coordination (upstream, downstream) and information exchange.
- Increased controller support tools for spacing and sequencing.
- Traffic synchronisation shall start more upstream.
- Optimised delay sharing according to the performance framework.

Inbound process

- The link between inbound and outbound planning is managed using CDM.
- More emphasis on planning has potential to decrease amount of tactical control. This is required to allow environment-friendly routing in the TMA.

Inbound planning

- Inbound planning should deliver stable traffic streams without need for using holdings in the nominal situation.
- In co-operation with the AOC and adjacent (upstream) centres, a lot of problems can be solved before the tactical stage.

- When the infrastructure is available, the planning could be further improved by air-ground interaction, starting from the moment a flight is airborne or a FAB entry time is available.
- Planning will be continuously refined as more information becomes available.

Outbound process

- Start with outbound speed control aimed at delivering a metered flow to our neighbouring ANSP's.
- This should be supported by improved outbound planning, supported by collaborative decision making.
- The process can be further improved by supporting delay sharing with adjacent (downstream) centres.

Outbound planning

- Planning starts several hours before the actual departure.
- Uses factors such as gate availability, runway usage (SIDs and wake vortex), TMA, sectors and ultimo adjacent centres.
- Requires a reliable estimate of the departure time.

Arrival Procedures

Continuous Decent Operations (CDO) or at least stepped CDO should be used to the maximum to reduce environmental impact and cost (noise emission, fuel consumption) and to improve predictability for ATC and pilots.

AMAN/DMAN will operate with an increased coverage and be linked between the major FAB aerodromes via Cross Centre Arrival management (XMAN).

Gate-to-Gate

When the operations plan is prepared during the demand and capacity balancing, it has to be ensured that take-offs and landings are sequenced. Arrival planning will be continuously refined as more information becomes available and when the infrastructure is available (AMAN system). This process starts in the en-route phase. It is applied cross border within the FABEC and between FABEC units and neighbouring units. The planning could be further improved by early flight information, starting from the moment a flight is known by the ATS system, e.g. starting from the moment a departure time or a FAB entry time is available, via data exchange between ground systems.

This de-conflicted sequence is influenced by unforeseeable events during the tactical phase. The arrival times which are calculated with a high degree of precision or currently intended departure times which are reported by the airlines, the pilot via data link, other ATM service providers or the central ATFCM unit are incorporated in the actual operations plan. This can lead to traffic congestions in the air and on the ground.

Based on this information, the organisational units involved check the compliance with certain provisions regarding the approach and departure sequence (e.g. existing capacity, turnaround times). In a CDM process, the organisational units and roles (approach planners supported by the respective ATFCM-ASM function, airline operations and airport operations) plan, optimise and define the approach flow and sequence (supported by AMAN systems) and departure sequence (supported by A-CDM).

To effectively accommodate flights which depart from aerodromes within the planning horizon of the AMAN system, data exchange between the respective A-CDM system and the AMAN system is necessary. The planned arrival time (TTA/EAT) of the destination aerodrome shall be incorporated in the A-CDM process at the departure aerodrome. This element becomes more important when the planning horizon is increased and subsequently more aerodromes are located within the planning horizon.

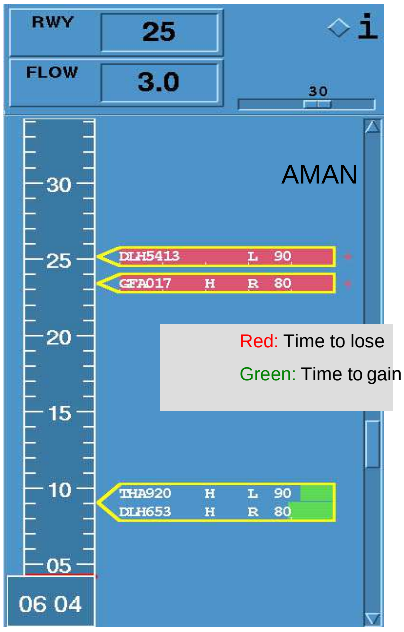

Figure 7: FABEC Arrival Management (Example based on time to lose/time to gain)

For arrival management the system can only work effectively if the planning tools extend their planning horizon also into the en-route area of adjacent ACCs/UACs (if necessary), to cover the TOD and a suitable portion of the route of the flight before TOD. The AMAN planning tool will calculate the time at the metering fix and coordination point and, derived from this information, it will provide times in the form of "time to lose" or "time to gain" or “speed to be flown” for upstream sectors and/or ACCs/UACs. The parameters calculated by the AMAN tool will be communicated to the preceding sectors or control centres so that they shall be considered in the optimisation of the trajectory. As a result and when possible, the relevant 4-D profiles are updated in the actual operations plan.

6.5 Aerodrome operations in the FAB

In relation with turnround and departure management Aerodrome operations shall be within the focus of this FAB ATM CONOPS.

Airport Collaborative Decision Making (Airport CDM) builds up the most important link between Arrival and Departure Management issues. Therefore it has to be considered as an operational basic to ensure a feasible turnround process.

In the FAB ATM CONOPS the interface between traffic synchronisation and aerodrome operations is an important issue as it takes under consideration different CDM partner information and needs.

In Europe Airport CDM is defined and regulated by an EU Community Specification (EN303212). This Community Specification is the baseline CONOPS as well as the minimum technical requirements for Airport CDM.

Airport CDM essential procedure parts are:

- o Transparency + Information Sharing to ensure Common Situational Awareness for all partners

- o Airport CDM is one operational process considering ATC Flight planning / Arrival Phase / Turnround / Take Off Phase.
- o Link Day of Operations with Schedule Planning to compare and correlate ATC-Flight Plan, Airport Slot and Airport flight data
- o Feasibility of flight turnround to Permanently match and correlate related In- and Outbound Flight times and data''
- o Use of Variable Taxi Times – VTT to replaces CFMU Default Taxi Times.
- o TOBT = Airline commitment to introduce of Target Off Block Time as an estimate of Aircraft Ready.
- o TSAT = Airport CDM commitment and result of Pre Departure Sequencing to introduce Target Start Up Approval Time based on TOBT, VTT, CTOT, any other constraints (e.g. TTA) and on real operational capacity as driver for the „Pre Departure Sequence.
- o Procedure adherence in order to allow Start Up clearance / Push Back under consideration of TOBT and TSAT.
- o Linking the airport into the network in order to implement reliable In – and Outbound estimates/target times through automated Data exchange with the ATFM (CFMU)

In addition to the above mentioned EU Community Specification on Airport CDM the necessity is seen to provide the local A-CDM process with as much as possible information from the Inbound leg of the flight/aircraft (e.g. information from Arrival Management processes) and from the planned Outbound leg of the flight/aircraft (e.g planned arrival time at the succeeding destination aerodrome, TTA).

7 ATM FUNCTIONS OF FABEC

To enable an optimised process between the existing ATFCM and ASM functions, a suitable organisational structure in the form of a FAB ATFCM-ASM function within the future FAB shall be established.

The FAB ATFCM-ASM function shall combine functions to provide Flow Management services and Airspace Management services at FAB level, while the function will be able to coordinate with centralised European functions and neighbouring FAB/States. The FAB ATFCM/ASM function will become an essential part in the functioning of FABEC.

Combining the ATFCM and ASM into one function is a logical step and in line with Eurocontrols future vision of moving from managing demand towards managing capacity and demand. The management of capacity in the FAB ATFCM-ASM function is performed by management of airspace incorporating the all levels of FUA.

The integration of the functions of airspace management, flow management and capacity management at level 1, 2 and 3 creates a seamless interaction between the airspace design, the airspace/route utilisation and capacity/flow optimisation, working at network, regional and local levels and throughout the whole gate-to-gate time cycle.

7.1 CNS/ATM Development functions - Link between ATFCM, ASM and ATS

Within the FAB common development and support functions shall be considered, which in particular cover following areas:

- Airspace design;
- Resource planning.

7.2 Coordination with the Central ATFCM function

In general the Central ATFCM function will maintain the tasks which this function is executing in Europe today.

In the context of the coordination with the FAB functions the following tasks are highlighted:

In addition the Central ATFCM function will provide[1]:

- STATFOR demand forecast and Future ATM Profile (FAP) capacity requirements based on sector family level for the Strategic planning (Determining demand).
- FAB ATFCM-ASM function with relevant data to support balancing of capacity and demand.

In collaboration with the FAB ATFCM-ASM function the Central ATFCM function will:

- Forecast capacity requirements and consideration of network effects.
- Consolidate capacity data to provide a capacity projection ranging from 5 years to day of operation.
- Assess impact of real time events e.g. reduced airport capacity, weather on network level.
- Further refine Operations Planning based on updated demand and capacity data received from ATFCM-ASM functions.

7.3 Airspace planning

The planning in particular covers following areas:

- Military training areas which could be established regardless of the national boundaries of the FAB partners (Support inter-FAB CBA's).
- Creation of modular and dynamic areas (dynamic sectorization).
- Fixed route system (SIDs and STARs)
- Free route operation in certain areas.

[1] DMEAN CONOPS Annex 1

Areas in which free route operations or dynamic areas for military training could be beneficial for the overall performance will be determined, considering the factors complexity and density of traffic. Potential performance improvements will be assessed (i.e. capacity increase, cost/benefit analysis, safety case).

Airspace design shall meet the military operational requirements and civil requirements. Areas for military training or mission purposes shall not be restricted by national boundaries (CBA).

A simulation tool will support assessing changes in airspace design considering demand and performance criteria in the strategic phase.

8 LIST OF REFERENCES

1 Dynamic Management of European Airspace Network Concept of Operations V P1

2 ICAO Doc. 4444 Edition 14 Air Traffic Management

3 ICAO Doc. 9854 Global ATM Operational Concept

4 Eurocontrol ATM Operational Concept Volume 1 Edition 2.1 (OCD)

5 Eurocontrol ATM Operational Concept Volume 2 Edition 1.2 (CONOPS)

6 ATFCM Evolution Plan for the ECAC States Edition 1.0 dated 29 September 2004

7 EUROCONTROL Airspace Strategy for the ECAC States Edition 1.0 dated 18.01.01

8 SESAR Definition Phase - Task 2.2.4/D1 A Baseline Operational Description for the Mid-Term

9 SESAR Concept of Operations WP2.2.2 (target concept) version 12.3

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FABEC Implementation Phase

Free Route Airspace CONOPS

EC Information

Attachment N.3

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DOCUMENT SUMMARY

Objective :	*This document is in support for FABEC Workshop II on the Airspace Strategy.*		
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DOCUMENT CHANGE RECORD

Version	Date	Reason for changes	Author of changes
0.1	30/11/11	Draft	DSNA
0.3	07/12/11	DSNA + MUAC input	DSNA
0.4	08/12/11	Workshop input	All
0.5	16/12/11	Amendment 14. System support	DSNA
0.6	03/01/12	New version including ANSPs input	DSNA
1.0	12/01/12	Review by SC OPS 26	DSNA

1. INTRODUCTION

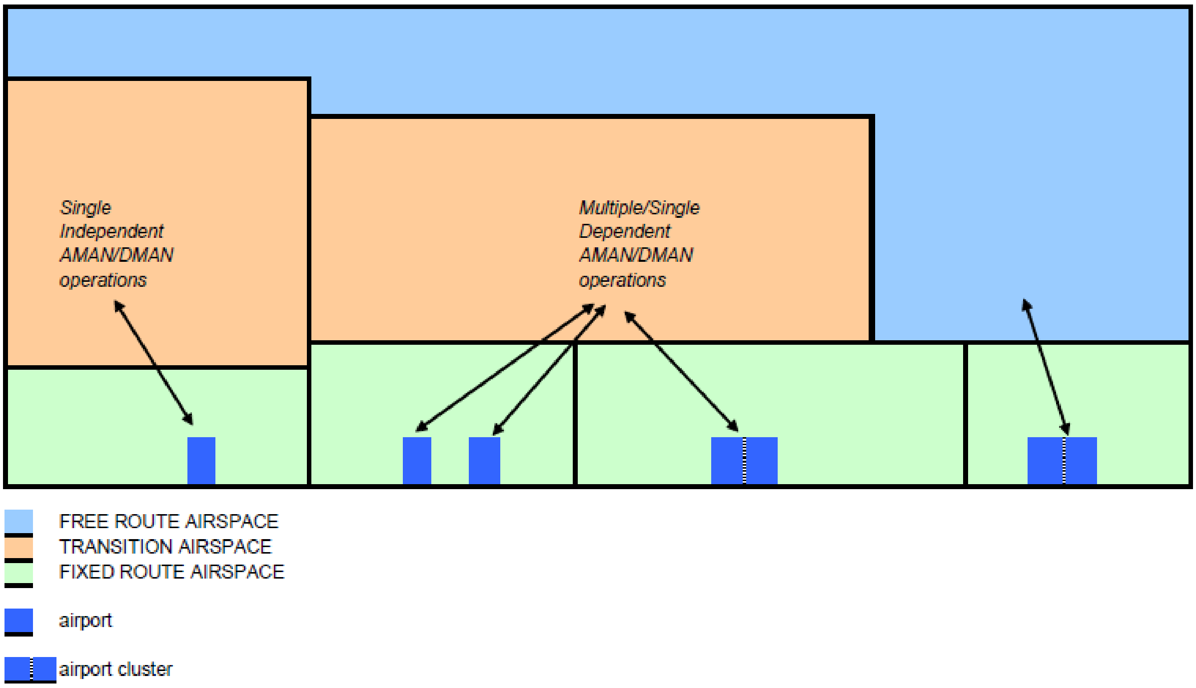
The FABEC ASB endorsed the airspace principles and the proposed airspace vision and strategy on September 7th, 2011.

The FABEC airspace strategy centres on the introduction of a three volume airspace organisation for all FABEC airspace, based on a common FABEC concept of operations:

- a Free Route Airspace (FRA) volume over the greatest possible FABEC area ;
- a transition airspace volume in which the transition from free route to fixed route airspace and vice versa will take place, focusing on the harmonised development of airspace to support traffic flows (e.g. arrival and departure management concept and tools) around the Top 5 TMAs (Paris, Frankfurt, Amsterdam, London and Munich);
- a fixed route airspace volume intended to optimise the use of the lower airspace to improve arrival and departure routes.

The FABEC airspace strategy is intended to ensure a better connection between the FABEC airports and the entire European Route Network by using extended arrival manager/ departure manager and including free route initiatives in the FABs surrounding FABEC.

The resulting conceptual view of the airspace design is shown below:



The FABEC Free Route Concept of Operations, developed underneath, has been worked out taking into account ARN V7 FRA concept.

FABEC FRA local initiatives already in force have also been considered. These initiatives showed the necessity of a step by step FRA implementation method regarding current technical enablers and foreseen technical enablers included in SESAR.

FABEC Free Route concept of operations encompasses present and future FRA initiatives, taken locally or at FABEC level. All these initiatives should lead to a common goal, which is the implementation of a harmonized and seamless FABEC free route airspace, based on a common Free Route concept of operations.

Objectives of Free Route

The main objective of FRA implementation is to offer opportunities for the users to improve efficiency of plannable direct routes / preferred trajectories within FABEC airspace and between FABEC and neighbouring FABs.

FRA will have to contribute as well in the environmental domain to a better performance in distance flown, in time savings and fuel consumption reduction.

FRA will have to provide sufficient capacity for airspace users while ensuring a high level of safety.

Advanced FUA concept will provide an utmost balanced solution between MIL and CIV requirements.

2. DEFINITION

A specified airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) way points, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control.

3. IMPLEMENTATION STEPS

In order to achieve the complete implementation of FRA within FABEC airspace, several intermediate steps are defined in the FABEC Free route roadmap.

4. SCOPE

The overall scope of the FABEC Free Route Concept of Operations is to provide an enabling framework for the stepped harmonised implementation of FRA in the FABEC airspace based on the agreed FABEC Free Route Roadmap.

The FABEC Free Route Concept of Operations forms the basis for a common understanding for all ATM partners involved in FRA (ANA, BAF, Belgocontrol, DFS, DIRCAM, DSNA, GAF, LVNL, MUAC, RNLAF and Skyguide).. FABEC Free Route concept of operations encompasses various FRA implementation scenarios that will have to :

- Meet the Safety Objectives;
- Be compatible with existing civil and military operations;
- Be sustainable through further development;

- Be capable of expansion/connectivity to/with adjacent airspace;
- Be compatible with European ARN- V7. Free Route Concept of Operations;
- Meet the required Network performance..

5. Main Enablers

The enablers are:

- Appropriate System Support, as required for the different implementation steps;
- Procedures – enhanced procedures where necessary for operations within FRA and at its interfaces;
- Adaptations to airspace structures;
- Adaptations to airspace management procedures;
- Appropriate AIS publication, areas where there is ATS delegation included.

6. Airspace Classification

FRA will, in principle, be classified as Class C airspace.

7. Flight Level Orientation

The Flight Level Orientation System (FLOS) applicable within FRA shall be promulgated through the relevant national AIS publications.

(This does not constitute a change to the current system of 2 FLOS in Europe).

8. Applicability of Free Route Airspace

8.1 Implementation in time

Even though the goal is to implement FRA on a permanent basis, a limited implementation during defined periods could facilitate early implementation. Procedures for transitioning between FRA and fixed routes airspace shall be set where required.

8.2 Implementation in structure

Implementation of FRA could potentially have a detrimental effect on capacity. In such airspace, ANSPs may decide to implement FRA on a structurally limited basis,.

9. Airspace Organisation

9.1 General

FRA forms an integral part of the overall FABEC and European ATM network, interfacing vertically or laterally with adjoining fixed route airspace or other FRA.

To implement FRA, an advanced FUA concept is required to guarantee compatibility between GAT widespread routing, OAT transit procedures and an efficient use of segregated areas.

Airspace reservations will remain. As all airspace users will have equal access to FRA, harmonized application of the advanced FUA Concept will have to be taken into account in order to ensure harmonized procedures and service provision for the benefit of all the airspace users.

9.2 Applicable Airspace

FABEC Free Route concept of operations is applicable to any area where FRA is implemented within the FABEC airspace.

9.3 Vertical limits of Free Route Airspace and their publication

There is no specific recommendation on the minimum Flight Level for the implementation of FRA. Such a lower limit may vary across the FABEC airspace. The setting of the lower limit will take into consideration inter alia, safety, capacity, flight efficiency, airspace complexity criteria, etc.

The vertical limits of the FRA shall be published in national AIS Publications. For interim implementation steps, alternative means of publication (e.g. through the RAD) may be used to facilitate implementation.

The setting of the vertical limits of FRA shall ensure full transparency towards adjacent/subjacent areas where FRA is not implemented or where only limited application of FRA is in place.

In order to gain full benefits from its applicability, the vertical limits should be based on operational requirements, not necessarily on FIR/UIR or ATS unit boundaries.

Nevertheless, with goal being a harmonized airspace structure across the FABEC airspace and the European network, the following recommendations are made:

- the lower vertical limits shall be coordinated at FABEC and European network level to ensure interconnectivity with adjoining airspace and this could vary in different areas or at different times within a particular FRA.
- the lower vertical limits should be the lowest feasible, taking into account the complexity of the airspace and the network performance objectives.

9.4 Horizontal limits of Free Route Airspace and their publication

The horizontal limits of the FRA shall be published in national AIS Publications. For interim implementation steps, alternative means of publication (e.g. through the RAD) may be used to facilitate implementation.

In order to gain full benefits from its applicability, the horizontal limits should be based on operational requirements, not necessarily on FIR/UIR or ATS unit boundaries.

Entry/exit points into/out of the FRA shall be published in national AIS publications with a clear reference to the FRA and to the nature of the point (entry, exit or entry/exit point).

In areas where the shape of the lateral boundaries of an FIR/UIR or ATC unit are such that direct routings could lead to exiting for a short time into adjacent airspace, all efforts shall be made to ensure that applicability of FRA is organized based on operational requirements and appropriate arrangements are made with the adjacent ATC units/States. If such situations are unavoidable, the appropriate publication of entry/exit points shall be ensured.

If FRA is implemented in adjacent FIR/UIRs, the publication of the FRA shall clearly reflect this cross-border application. The publication of entry/exit points on the common FIR/UIR boundary is not necessary from an operational perspective.

Entry/exit points into/out of FRA shall take into account adjacent airspace where FRA is not implemented. Entry/exit points will be defined to allow for a structured transition between the two operational environments, this may not necessarily be at the FIR or ATC unit boundary.

In order to ensure overall airspace structure interconnectivity, the entry/exit points from/into adjacent non Free Route Airspace shall ensure interconnectivity with the fixed ATS route network.

9.5 Vertical Connection between Free Route Airspace and the underlying Fixed ATS Route Network

The vertical connection between FRA and the underlying fixed ATS route network shall take into account the various climbing and descending profiles. The interconnectivity between FRA and the underlying fixed ATS route network shall be ensured through the publication of a set of waypoints. The transition procedures from/to FRA shall include the publication of extended SIDs/STARs or of a fixed ATS route network reflecting the typical climbing/descending profiles. The promulgation of these points shall be made through the national AIS publication with a clear indication of the nature of these points (entry, exit or entry/exit points).

9.6 Maximising Efficiency of Free Route Airspace

To maximise the efficiency of FRA and to ensure safe and efficient transfer of flight, all efforts need to be made to ensure any required realignment of the fixed route network in adjacent/subjacent airspace not applying FRA. Wherever a fixed route network will remain in operation below the FRA, this underlying route network shall be refined where necessary and coordinated at FABEC and European network level to take into account the needs of free route operations in the airspace above.

9.7 Publication of a Contingency ATS Route Network

There is no requirement for a European contingency fixed ATS route network.

9.8 Maintenance of a Fixed ATS Route Network within Free Route Airspace

Wherever a fixed route network is maintained within airspace where Free Route Operations are implemented, details shall be published in AIS publications.

9.9 A-FUA concept and Airspace Reservations

An advanced FUA concept has to be defined to guarantee compatibility between GAT widespread routing, OAT transit procedures and an efficient use of airspace reservations.

In the context of this FABEC Free Route Concept of Operations, **“airspace reservation”** refers to airspace of defined dimensions for the exclusive use of specific users, including TRA, TSA, D, R, P, CBA Areas and any specially activated areas. These are special designed areas within which both civil and military activities could take place.

Some airspace reservations are permanently active (such as prohibited areas) while others are active for varying periods of time and at varying levels. (e.g. TSA and similar exercise areas). Active airspace reservations are crossed or avoided depending on the degree of coordination (including civil/military coordination) and the status of the activity in the area. This will remain the case in FRA.

There is the potential for airspace reservations to be reconfigured to meet different task needs.

In areas where coordination procedures (including civil/military coordination procedures) and airspace conditions permit, the airspace users are permitted to flight plan routeings through airspace reservations.

Procedures for tactical rerouting will be created whenever airspace is not available for crossing..

In other cases, when such airspace is not available for crossing, 5LNC will be defined to facilitate flight planning clear of the airspace reservation and ensure sufficient separation from the activity. The promulgation of these 5LNCs shall be ensured through national AIS Publication. If these points are to be used only for avoidance of airspace reservations, specific conditions for the use of these points for flight planning shall be published. An overall standardization of the separation from airspace reservations is needed to implement cross-border operations and FRA FABEC wide.

Publication of activation time of airspace reservations should be considered.

Note: the possibility of using lat/long should be considered

Procedures shall be developed between the CFMU and all interested parties to ensure a harmonized application of procedures for the avoidance of airspace reservations.

9.10 OAT Handling

OAT en-route shall benefit in a similar way from the implementation of FRA, considering the availability of guaranteed by level 1 / coordinated / fixed routes, corridors and flexible routes.

9.11 Sectorisation

The present sectorisation scheme may need to be restructured to accommodate traffic flows

Sector design will need to respond to this change and may need to be more flexible as traffic demand varies.

The FRA sectors should be:

- Unconstrained by FIR/UIR or State boundaries.
- Capable of being reconfigured to meet demand (e.g dynamic sectorisation). A structured methodology where sectors are taken from a library of designs already known to the internal and external systems is likely in areas where there are significant fluctuations of traffic flow orientation. Changes to sector definition will need to be notified to the CFMU and should be transparent to adjacent units.
- If required sectors design should take into account mixed operations.

Sector Design Criteria should, at least, take into account:

- the principle traffic flows and orientation;
- minimizing short transits through sectors;
- minimizing sector and ACC re-entry;
- positions of airspace reservations;
- coherency with adjoining fixed route sectors and link routes to SIDs and STARs;
- civil / military coordination aspects.

Sectors shall be aligned as far as possible so that the number of flights with short transit times is reduced to a minimum. If this is not feasible such traffic should be exempted from CFMU traffic counts. Appropriate rules shall be set in this context.

More flexibility in defining a larger number of elementary sectors/airspace volumes and sector configurations will need to be explored. Sectors will need to be designed to minimize short transits and to avoid sector/ATC unit re-entry of flights. Operationally designed, cross-border sectors may be needed where Free Route Airspace is implemented in adjacent areas.

A more extensive application of cross-border sectors is likely to be required to reflect better variations of traffic patterns.

Local FMPs will have to take a more proactive role in the selection of optimum sector configurations. Active sector configurations shall be dynamically communicated to the CFMU and CIV/MIL ATC units.

9.12 Sector and Traffic Volumes Capacities/Monitoring Values

Sector capacities shall take into account the more dynamic variations of traffic patterns. Definition of traffic volume capacities/monitoring values shall take into account a minimum transit time. Following advice from the appropriate ATC unit, appropriate procedures shall be put in place by the CFMU to exempt such flows from sector traffic counts.

9.13 ATS Delegation

In areas where operational boundaries do not coincide with FIR/UIR boundaries, and delegation of ATS is effective, if one ATC unit has implemented Free Route Airspace but the adjacent one has not, the operational boundaries of FRA shall be published in the national AIS publications of both States. The Letters of Agreement between the concerned ATS units shall be amended accordingly to reflect any changes to the applicable procedures in the airspace where ATS is delegated.

10. AIRSPACE MANAGEMENT

10.1 General

ASM in FRA will differ from that of the fixed Route Network in that AOs will no longer be given information on which routes are available, but will need to know which airspace is available/not available. For the transit period of a given flight through FRA, the airspace users will need to know the activity of all pertinent airspace reservations areas to enable the selection of a flight path that will avoid them.

ATC units, corresponding military authorities, airspace users and the CFMU will need to know and share the same updated information with regard to activity of airspace reservations.

An advanced FUA concept has to be defined to guarantee compatibility between GAT widespread routing, OAT transit procedures and an efficient use of airspace reservations.

10.2 Information Sharing

When filing the flight plan, the airspace users will need to know the latest available information on the planned activity of airspace reservations affecting each flight.

In the pre-tactical phase the planned activation of all airspace reservations shall be made available to all interested parties. For the purpose of FRA, the eAIM shall be complemented by a similar publication that promulgates airspace availability/non-availability prior to the day of operation and that is updated as necessary during the tactical phase.

In the tactical phase, changes to the planned activation will need to be communicated to the CFMU as soon as they occur and shared with all the relevant ATM actors. A real-time airspace database will be necessary to deliver or make available real-time updates on airspace constraints.

An enhanced exchange and sharing of ASM data will be required at network level to ensure that airspace reservations is crossed or avoided depending on local procedures and whether or not activity is taking place in the area.

11. LETTERS OF AGREEMENT AND COORDINATION PROCEDURES

Letters of Agreement shall be adapted to reflect the specificities of Free Route Operations in regard to transfer procedures (points / segments / windows), flexible changes in sectorisation, links with the fixed route network, high fluctuations in traffic flows, possibility to leave/enter the airspace at random points, OLDI / IOP parameters, etc...

Appropriate mentioning of ATS delegation in areas involving FRA shall be fully considered.

The automatic exchange of flight data between ACCs will need to consider the possibility of transfer at random points.

Transfer procedures : Appropriate procedures shall be defined to reflect these new provisions.

12. FLIGHT PLANNING

12.1 General

Principles are outlined for GAT and OAT flight-planning, dealing primarily with GAT but will specifically mention OAT requirements where necessary.

Except in FRA where it is published that tactical rerouteing will be given, the responsibility is on the originator of a FPL to submit a routeing through FRA that avoids active airspace reservations.

CIV/MIL ATC, AOs and the CFMU should have the same information regarding the intended profile and routing of a flight, regarding both the initial flight plan and any subsequent revisions to that information.

In a longer term the use of users preferred routes and later on of business trajectories through the operational flight plan will have to be considered.

12.2 Use of Intermediate Lat/Long Points for Flight Planning

In order to benefit from the best operating conditions, in the longer term, airspace users may be allowed to use any intermediate Lat/Long points for flight planning. Such possibility shall be clearly promulgated in national AIS publications. Where such utilisation is not possible, publication/maintenance of intermediate 5LNC points shall be ensured.

12.3 Flight Planning Routeings through Airspace Reservations

To be able to select a route that avoids active airspace reservation areas in FRA, it is required that the activity of all pertinent areas is known to the AOs. If no alternative route is available, tactical re routeing will be provided. Flight plans planned around active airspace reservations should be “hard checked” by IFPS.

The selection of the route shall be based on the 5LNC or lat/long formally published to this effect.

In areas where civil/military coordination procedures and airspace conditions permit, the airspace users can be allowed to flight plan through active airspace reservations. Tactical re-routings could be expected in case of areas not being available for civil operations.

12.4 *Route Description*

FRA entry/exit points, intermediate lat/long points and other significant points shall be described using the standard ICAO format. Route portions between waypoints or Lat/Long shall be indicated by means of DCT.

12.5 *Flight Planning Facilitation through the Use of DCTs*

The use of published entry points with associated exit points might be required in certain cases to facilitate flight planning in FRA. This is especially valid in cases where only limited combinations of entry/exit points are permitted within FRA. Similarly, a number of DCTs might not be allowed for use by the airspace users. A harmonised approach for the publication of these DCTs will be ensured at network level. This approach shall ensure the respect of the status of airspace within various FIRs (e.g min/max FLs, avoiding penetration of uncontrolled airspace, availability period, etc.).

12.6 *Requested FL Change*

The airspace users may use any significant point or Lat/Long for indicating changes to the RFL. The airspace users shall observe the Flight Level Orientation System applicable within the respective FRA.

12.7 *Flight Plan Submission*

GAT flight-plans will be submitted to IFPS within the appropriate time-parameter. RPLs may continue to be submitted for flights that will transit FRA, but they might not have the full benefit of optimum route selection derived from precise information on airspace availability. They will continue to be checked by IFPS following normal procedures for proposing alternative routes when necessary.

Flight plan filing limitations shall be promulgated for areas where Free Route Airspace Operations is structurally limited – i.e. only a limited combination of entry/exit points are permitted.

12.8 *Flight Plan Checking and Correction*

In addition to the normal flight plan validation rules within IFPS, the flight-planned route through FRA shall be considered invalid if it:

- Fails to comply with published entry/exit requirements
- Infringes an airspace reservation
- Fails to maintain the prescribed minimum lateral and vertical distances from an airspace reservation; unless the route is allowed to be filed through the area.
- Fails to maintain the published FLOS.

In proposing alternative routes, IFPS will not be able to consider all the varying AO criteria for route selection.

In case of time-limited application of Free Route Operations, IFPS shall check the flight plan to ensure that it complies with the time parameters of the Free Route Operations.

12.9 Flight Plan Distribution

Real time updates to airspace availability should lead to a recalculation of the submitted flight profile by IFPS before the FPL is distributed. To ensure that subsequent route corrections can be offered for affected flights, an appropriate distribution time parameter will need to be set. Once this parameter has passed and FPLs are distributed, further route updates will not be processed.

Flight Plans shall be distributed to appropriate ATS providers, relevant military organisations and other authorised parties decided by National Authorities. The IFPS shall ensure the appropriate calculation of the flight profile to enable a correct distribution of the flight plan to all interested parties.

For large scale applications of free route airspace, the flight plan distribution will need to be ensured to the appropriate ATC units and sectors, hence the importance of having updated information on active sector configurations. In addition, the ATC units, the airspace users and CFMU will need access to exactly the same information, both for the initial flight plan and subsequent updates. The importance of completely up-to-date information on the status of airspace reservations is to be again underlined.

12.10 DCT Limits

Existing limitations on the DCTs (in distance and for cross border DCTs) will need to be reviewed.

In areas where a fixed route network remains, the % limitation of allowing DCT shall be set by each individual unit.

13. AIR TRAFFIC FLOW AND CAPACITY MANAGEMENT

13.1 General

Airspace users shall comply with normal ATFCM procedures both within and outside FRA.

Large scale applications of free route airspace or implementation of free route operations in adjacent ATC units will generate a large variation of trajectories. Real-time updates of the airspace situation with respect to both sector configurations and airspace reservations will be required in order to offer the most updated ATFCM situation at network/local levels.

13.2 Sector Configuration Management

In areas where adjacent airspace is FRA, the volatility of the traffic flows may be higher than today. This will require a larger number of elementary sectors, a larger number of sector configurations and a more flexible and dynamic adaptation of the sector configuration to the traffic demand/pattern.

Changes to sector configurations will need to be notified in real time to the CFMU to enable optimum network management actions. Appropriate procedures and system support to enable this flexibility shall be required. System support shall be in place to better predict trajectories in an environment where trajectories will be more volatile than in a fixed route structure.

In addition, procedures need to be defined to allow CFMU, through collaborative decision making processes, to propose the most optimum configurations, taking into account the expected traffic pattern at network level.

Variable sector monitoring values, communicated in real time to the CFMU, will be required to reflect the changing traffic complexity.

13.3 Sector and Traffic Volumes Capacities/Monitoring Values

The use of traffic volumes and exclusions will need to be considered, as large variations in traffic patterns could appear in the context of large scale applications of free route airspace or even when two adjacent ATC units allow free route operations.

13.4 Letters of Agreement Restrictions

A number of restrictions currently stipulated in the existing Letters of Agreement and implemented by CFMU for flight planning or ATFCM purposes may no longer be applicable in free route airspace. Such provisions will need to be reviewed.

13.5 Re-Routeing Proposals

The possibility for IFPS to propose routes to airspace users, taking into account the best operating conditions in free route airspace, shall be considered. New procedures will be required to define rerouting within free route airspace. System support will be required to facilitate this task. The provision of a time window for the period the FPL/RPL will be suspended or invalid should be considered (FLS/REJ).

13.6 ATFCM Procedures

A comprehensive re-evaluation of the current procedures for strategic, pre-tactical and tactical planning phases shall be undertaken to facilitate large scale application of FRA.

14. SYSTEM SUPPORT

Based on this operational concept, additional system support will be needed to facilitate the different phases of the stepped implementation of FRA in the FABEC area.

A list of system support tools, consistent with SESAR requirements, is depicted in the FABEC FRA roadmap. The introduction of these tools depends on the different free route implementation steps and local procedures/systems.

FABEC Implementation Phase

Extended Arrival Management OCD

EC Information

Attachment N.4

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

DOCUMENT SUMMARY

Objective : *The Operational Concept Document provides the common framework for Extend Arrival Management Operations in support of the FABEC Airspace Strategy*	
Origin : *SC OPS*	**Audience** : *SC OPS, SC TECH, ASB*

Title : Extended Arrival Management – Operational Concept Document
Reference : *FABEC Extended ArrivalManagement OCD v1.0*

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DOCUMENT CHANGE RECORD

Version	Date	Reason for changes	Author of changes
0.1	03.11.11	New FABEC document; based on the OCD prepared by MUAC covering the preceding XMAN initiative involving MUAC, LVNL and DFS	DFS
0.2	27.11.11	Contents updated: - Link to FABEC Free Route Airspace CONOPS - Outlook to SESAR AMAN developments	DFS
0.3	5.12.2011	Update after FABEC XMAN/AMAN/DMAN Workshop 29./30.11.11	DFS
0.4	9.12.2011	Update after internal meeting on 9.12.11 - Page 11: new table: Relation between AMAN systems and adjacent ATC units - Page 15 and 17: new pictures - new Chapter 3.5 XMAN and Data Link - Annex: new Scenario 3	DFS
0.5	22.12.2011	Inclusion of comments from FABEC partners	DFS, All Partners
1.0	11.01.2012	Endorsement at SC OPS 26 Meeting Update of document references	DFS

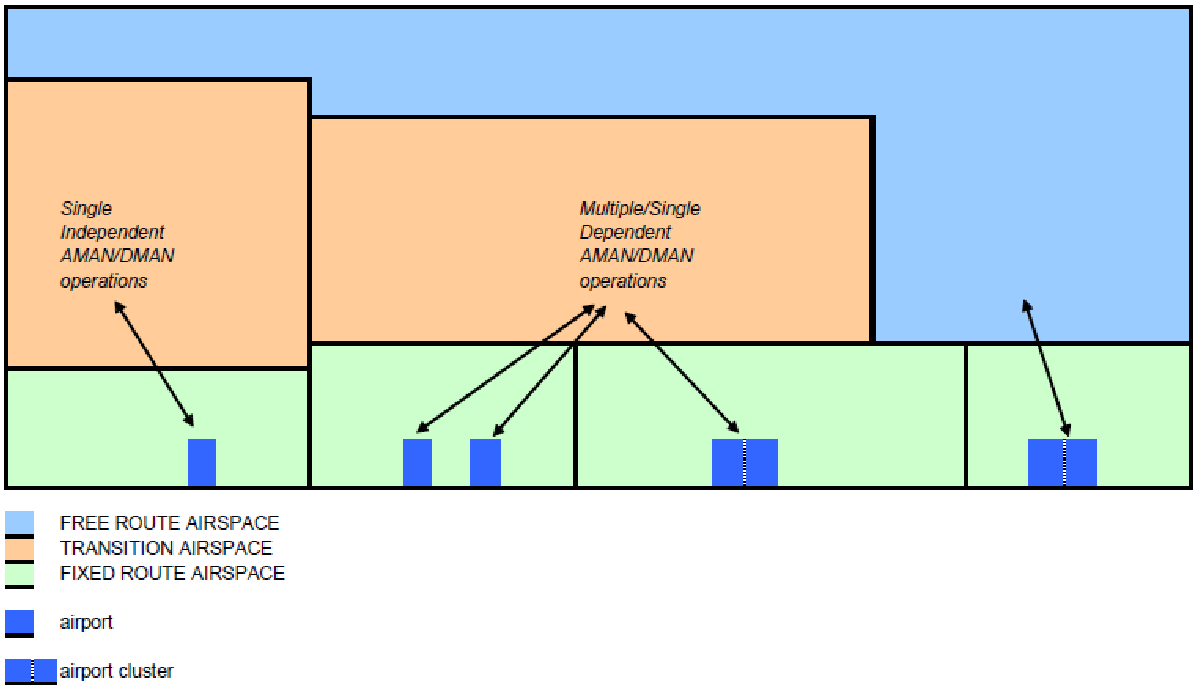
TABLE OF CONTENTS

1 INTRODUCTION

The FABEC ASB endorsed the airspace principles and the proposed airspace vision and strategy on September 7th, 2011 [1]. These set out a three volume airspace concept for all FABEC airspace, split into:

- Free route airspace volume (FRV) over the greatest possible FABEC area based on common concept of operations, providing flexibility and flight efficiency for airspace users;
- Fixed route airspace volume containing multi-hub terminal area (TMAs) serving major airports or a number of adjacent airports in an extended TMA operation, with flexible boundaries and cross border sector groups;
- Transition airspace volume linking the Top 5 TMAs (Paris, Frankfurt, Amsterdam, London and Munich) and fixed routes airspace to free route and to other parts of FABEC, including a harmonised concept of operation for the implementation of arrival and departure management systems, providing capacity and flight efficiency.

The resulting conceptual view of the airspace design is shown below:



As can be seen from the graphics, arrival and departure management need to be able to connect TMAs to transition airspace and even to free route airspace. In consequence, various ATC units will be involved in arrival management and/or departure management operations for a given TMA/airport.

In 2010/11 a XMAN Task Force comprising of members from LVNL, MUAC and DFS have already started to work on the subject of extended arrival management operations. This Operational Concept Document takes on board the contents of the work done in that context [2].

1.1 Purpose and Scope

This document is the Operational Concept Document (OCD) for the implementation of arrival management in the FABEC airspace. As such it covers and links the following items:

- arrival management operations for the major airports/TMAs in lower airspace within the responsible ATC unit
- extension of arrival management operations into the airspace of adjacent ATC units (ACC or UAC)
- consideration of multiple arrival management feeds within the airspace of one ATC unit (e.g. in the upper airspace (“en-route” management)).

The objective is to develop a single concept of operations for all FABEC partners that can be applied regardless of the traffic situation or distinction between upper and lower airspace. The concept should be able to be applied at a local level, within FABEC and even across FAB boundaries.

The concept will describe how arrival flows can be managed from en-route to the threshold of the runways, providing economical benefits to the airspace users and environmental improvements to all concerned. It will form the basis for a standardised set of requirements and a harmonised implementation plan.

The Operational Concept Document shall be applicable for arrival management operations at least for the major 5 airports/TMAs (Paris, Frankfurt, Amsterdam, London and Munich). Potentially it should also apply to intermediate airports/TMAs such as Zurich, Brussels, Berlin, Dusseldorf etc.

The necessary extension of arrival management operations is expected to reach out to a horizon of up to 200 NM around the major airports. The planning tools will extend their planning horizon into the en-route area of adjacent ACCs/UACs (if necessary), to cover the Top of Descent (TOD) and a suitable portion of the route of the flight before TOD. This means, in turn, that most of the FABEC control centres will be affected by extended AMAN operations and will need to implement the required system support and procedures.

The information calculated by arrival management systems (AMAN) shall be made available at ACC/UAC CWPs at which the optimal Top of Descent into the 5 major Airports/TMAs (Paris, Frankfurt, Amsterdam, London and Munich) and the intermediate airports is reached. Interim implementation steps will be defined in the XMAN roadmap.

1.2 XMAN high level Objectives

The XMAN Task Force has developed high level objectives [7];

- Develop solutions that enable quick application.
  Arrival Management is a topic confronting us in FABEC. ANSPs have developed Arrival Management Tools to optimize the sequencing into Hub airports. Thus increasing the capacity, reducing track miles flown and reducing fuel consumption and CO2 emission. Convergence of strategies is required now with the objective of ensuring that medium and long-term strategies are aligned.
- Transit to time based operations.
  Time Based Operations (TiBO) is the intermediate phase in progress to Trajectory Based Operations (TBO). The users have indicated that this is their preferred option giving them more transparency to their part of the process.
- Ground based arrival management.
  Currently the ground based system has demonstrated performance when it comes to times. The accuracy in avionics on the other hand has not yet demonstrated this and therefore AMAN will be a ground based automation for the short and medium term.
- Progress to more use of avionics (RTA function).
  The avionics are becoming more accurate and the number of high performance Flight

Management Systems is increasing. It is expected that the avionics will become more accurate than the ground system and therefore an increasing use of avionics is foreseen.

- Application of speed or time is subject to decision by the local unit.
  It is left up to the local unit to decide between either presentation of ‘time to lose’ (TTL)/’time to gain’ (TTG) or speeds/routes to the controller. There might be a need to ‘translate’ TTL/TTG into a speed or vice versa for uniformity within one unit.
- Start arrival management in the en route control.
  The larger the distance to the metering fix, the smaller the impact on the aircraft if it needs to be delayed or expedited. At the same time, the larger the distance to the metering fix, the greater the number of steering options. If the distance is enlarged, then this will automatically extend AMAN into the en route phase of flight.
- Exchange of data between ground systems.
  There is a need for systems to interact if arrival management is pushed beyond borders. It is important that existing and planned technology are interoperable and that the data exchanged is harmonized.
- Increase transparency about the arrival management plan in the cockpit.
  The customer requires the ATM system, arrival management included, to become more transparent. Delay has an impact on the handling of the flight, and on connecting flights. Therefore the airline and crew need to be informed.
- Provide information to the AMAN in regard to preferred trajectory, speed, etc.
  The TBO concept is based on trajectory negotiations between user and service provider. Part of this negotiation for aircraft operators is to share desired trajectory, speed, etc. This information must be available to the service provider in order to be able to provide tailored solutions as much as possible. Issues with information sensitivity must be resolved.
- Effects to other tools have to be considered.
  An AMAN system interacts with multiple systems and people, It is crucial that the incorporation of AMAN in to the operational environment does not have a detrimental impact.
- Fully integrated, interoperable system solution
  The system solution must be interoperable in order to ensure operational harmonization. Integration is an operational requirement.
- In line with SESAR development.
  The SESAR concept is the long-term vision when it comes to AMAN. All implementation steps must keep the long term objective as focus, but at the same time should provide sufficient freedom for local variances.

1.3 Related FABEC documents

More efficient arrival management is a corner stone of the FABEC Concept of Operations [3]. Relevant statements are:

- Arrival and departure management is moved from tactical control to preventive control with the extending horizon of traffic synchronisation.
- AMAN/DMAN will operate with an increased coverage and be linked between the major FAB aerodromes. The AMAN will be extended to upper airspace, including electronic coordination means both down- and upstream, and maximum usage will be made of datalink to pass arrival times etc. to aircraft.

The SC OPS tasked the XMAN Task Force to develop high level objectives which have been presented to the SCO/24 and are the foundation for the further work [7].

In a common roadmap of FABEC SC OPS and SC TECH the most important Operational Requirements to be achieved in FABEC are listed [4]. One of the priority topics is OR3: “Metering/sequencing traffic to hubs at larger distances (100 NM+) and higher levels (FL 300+); connecting AMAN Operations with the en-route airspace."

As stated above, electronic co-ordination means in support of arrival management need to be implement-ted. The FABEC OLDI Task Force has investigated this requirement and has concluded that the OLDI mechanism offers the capabilities to satisfy the automatic co-ordination and data exchange needs [5].

The Operational Concept Document for the departure management process including Airport-CDM [9] for the major 5 airports/TMAs (Paris, Frankfurt, Amsterdam, London and Munich) is being developed as a separate document and consistent with this document.

The FABEC Free Route Concept of Operations [10] also deals with the connection to the fixed route network, which in turn connects with the extended arrival management operations. Alignment at this interface needs to be assured.

1.4 Reference Documents

[1] Outcome FABEC CEO Workshop 7th Sept 2011

[2] Arrival Management in the Core Area – Draft Edition, Edition 01.02, dated 23.09.11

[3] FAB ATM Concept Vsn 1.4, dated 16.12.11, Chapter 4.2.5

[4] OPS-TECH Common Roadmap Vsn. 0.5, dated 08.06.11

[5] FAB OLDI TF WP6 AMAN-FDPS Interface, Vsn. 1.0, dated 04.10.10

[6] AMAN Information Extension to En-route Sectors- Concept of Operations, Edition 0.3, dated 22.04.09

[7] XMAN high level objectives SCO/24, September 2011

[8] FABEC XMAN/AMAN System Requirements, Vsn 1.0, dated 11.01.12

[9] DMAN/A-CDM Operational Concept Document, Vsn. 1.0, dated 12.01.12

[10] FABEC Free Route Airspace Concept of Operations, Vsn. 1.0, dated 11.01.12

[11] EUROCONTROL Specification for On-Line Data Interchange (OLDI), Edition 4.2, dated 19.05.2010

1.5 Glossary of Terms

Term / Acronym	Definition
ASB	ANSP Strategic Board (FABEC CEO Decision Body)
AMAN	An ATM tool that determines the optimal arrival sequence times at the aerodrome and/or possibly at other common route fixes (e.g. IAF).
Air Traffic Management	The aggregation of the airborne functions and ground-based functions (air traffic services, airspace management and air traffic flow management) required to ensure the safe and efficient movement of aircraft during all phases of operations.
Air Traffic Service	A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service).
Air Traffic Services Unit	A generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office.
Constraint	Any limitation on the implementation of an AMAN Information Extension to En-route Sectors Concept of Operations operational improvement, or a limitation on reaching the desired level of service. We use this term generically to refer to time, speed, lateral, and vertical data issued to the aircraft that restrict the options of the flight crew or FMS on how the aircraft is to be flown.

Constraint Waypoint	Waypoint for which a time constraint has been agreed.
Flight Plan	Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft.
XMAN	Cross Border Arrival Management (or Extended Arrival Management): Describes the extension of Arrival Management procedures across FIR borders with the help of upgraded AMAN systems and information provision to adjacent ATS units

1.6 Acronyms

ACC	Area Control Centre
AMAN	Arrival Manager
ANSP	Air Navigation Services Provider
ATC	Air Traffic Control
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATS	Air Traffic Services
COP	Coordination Point
CTA	Controlled Time of Arrival
CTO	Controlled Time Over
ENR	En-route
ETA	Estimated Time of Arrival
FDPS	Flight Data Processing System
FPL	Flight Plan
IAF	Initial Approach Fix
ICAO	International Civil Aviation Organization
LoA	Letter of Agreement
MET	Meteorological Information
MONA	ATC Monitoring Aids
ODT	Operational Requirements and Data Processing Team
OLDI	On-line Data Interchange
RTA	Required Time of Arrival
RTD	Required Time of Departure
TMA	Terminal Control Area
TP	Trajectory prediction

2 OVERVIEW

FABEC provides a unique opportunity to develop a harmonised approach to arrival management in the core area of Europe.

Within the Core Area, DFS (serving Frankfurt und Munich airports), NATS (serving London airports), LVNL (serving Amsterdam airport), DSNA (serving Paris airports), Belgocontrol (serving Brussels airport), and skyguide (serving Zurich airport), i.e. the ANSPs serving the major Hubs, have implemented or intend to implement Arrival Management techniques within their Technical Systems and Operational Procedures.

However, these implementations are currently limited to the responsible Approach/ACC Units, except for Munich, where an extension of arrival management operations into the adjacent Vienna En-Route centre has been realised.

The effect of this is that - most of the times - only within Lower Airspace, arrival-sequence related methods are applied, leading to tactical instructions (speed-adjustments, vectoring) at the most difficult stage of the flight, and with the most penalising consequences for the environment (noise, CO_2 emission).

By extending the time-horizon of such Arrival Management techniques into adjacent and/or Upper Airspace, it is envisaged that the effects on the environment will be minimised, and at the same time, that controller workload in lower airspace will be reduced. It seems obvious that by extending the time-horizon of arrival management, the net effect will result in optimising hub operations and meeting airlines needs. Where a Gate-To-Gate concept would be the ultimate goal, this document tackles half of the equation: the En-Route-To-Gate half.

The connection to the Gate-To-En-Route part is provided by the DMAN/A-CDM Operational Concept Document [9] where the optimisation of the turn-around-process at the airport is described. Important input information is precise and reliable arrival times which can be delivered by the XMAN/AMAN process. The connection of A-CDM information and XMAN/AMAN is of utmost importance in case the aircraft departs at an airport in the vicinity of the destination.

The starting point of the arrival management process needs to connect properly to the Free Route Operations Airspace, as described in [10]: “The vertical connection between Free Route Operations Airspace and the underlying fixed ATS route network shall take into account the various climbing and descending profiles. The interconnectivity between Free Route Operations Airspace and the underlying fixed ATS route network shall be ensured through the publication of a set of waypoints. The transition layer from/to Free Route Operations Airspace shall include the publication of extended SIDs/STARs or of a fixed ATS route network reflecting the typical climbing/descending profiles. The promulgation of these points shall be made through the national AIS publication with a clear indication of the nature of these points (entry, exit or entry/exit points).”

As an en-route centre is managing different traffic-flows (into different airports) which need now not only to be de-conflicted to ensure safety-levels, but also need to be optimised to increase Arrival-Management efficiency, special procedures and tools will have to be put in place. These tools and procedures in the feeding centre should be made as homogeneous as possible for the en-route controller, while still taking into account “local” arrival management techniques and capability levels in the receiving units.

Moving this arrival-management task (partially) into adjacent and/or upper airspace will:

- Require as much as possible system support (e.g. implementation of OLDI AMA message) and/or new operational procedures.
- Introduce additional workload to the Controller in the adjacent and/or upper airspace. This needs to be mitigated by appropriate system support (for example by integration of multiple AMAN feeds into an EMAN and implementation of MTCD).

The environmental and flight-efficiency improvements of applying these techniques in the en-route-phase can only be guaranteed if corresponding operational procedures are applied in the receiving ACCs.

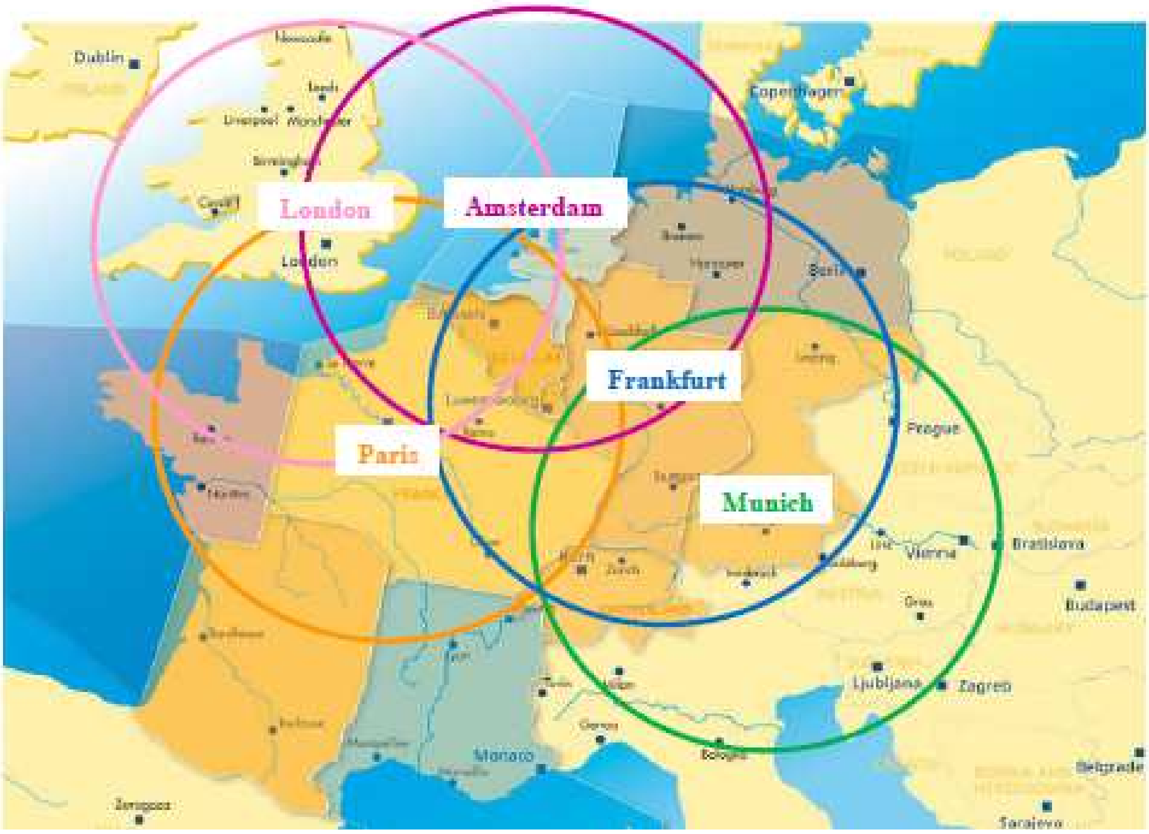
It is very likely that the capability-level of implementing arrival-management techniques in en-route airspace is driven by technical means to support the concept. Important enablers are electronic coordination means both down- and upstream, and datalink, which is expected to be the preferred means to pass arrival times etc. to aircraft, especially for en-route sectors.

It is however not excluded that improvements can already be achieved through enhanced operational procedures and techniques which do not depend on technical evolutions of the current ATM Systems.

2.1 Geographical Scope

The necessary extension of arrival management operations is expected to reach out to a horizon up to about 200 NM around the major airports. Together, these horizons will cover almost the entire FABEC airspace. Therefore, most of the FABEC control centres will be affected by extended AMAN operations, some of which will need to feed several arrival streams for different airports/TMAs.

The situation is shown in the following graphics:



The following relation between AMAN systems and adjacent ATC units feeding the corresponding arrival streams within a horizon of about 200 NM can be identified:

	AMAN LONDON	AMAN AMSTERDAM	AMAN BRUSSELS	AMAN FRANKFURT	AMAN MUNICH	AMAN PARIS	AMAN Zurich
Maastricht UAC	**X**	**X**	**X**	**X**	**(x)**	**X**	
Karlsruhe UAC				**X**	**X**		**X**
Langen ACC		**(x)**	**X**		**X**		**X**
München ACC				**X**			**X**
Bremen ACC		**(x)**		**(x)**	**(x)**		
Amsterdam ACC	**(x)**		**X**	**(x)**			
Brussels ACC	**(x)**	**X**		**(x)**		**X**	
Reims ACC/UAC	**X**		**(x)**			**X**	**X**
Paris ACC/UAC	**(x)**		**X**				
Brest ACC/UAC	**X**					**X**	
Bordeaux ACC/UAC						**X**	
Marseille ACC/UAC						**X**	
Zürich ACC/UAC				**(x)**	**X**		
Geneva ACC/UAC						**X**	**X**
Upstream centres outside FABEC							
London ACC		**X**	**X**			**X**	
Scottish Centre	**X**	**(x)**					
Wien ACC/UAC					**X**		
Prague ACC/UAC					**X**		
Padua ACC/UAC					**X**		**X**

(x) = If a small x is shown in parenthesis the overall traffic is below 5% of the overall inbound traffic for this airport.

Assuming that this traffic composition remains more or less stable (except for Karlsruhe and Munich, where from 2013 the upper airspace > FL 315 will be moved from Munich ACC to Karlsruhe UAC) for the upcoming years, the table can give a strong hint where the early introduction of XMAN is most beneficial.

The most affected ATC Units are UAC Maastricht, UAC Karlsruhe, ACC Reims, ACC Langen and ACC Brussels. The picture would not change much, if more intermediate airports/TMAs with an AMAN System would be incorporated in the consideration.

A more refined analysis will need to consider traffic flows between related ATC units / TMAs in order to identify the most important arrival streams and priorities for implementation of extended arrival management operations.

2.2 Levels of Integration

The EUROCONTROL AMAN Information Extension to En-route Sectors- Concept of Operations [6] describes three levels of integration between the units responsible for the Arrival Management and the upstream unit and their ATS-System. These levels are:

Level 1 – No upgrade of the en-route ATS system, remote terminal display (not integrated), voluntary basis depending on workload;

Level 2 – ATS system upgraded to allow interoperability and integration of the display, adaptation of the Letters of Agreement however still on a voluntary basis;

Level 3 – Full integration in to the en-route system including automated support for coordination and transfer with negotiation facilities, Letters of Agreement formalise the process.

It is expected that the highest level of integration will bring the most benefits. However, this must be balanced by the cost of implementation and the local needs at the airports.

The target level of integration within FABEC would be initially Level 2 including Letters of Agreement. In the long term the concept and the implementation should be upgraded to Level 3.

3 DETAILED CONOPS

The concept is based on the principle that the AMAN will provide the optimum arrival sequence and that the corresponding information will be made visible to the en-route controllers as soon as practicable. This will enable the en-route controllers to take early action for the flights that are required to modify their trajectory in order to accommodate the AMAN resolutions.

In the following the concept is elaborated by

- giving an overview of the different methods of arrival management; speed control versus time control.
- providing scenarios describing cases where arrival management is necessary to be started in the upper airspace
- detailing the concept of arrival management in en-route airspace.
- describing the required system support related to the OLDI mechanism and its usage.

3.1 Methods

Today's AMAN systems work all time based. They calculate scheduled times for a COP (Coordination Point), Metering-Fix and runway thresholds. There are two different ways for realizing these scheduled times, either regulating the aircraft on speed control or by time management (fixed times to achieve or time to gain/lose) based on a metering fix or a COP. Both techniques have their advantages.

It needs to be ensured that en-route control centres, which may have to control arrival streams for various AMANs, will be able to accommodate both methods.

Speed control gives a great deal of predictability in the path the plane will fly but is "less" accurate in achieving the required precision overhead fixes and is highly dependant on the sophistication of the trajectory calculation the AMAN is able to deliver. It does, however, have the advantage of being a positive control instruction that provide controllers with known parameters.

Time management requires the use of an airborne flight management system function known as the Required Time of Arrival (RTA). Only the most modern FMSs have this function although pilots are also able to fly to times by juggling with, for example, the cost index. When using time management the current position of the flight is known - as is the end state (where it is required to be at a certain time) - but the path in between these two points is variable as different FMS/airframe combinations manage the speed variation differently. While this potentially gives a higher accuracy over speed control, controllers in simulations have voiced concerns regarding the unknown behaviour of the aircraft, after issuing time constraints to the aircraft. This is currently under discussion in various working groups and has been raised as an issue in the SESAR Concept.

Time Management could be combined with Point Merge operations in order to allow for a delay sharing with downstream ATC units, to support continuous descent approaches and to include collaborative arrival management decision making.

The other relevant part of the equation for en-route airspace is the metering fix – from initial investigation AMANs using time issue information at a distance from the fix and vice versa for those using speeds. It may very well depend on the method, when the optimum point in time will be to receive a required action as calculated and transmitted by AMAN.

This may imply in some areas that the AMAN's horizon needs to look out very far and this implies in turn that the AMAN needs to receive FPL information and track information early enough, such that position correlation for the relevant aircraft is already achieved before this horizon. In addition it requires that the trajectory prediction of AMAN is accurate enough to calculate the speed/time required without overburdening the adjacent en-route centre with frequent changes in the transmitted arrival management constraints. Limited radar coverage of the approach unit needs to be mitigated by appropriate track data provision from adjacent ATC units.

3.2 Scenarios

The “basic” scenario described below (coordination with only one ACC) takes account of operational procedures and technical capabilities which are closely aligned to the currently available system support based on the OLDI mechanism, i.e. the OLDI AMA message and its potential use. More “advanced” scenarios would require more sophisticated AMAN systems and would envisage dialogue procedures in order to determine the best possible approach trajectory.

The following generic scenario describes the basic steps in the interaction between the accepting ATC unit, i.e. the ATC unit which runs the AMAN, and the transferring ATC unit, where the flight is under control at the start of the scenario.

1. For each eligible flight the transferring unit FDPS sends an ABI and/or an ACT message to the accepting unit. The ACT message contains the last up to date flight data for the flight including the co-ordination point, estimated time over the co-ordination point and the corresponding flight level.
2. The accepting unit updates its flight plan and trajectory calculation for the eligible flight and relays the information (e.g. ETO) to its AMAN.
3. When the flight enters the Planning Horizon of the AMAN, the AMAN and supporting control tools updates its optimum arrival sequence with this flight and calculates according to its capabilities e.g.
    a. Expected Approach Time (EAT) and/or
    b. Time to lose or time to gain relative to the Metering Fix (IAF) and/or
    c. Calculated time over (CTO) a coordination point (COP) and/or
    d. Speed constraint and/or
    e. Route proposal (to planned IAF)
4. The accepting unit prepares the AMA message (either automatically or manually) related to the eligible flight with the bilaterally agreed parameters and sends it to the transferring unit. In addition it displays the information at local CWPs where required.

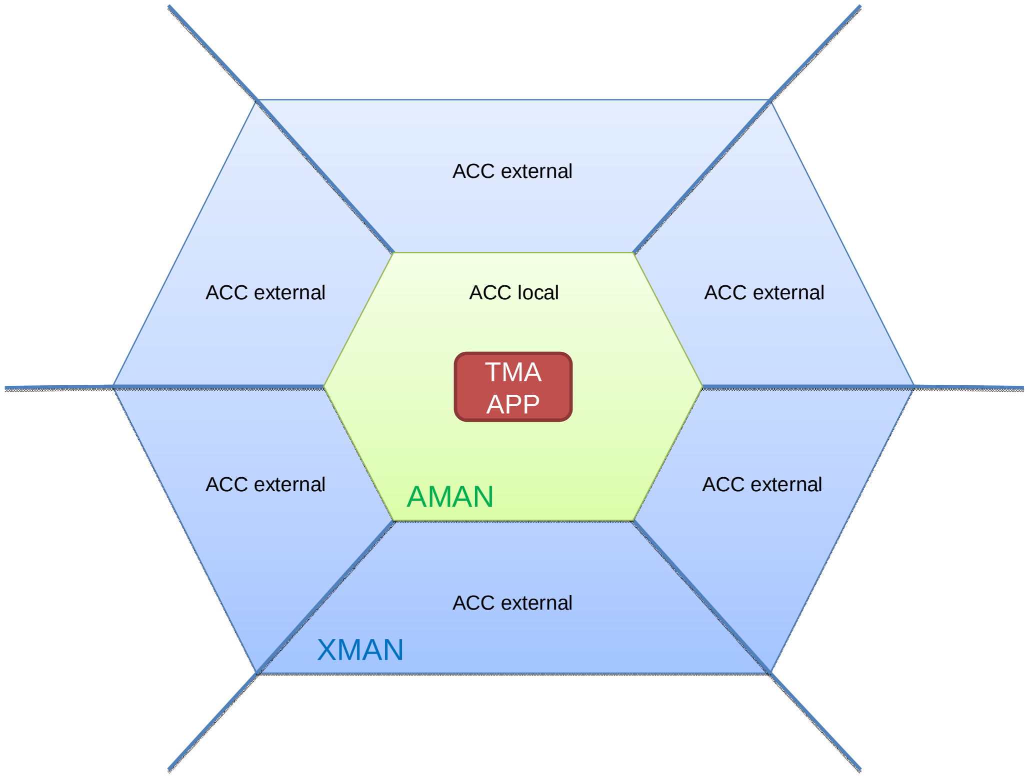
   Note: No AMA message shall be sent, if the flight falls outside of pre-defined parameters.
5. The FDPS of the transferring unit processes the AMA message, sends a LAM if successful, and displays the contents of the AMA message to the relevant ATCO.
6. The en-route controller analyses the information and decides that the traffic situation and his workload allow them to implement the AMAN constraint. If bilaterally agreed, verbal coordination is performed, if the constraint cannot be applied.
7. The En-route controller instructs the aircraft about the AMAN constraint, and informs the flight crew about the reason for the instruction.
8. The flight crew acknowledges the instruction and adjusts the flight profile accordingly.

Additional steps and procedures may become necessary, if the controller realises potential conflicts for the flight which has implemented the arrival management constraint.

The specific scenarios with examples of real systems and flights can be found in the Annex:

- Scenario 1 (Time based into Frankfurt Airport)
- Scenario 2 (Speed/Route based into Amsterdam Airport)
- Scenario 3 (ACARS/FMS executed into London Heathrow Airport)

3.3 Arrival Management in en-route Airspace



In general, aircraft from different directions need to be managed into different arrival streams by en-route centres. This highlights two important issues, those of overall arrival management and integration of multiple arrival management.

These issues need to be managed appropriately in order to mitigate the following situations:

- Implementation of arrival management in to an airport from a single direction at the optimum distance artificially penalises flights coming from that direction. For example flights in to Amsterdam can be optimally constrained in the upper airspace from 160nm when passing through MUAC's eastern sectors. Ideally from the south Reims control would start the process and from the west London. Unless Amsterdam integrate their AMAN with Reims and London the traffic from these directions will fly their unconstrained flight plan speeds until the FIR boundary, potentially queue jumping, and suffering short term more penalising constraints in the lower airspace with the resulting negative economic and environmental effects. Ideally, a single en-route unit would feed from all directions into the horizon of the AMAN.
- Aircraft are not under control of only a single entity so that speed or time control cannot be varied effectively which reduces the ability to use these techniques for metering or delay absorption. Insufficient airspace results in a small transit time negating the possibility to use effective speed/time reductions and or path stretching and limiting the effective merging of traffic streams for de-confliction and streaming purposes.

- The Top of Descent is spread across multiple centres limiting the use of concepts such as CDOs or tailored arrivals and puts in jeopardy the future development of airborne sequencing and merging techniques.
- In addition multiple units are involved in de-confliction of the departure streams from the arrivals and the over flights increasing coordination and workload for controllers and providing a sub-optimal service.

Therefore, ensuring and implementing a homogenous application for the en-route controller in order to integrate multiple arrival-management applications in the receiving units, is paramount. System support with MTCD and En-route Manager capabilities would be important to fully achieve the benefits of XMAN operations.

In order to gain experience and to optimize the procedures in the en-route units a stepwise approach could be followed:

- In a first step the arrival constraint information for the aircraft is displayed to the respective controller for reference and information purposes only.
- In a second step the controllers are asked to adhere to the arrival constraint request as much as possible provided that this is possible in respect to the traffic situation and their workload.
- In a third step the amount of adherence to comply with the given arrival constraint request is increased and formal procedures are established (LoA). This will be the target level of ambition to be achieved.

In addition, airspace and centre boundaries realigned to allow single en-route units to manage arrivals and departures from multiple busy aerodromes increases the ability of the unit to accurately plan sector demand and adapt accordingly because all necessary traffic is known. It provides an increase of flexibility by not being constrained by multiple, different, Letters of Agreement and provides the most optimal flight path for each flight.

3.4 Accommodating flights from nearby airports

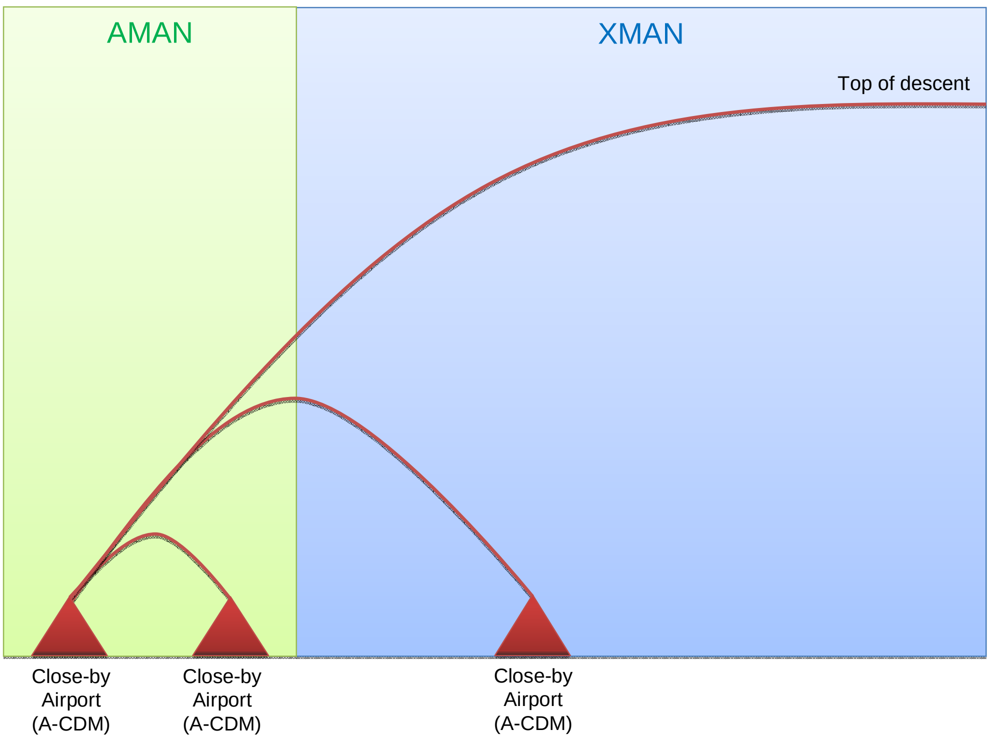
AMAN metering and sequencing of short-route-flights from nearby airports is depending on the condition the aircraft will enter the AMAN operational horizon, either within the local ATC unit (AMAN) or cross border extending to adjacent ATC units (XMAN).

There are two possibilities:

a) The flight is known well in advance and a corresponding flight plan is available right in time. These data can be provided e.g. by airports with A-CDM operation. AMAN inserts the expected flight provisionally into the arrival sequence by using the planned data of the not yet active flight. When the flight becomes active and deviations from the planned trajectory are detected, a corresponding up-date of the aircraft position in the sequence needs to be calculated.

b) The aircraft appears without any warning (lead time). When initial flight data become available at a relatively late point in time the aircraft has to be inserted into the already established arrival sequence. This will cause re-sequencing and metering within the arrival sequence and corresponding up-date of advisories. Due to missing provisional sequencing position for this aircraft a larger amount of already sequenced flights will be affected in this case. If the respective flight is placed into the sequence this could cause a large amount of flights to be re-sequenced (and therefore delayed). If this is inadequate, manual intervention is required.

Clearly possibility a) is favoured and information provision for departures from airports within the XMAN horizon shall be available for early sequencing calculations by the AMAN system.



3.5 XMAN and Data Link

For large oceanic airspaces the horizon of AMAN could reach out to several hundred nautical miles. In this case only limited ground-based surveillance information would be available to the AMAN system. However, the AMAN system could receive the ETOs for the coordination points and the metering fix directly from the aircraft or the airline operations centre via ACARS. In return the AMAN time constraint for this flight could be sent via ACARS directly to the aircraft. The flight crew would calculate the (AMAN) requested flight profile (FMS) accordingly and would request from ANSP for a speed reduction, a level change or an element of both.

3.6 System Support

OLDI support in this context is describing the messages that can be used to facilitate the passing of information needed from/to arrival systems.

The operational system currently used for the purpose of replacing verbal exchanges between centres is called OLDI (OnLine Data Interchange) [11] and ideally this should be used to exchange the required data.

The OLDI AMA message as described below is used to transport the AMAN information to the upstream centre with the purpose of enabling the accepting unit to pass to the transferring unit information on the AMAN constraint in order to optimise the approach sequence.

The AMA message satisfies the following operational requirements in order to alleviate ATC workload in co-ordinating arriving flights:

- provide the transferring ATC unit with the time that the flight is to delay/gain at the arrival management metering fix;
- where procedures have been bilaterally agreed between the units concerned, provide the transferring ATC unit with a target time for the flight to be at the COP;
- when bilaterally agreed, provide the transferring unit with a speed and/or a route advisory.
- the advisory needs to be communicated to the flight, prior to transfer.

The AMA message contains the following mandatory items of data:

- Message Type;
- Message Number;
- Aircraft Identification;
- Departure Aerodrome;
- Destination Aerodrome;

and based on bilateral agreement, one or more of the following optional items of data:

- Metering Fix and Time over Metering Fix;
- Total Time to Lose or Gain.
- Time at COP;
- Assigned speed;
- Application Point
- Route
- Arrival Sequence Number

Note: The item Route contains the requested routing.

The reception and correct processing of an AMA message is acknowledged by sending a Logical Acknowledgement Message (LAM).

The OLDI mechanism will be the standard data exchange to be implemented in XMAN operations in the first implementation step.

A more detailed description of the AMA message and some extensions can be found in the FABEC XMAN System Requirements [7] document.

4 Future Developments

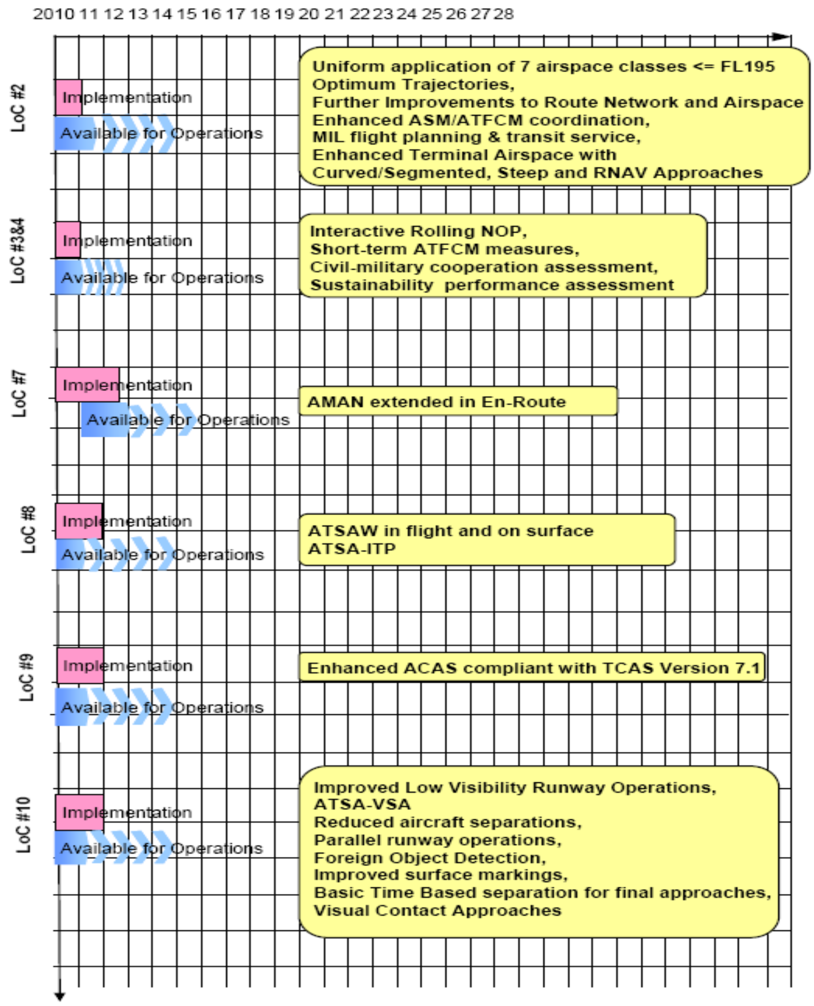
The FABEC XMAN/AMAN Operational Concept Document covers the procedures and system support which has been prototyped already today and which can be implemented in the next few years as a first implementation step. There are further developments ongoing in the area of arrival management. These are shortly described below and – when mature - would be taken on board by FABEC as a next implementation step.

4.1 SESAR AMAN En-Route

From a strategic point of view this XMAN Operational Concept Document is aligned with the SESAR Master Plan and is intended to support more specifically the ATM Service Level 1, namely the LoC # 7- Queue Management Tools. One of the planned operational improvements is AMAN extended in En-Route: Introduce Arrival Management Extended to En-Route Airspace.

Initial operational capability for AMAN extended in En-Route is expected in the 2011-2015 timescale as illustrated in the figure below.

Proposed change: Replace figure 14: ATM Service Level 1 with the figure below.



For the Service Level 2 SESAR addresses Arrival Management in the context of Traffic Synchronisation (TS). The Traffic synchronisation approach in SESAR is covered by 5 Operational Focus Areas, encompassing not only extended AMAN but also AMAN and Point Merge, integrated AMAN & DMAN, i4D and CTA, DMAN multiple airports.

AMAN extended to en-route also deals with CCD, CDA, PTC, multiple-airport AMAN-DMAN. It is also addressed in the Trajectory Management Framework dealing with FDPS interoperability (IOP).

These topics will be worked out and validated in SESAR in the next years until 2016. The results will provide guidance how XMAN could be further developed within FABEC. The findings will be taken into account in due time.

4.2 Use of Aircraft Parameters and Data Link

- **Use of multiple controlled times of over-fly (CTO)**

The CTOs allow to perform precise sequencing not only on arrival (CTA) but also on other intermediate merging points e.g. in en-route. The CTOs are ATM imposed time constraints set on successive defined merging points for queue management purposes. The CTOs are computed by the ground actors on the basis of the estimated times provided by the airspace user (airline operation centre or flight crew). They have to be met by the aircraft with the required performance.

The CTOs allow to perform precise sequencing not only on arrival (CTA) but also on other intermediate merging points e.g. in en-route.

- **Use of Mode S parameters**

Current aircraft performance data and aircraft intent data transported to the ground system via Mode S or VDL/ATN data link can be taken into account by the XMAN/AMAN system such that most economic flight profiles can be retained for the optimisation of the arrival sequence.

5 ANNEX: EXAMPLE XMAN SCENARIOS

Scenario 1 (Time based into Frankfurt Airport)

A DLH flight enters MUAC from London destination Frankfurt, calls in on the frequency and is identified.

At a pre-defined time parameter before crossing the boundary between MUAC and Langen ACC an activation message (ACT) is initiated by the MUAC nFDPS. The ACT message contains the last up to date flight data for the DLH including the co-ordination point, estimated time over the co-ordination point and the corresponding flight level.

The Langen FDPS (P1) receives and processes the notification message. The trajectory prediction takes into account the estimated time over the COP and the AMAN tool places the DLH in the arrival sequence. The AMAN calculates a calculated time of arrival (CTA) for the threshold, a calculated time over for the metering fix (MF) (TOM) including a time to lose (TTL) or time to gain (TTG) to achieve that time at the metering fix, and a calculated time over (CTO) the COP.

The metering fix related constraints (TOM and TTL/TTG) are displayed to the Langen controller. The AMA message containing these metering fix related constraints and the COP related constraint (CTO) is issued by P1 to the nFDPS.

The notification of the time constraint is processed in the nFDPS and the relevant content is displayed to the controller through the CWP HMI.

The en-route controller analyses the information and decides that the traffic situation and his workload allow them to implement time constraint.

The en-route controller instructs the aircraft to arrange its flight to cross the MF with the required delay, and informs the flight crew about the reason for the instruction.

The flight crew acknowledges the instruction and adjusts their speed accordingly.

The en-route controller assesses that at the current speed the DLH is conflicting with another flight and decides to descend the aircraft to a lower flight level and provides a vector away from the conflicting aircraft in order to facilitate the descent.

The flight crew acknowledges the instruction and complies with it. However, because the aircraft is no longer flying to the COP they are no longer able to meet the arrival management time constraint.

After the DLH is clear of the conflicting aircraft the DLH is returned on their own navigation to the COP and, as they rejoin their route to the MF the FMS recalculates the required speed to meet the time constraint.

The flight continues its progression and shortly before crossing the boundary is handed over by the MUAC en-route controller to the Langen ACC controller.

The DLH enters the Area of Responsibility of Langen and the flight crew establishes communication and is identified. The Langen ACC controller issues a revised clearance for the portion of the route contained in its Area of Responsibility in accordance with the arrival management proposal.

DLH acknowledges and flies the cleared route avoiding the need for radar vectoring.

Scenario 2 (Speed/Route based into Amsterdam Airport)

A KLM flight enters MUAC from Copenhagen inbound Amsterdam, calls in on the frequency and is identified.

At a pre-defined time parameter before crossing the boundary between MUAC and LVNL an activation message (ACT) is initiated by the nFDPS. The ACT message contains the last up to date flight data for the KLM including the co-ordination point, estimated time over the co-ordination point and the corresponding flight level.

The LVNL FDPS (AAA) receives and processes the notification message. The trajectory prediction takes into account the estimated time over the COP and the AMAN tool places the KLM in the arrival sequence. The AAA Inbound Planning (IBP) function calculates an estimated time of arrival (ETA) for the initial approach fix (IAF).

The SARA tool calculates a speed for the KLM to fly taking in to account the known routing, this speed is displayed to the LVNL controller and via the AMA message a coordination message containing this constraint is issued by the AAA to the nFDPS.

The notification of the speed constraint is processed in the nFDPS and the relevant content is displayed to the controller through the CWP HMI.

The en-route controller analyses the information and decides that the traffic situation and his workload allow them to implement speed constraint.

The en-route controller instructs the aircraft to reduce speed, and informs the flight crew about the reason for the instruction.

The flight crew acknowledges the instruction and complies with it.

The en-route controller assesses that at the current speed the KLM is conflicting with another flight and decides to descend the aircraft to a lower flight level and provides a vector away from the conflicting aircraft in order to facilitate the descent.

The flight crew acknowledges the instruction and complies with it. However, at the revised altitude and direction the initial speed is no longer adequate for meeting the arrival management time constraint over the COP.

The SARA tool notices the discrepancy via its tracking functionality and calculates a new speed for the KLM to fly, the MUAC controller communicates the revised speed instruction.

The flight continues its progression and shortly before crossing the boundary is handed over by the En-route controller to the Amsterdam ACC controller.

The KLM enters the Area of Responsibility of LVNL and the flight crew establishes communication and is identified. The ACC controller issues a revised clearance for the portion of the route contained in its Area of Responsibility in accordance with the arrival management proposal.

KLM acknowledges and flies the cleared route avoiding the need for radar vectoring.

Scenario 3 (ACARS/FMS executed into London Heathrow Airport)

The expanded AMAN horizon set at a flying time (85 mins) equivalent to 550 NM from Heathrow, will have a stable sequence of out of area traffic.

By 500 NM from Heathrow the AMAN system will have sequenced the subject aircraft, formulated the delay and calculated a time to lose (TTL), of up to 5 minutes for a point at approximately 130NM from Heathrow.

At 500NM this time will be sent via ACARS to the aircraft. The aircraft will be required to comply to lose the time in the next 370nm hence eliminating the need for stack holding at low level during normal operations.

This message is unknown to the ANSP the aircraft is receiving a service from at 500 NM (although relevant ANSPs will be briefed on the likely effect), and the pilot will, as required, make the request for either a speed reduction, level change or an element of both.

As there is considerable distance involved, the speed reduction may be only 0.01 mach, or the speed will remain the same but the level may change by 1000-2000 ft. Sector controllers at NATS and surrounding ANSPs should deal with speed and level change requests from pilots as a result of this initiative as 'normal air traffic control': granting or declining the request as required in order to maintain safe separation with other traffic.

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FABEC Implementation Phase

DMAN/A-CDM OCD

EC Information

Attachment N.5

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

DOCUMENT SUMMARY

Objective : *The Operational Concept Document provides the common framework for DMAN/A-CDM Operations in support of the FABEC Airspace Strategy*	
Origin : *SC OPS*	**Audience** : *SC OPS, SC TECH, ASB*

Title : Airport CDM – Operational Concept Document
Reference : *FABEC Airport CDM OCD v1.0*

Version : *1.0*	**Date** : *12.01.2012*	**Status** : ☑ Draft ☐ Released	**Classification** : ☐ Public ☑ FABEC limited ☐ Addressees limited

DOCUMENT CHANGE RECORD

Version	Date	Reason for changes	Author of changes
0.1	11.11.11	New FABEC document	DFS
0.2	21.11.11	Contents updated	DFS
0.3	05.12.2011	Update on all chapters based on FABEC WS results (29./30.11.2011)	DFS
0.4	22.12.2011	Updates based on received comments	DFS
1.0	12.01.2012	Endorsement at SC OPS 26 Meeting	DFS

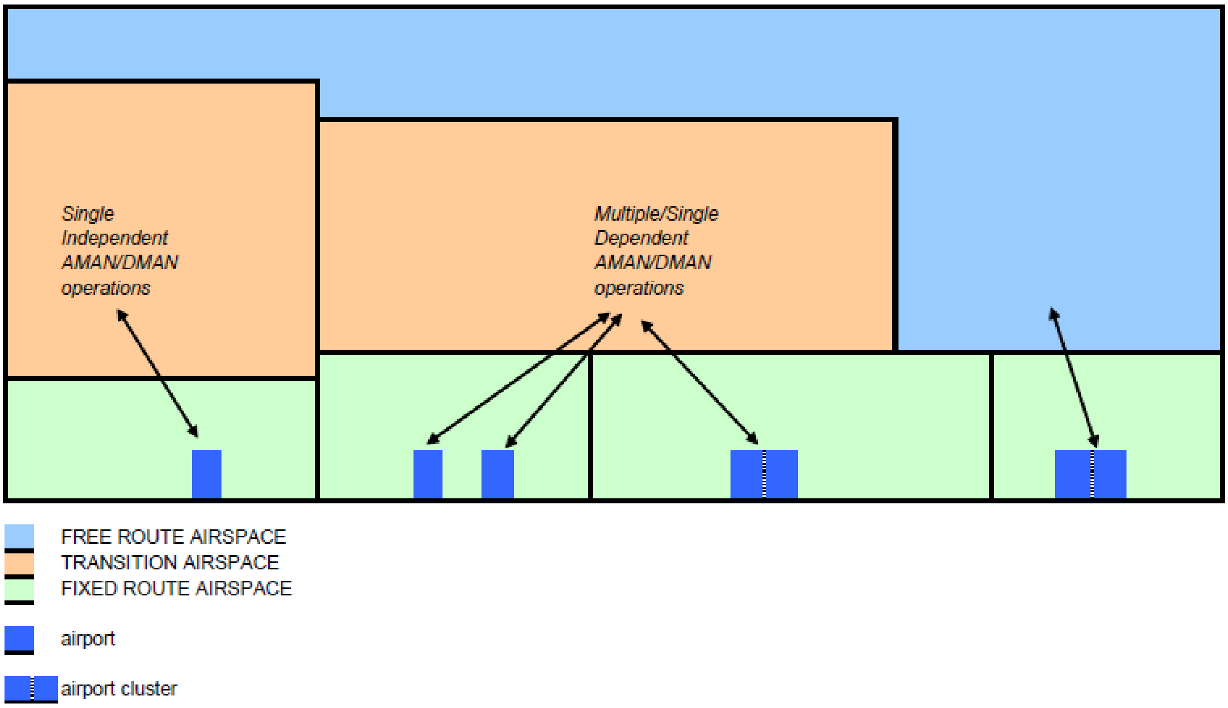
TABLE OF CONTENTS

1 Introduction

The FABEC ASB endorsed the airspace principles and the proposed airspace vision and strategy on September 7th, 2011 [1]. These set out a three volume airspace concept for all FABEC airspace, split into:

- Free route airspace volume (FRV) over the greatest possible FABEC area based on common concept of operations, providing flexibility and flight efficiency for airspace users;
- Fixed route airspace volume containing multi-hub terminal area (TMAs) serving major airports or a number of adjacent airports in an extended TMA operation, with flexible boundaries and cross border sector groups;
- Transition airspace volume linking the Top 5 TMAs (Paris, Frankfurt, Amsterdam, London and Munich) and fixed routes airspace to free route and to other parts of FABEC, including a harmonized concept of operation for the implementation of arrival and departure management systems, providing capacity and flight efficiency.

The resulting conceptual view of the airspace design is shown below:



As can be seen from the graphics, arrival and departure management need to be able to connect TMAs to transition airspace and even to free route airspace. In consequence, various ATC units will be involved in arrival management and/or departure management operations for a given TMA/airport.

In relation with turnround and departure management Aerodrome operations shall be within the focus of the FAB ATM CONOPS.

Airport Collaborative Decision Making (Airport CDM) builds up the most important link between Arrival and Departure Management issues. Therefore it has to be considered as an operational basic to ensure a feasible turnround process and reliable target information towards process partners, e.g. ATFCM, AMAN of destination airport, etc.

In the FAB ATM CONOPS the interface between traffic synchronisation and aerodrome operations is an important issue as it takes under consideration different CDM partner information and needs.

In Europe Airport CDM is defined and regulated by an EU Community Specification (EN303212). This Community Specification is the baseline ConOps as well as the minimum technical requirements for Airport CDM.

Airport CDM essential procedure parts are:

Transparency + Information Sharing:

- To ensure Common Situational Awareness for all partners“

Airport CDM is one operational process:

- Considering ATC Flight planning / Arrival Phase / Turnround / Take Off Phase”

Link Day of Operations with Schedule Planning:

- „Comparison & Correlation of ATC-Flight Plan, Airport Slot and Airport flight data“

Feasibility of flight turnround

- „Permanent matching and correlation of related In- and Outbound Flight times and data“

Use of Variable Taxi Times – VTT

- „ Replaces NETWORK MANAGER Default Taxi Times”

TOBT = Airline commitment:

- „ Introduction of Target Off Block Time as an estimate of Aircraft Ready“

TSAT = Airport CDM commitment and result of Pre Departure Sequencing:

- *„ Introduction of Target Start Up Approval Time based on TOBT, VTT, CTOT, any other constrains (e.g. TTA) and real operational capacity as driver for the „Pre Departure Sequence “*

Procedure adherence:

- *„Start Up clearance / Push Back will be granted under consideration of TOBT and TSAT “*

Linking the airport into the network:

- *„ Reliable In – and Outbound estimates/target times through automated Data exchange with the Network Manager“*
- *Check of consistency of airport slot with actual departure and landing times*

Airport CDM should also become an operational process at secondary airports and not only to the 5 major TMAs (Paris, Amsterdam, Frankfurt, Munic, London), as these airports (e.g. Brussel, Zurich, Berlin, Dusseldorf) may have an important impact on such major TMAs.

This document has to be seen as a living document, which could be adapted if there will be futural technical or operational process amendments defined.

1.1 Purpose and Scope

This document is the Operational Concept Document (OCD) for the implementation of Airport CDM in the FABEC airspace.

Whenever within FABEC A-CDM at an airport is implemented this document has to be applied.

1.2 Reference Documents

[1] Outcome FABEC CEO Workshop 7th Sept 2011

[2] FAB ATM Concept Vs 1.0, dated 10.07.07, Chapter 4.2.5

[3] OPS-TECH Common Roadmap Vs. 0.5, dated 08.06.11

[4] Community Specification ETSI EN 303 212

[5] EU Regulation 95/93 updated by 793/2004

[6] Designation of EUROCONTROL by EU as Network Manager

1.3 Glossary of Terms

Term / Acronym	Definition
ASB	ANSP Strategic Board (FABEC CEO Decision Body)
TTA	Target Time Arrival
A-CDM	Airport Collaborative Decision Making
FRV	Free Route airspace volume
OCD	Operational Concept Document
ATFCM	Air Traffic flow and capacity management
TOBT	Target Off Block Time
DPI	Departure planning information message
TMA	Terminal Area
AMAN	Arrival Management
TSAT	Target Start Up approval time
SID	Standard instrument departure route
TTOT	Target take off time
ELDT	Estimated landing time
FUM	Flight update message
OCC	Operational control center
CFMU	Central flow management unit
NM	Network Manager
A-DPI	ATC Departure planning information message
E-DPI	Early Departure planning information message
T-DPI	Target Departure planning information message
C-DPI	Cancel Departure planning information message
EXOT	Estimated Taxi Out time

ETFMS	Enhanced tactical flow management system
DLA	Delay message
CHG	Change message
CNL	Cancellation message
SIBT	Standard Inblock time
MTTT	Minimum turn round time
EIBT	Estimated inblock time
SOBT	Schedule Offblock time
ARR	Arrival message
FMS	Flight management system
XMAN	Cross Border Arrival Management

2 PROCESS DESCRIPTION A-CDM

This document describes the Airport Collaborative Decision Making (CDM) procedure at an airport and is to be understood and used as a basis for the different partners, such as ground handling agents, local ATC, Flow Managers and Airline OCC.
Together with the publications about Airport CDM (Aeronautical Information Publication – AIP and the airport user regulations), this document is to ensure that Airport CDM at an airport xy is handled in an optimal way in the interest of all partners.

2.1 General, definition and partners

Airport CDM is an operational overall process (concept/procedure) supporting an optimized turn-round process at an airport. It covers the period of time between the estimated off-block time (EOBT) -3hrs and take-off and is a coherent process from flight planning (ATC flight plan) to landing and the subsequent turn-round process on the ground before the next take-off.

Airport CDM at an airport is based on the European Airport CDM, the common specification (Community Specification EN303212) for A-CDM.

2.2 Objectives of Airport CDM

Airport CDM aims at optimally utilising the available capacities and operational resources at an airport by increasing the efficiency of the individual steps of the turn-round process.
Airports can be integrated into the European ATM network through the exchange of reliable estimated arrival and departure times between Airport CDM and the Network Manager (NM).
Airport CDM optimises operational cooperation between the following partners:

- Airport operator
- Airlines
- Handling agents
- Ground handling agents

- Air navigation service provider
- European air traffic flow management / Network Manager
- Airport slot coordinator

2.3 Coordination with air traffic flow and capacity management (ATFCM)

Due to a fully automated data exchange with ATFCM , landing and take-off times can be forecasted in a timely and reliable manner and/or precisely calculated take-off times (CTOT) can be given, based on local target take-off times.

- At least the following messages are used:
- Flight update message, FUM
- Early departure planning information message, E-DPI
- Target departure planning information message, T-DPI target
- Target departure planning information message, T-DPI sequenced
- ATC departure planning information message, A-DPI
- Cancel departure planning information message, C-DPI

The basic procedures for cooperation between the airlines and/or ATC and ATFCM remain the same.

Furthermore, all estimated departure times are automatically transmitted to the ATFCM during the turn-round process. In the case of delays caused by the airlines, the common CTOT allocation mechanisms apply. These allocation mechanisms are confirmed and/or refined via DPI messages. The ATFCM determines and allocates the CTOT on the basis of these estimated departure times (DPI).

2.4 Integration of A-CDM data into the AMAN/XMAN

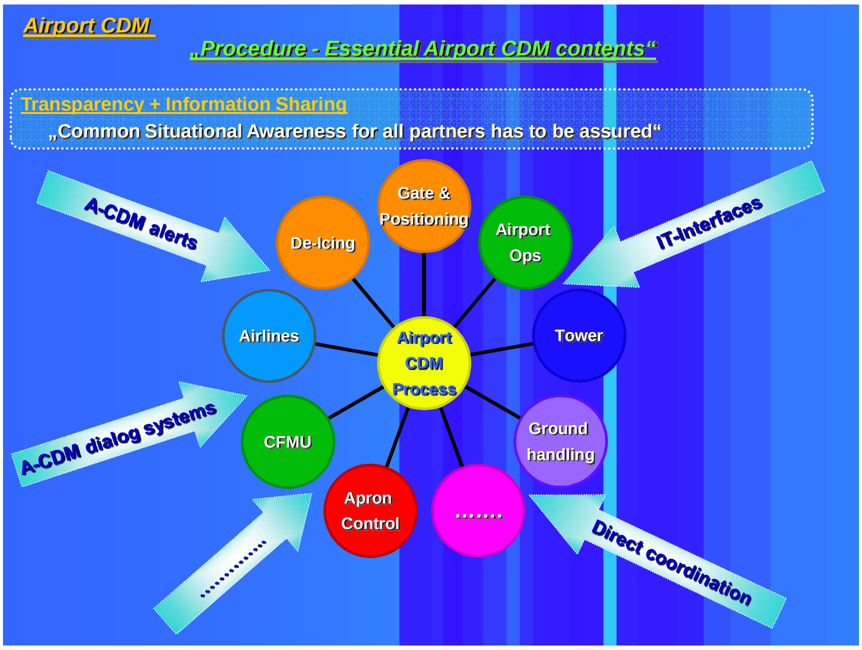
Whilst A-CDM clearly optimizes the processes at the departure airport, it is of relevance to integrate the accurate data of the outbound process into the AMAN especially when close by airports are involved.

2.5 Main essential contents of the Airport CDM process

The main essential contents of the Airport CDM process are:

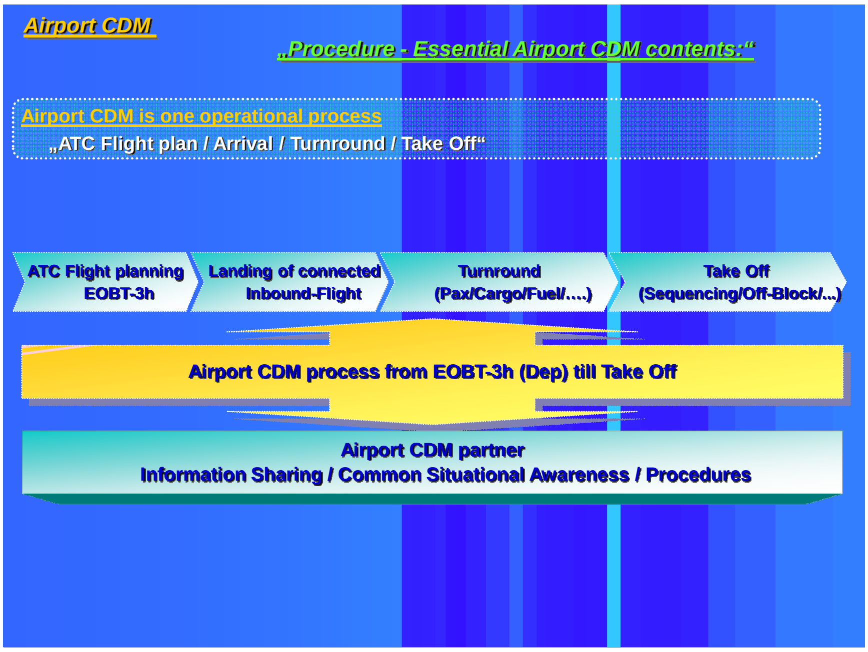
2.5.1 Transparency of the process

Common situational awareness has to be seen as the most important basic step for all process partners. Therefore transparency and information sharing has to guaranteed for all partners. There are different means to ensure Common situational awareness, e.g. A-CDM alerts, IT-Interfaces, A-CDM Dialog systems, etc.



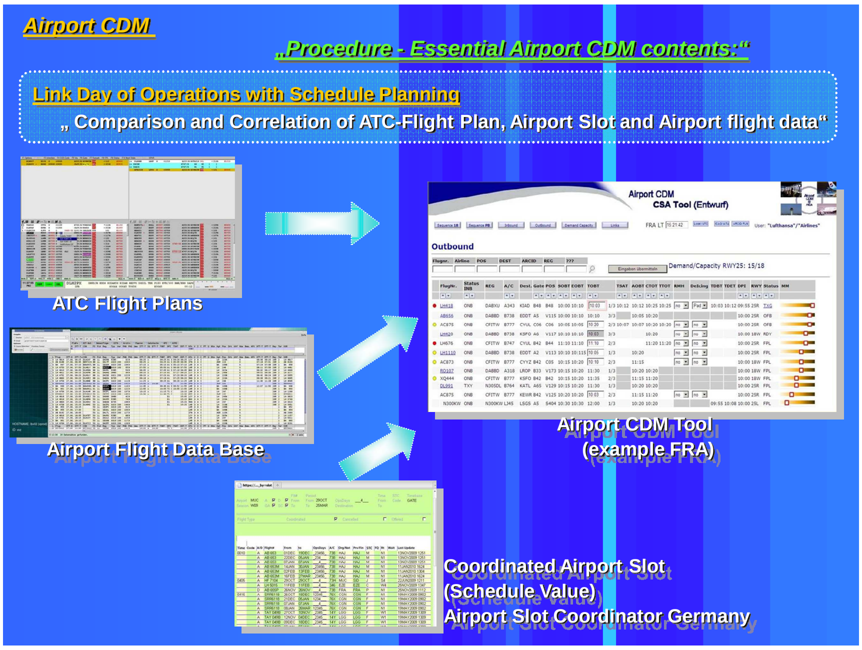
2.5.2 Airport CDM is a common operational process

It is essential, that A-CDM has to be seen as one operational process including most important procedure steps like ATC flight plan, landing phase plannings, turn-round activities, sequencing till take-off.



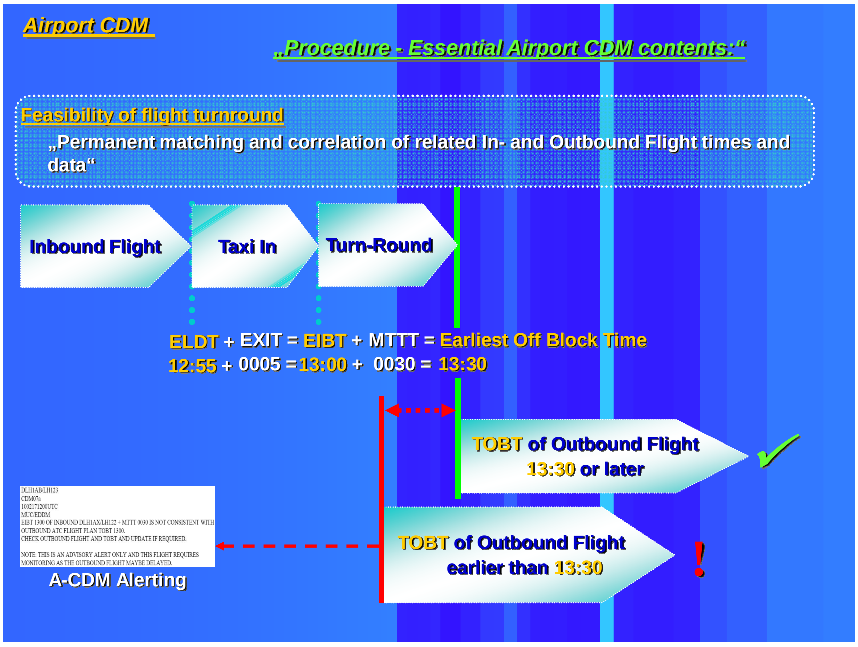
2.5.3 Combination of the day of operations and schedule planning

By comparison and correlation of different flight information (at least: ATC flight plan, airport slot and airport flight data) the link of schedule planning and day of operation will be ensured.



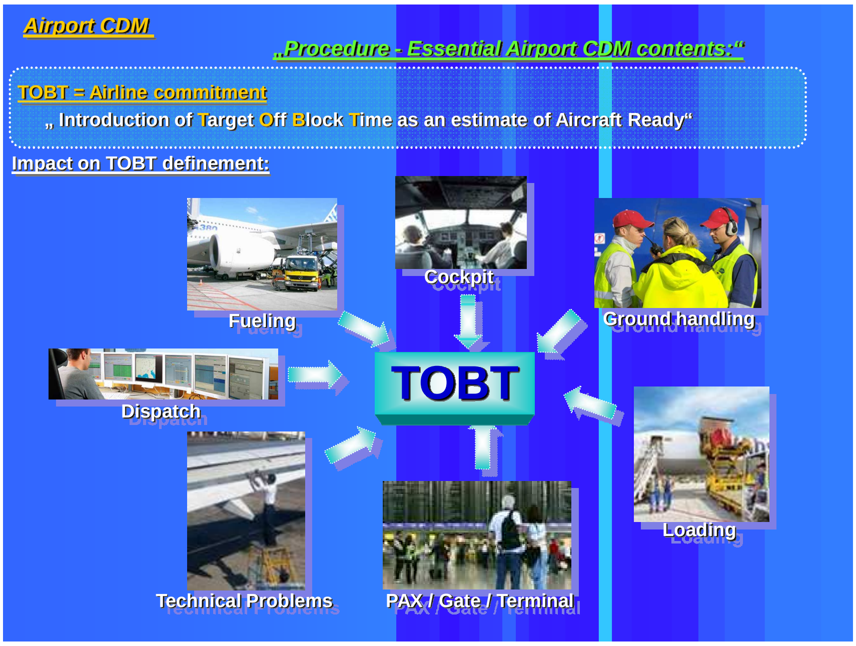
2.5.4 Feasibility of the turn-round process

Taking into account arrival and departure information ensures the combination, check and adjustment of linked arrival and departure flights. This leads to an feasibility check of the turn round to ensure reliable target information towards the linked process partner.



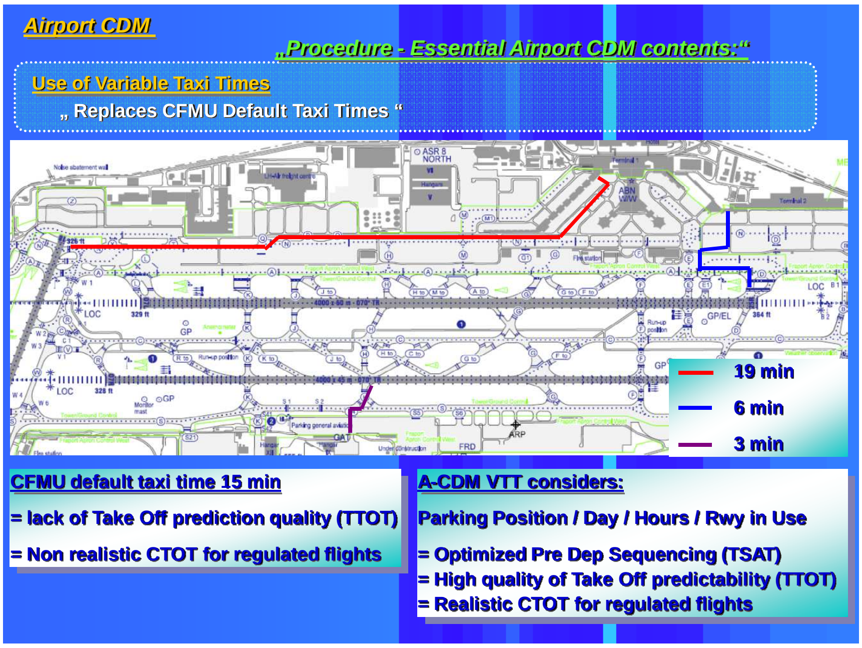
2.5.5 Usage of Target off Block Time as the target time for „Aircraft Ready“

The TOBT is the major Aircraft operator commitment and contribution towards the A-CDM process. The TOBT is the essential target time for all further process calculations. The responsibility to identify the necessary information from their linked process to define the TOBT rests with the Aircraft operator.



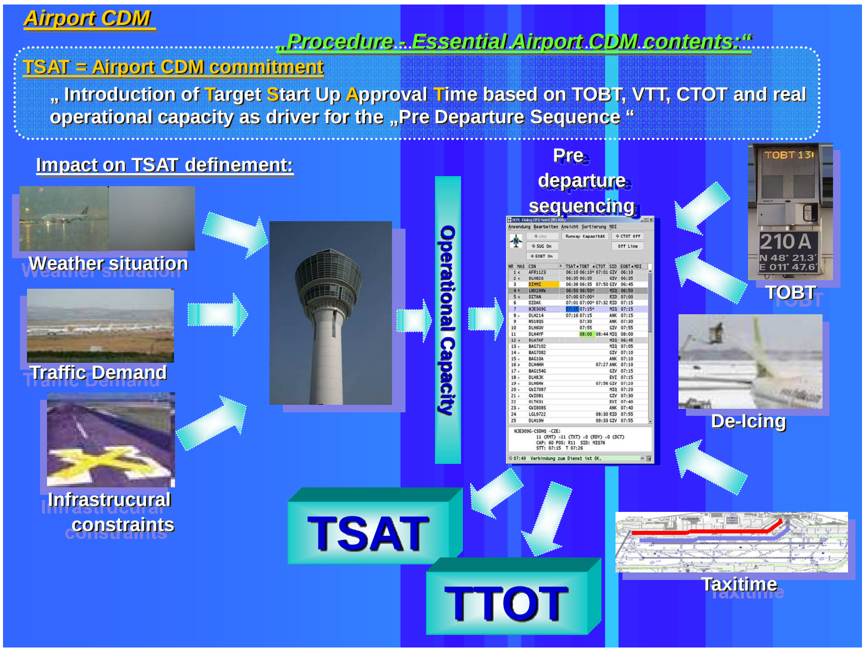
2.5.6 Usage of the “Variable Taxi Times”

Without Airport CDM the calculation of Take off times is based on default times, this method leads mostly to non-realistic estimate values. By taking into account parameters like the parking position, runway in use, time periods and actual landing direction as well as the de-icing duration of remote de-icing, the creation of a variable taxi time (EXOT = Estimated Taxi Out Time) is possible. These EXOT allows calculation of reliable target times.



2.5.7 Introduction of the „Target Start Up Approval Time"

The TSAT is calculated by the A-CDM pre-departure sequence planning system and takes into account input parameters like TOBT, variable taxi times (EXOT), CTOT (in case of regulated flights) and the actual operational capacity, as well as any other operational constraints. TSAT provides the basis for the pre-departure sequence and the moment at which the start-up approval can be expected. TSAT has to be seen as the Airport CDM commitment/contribution to the A-CDM process.

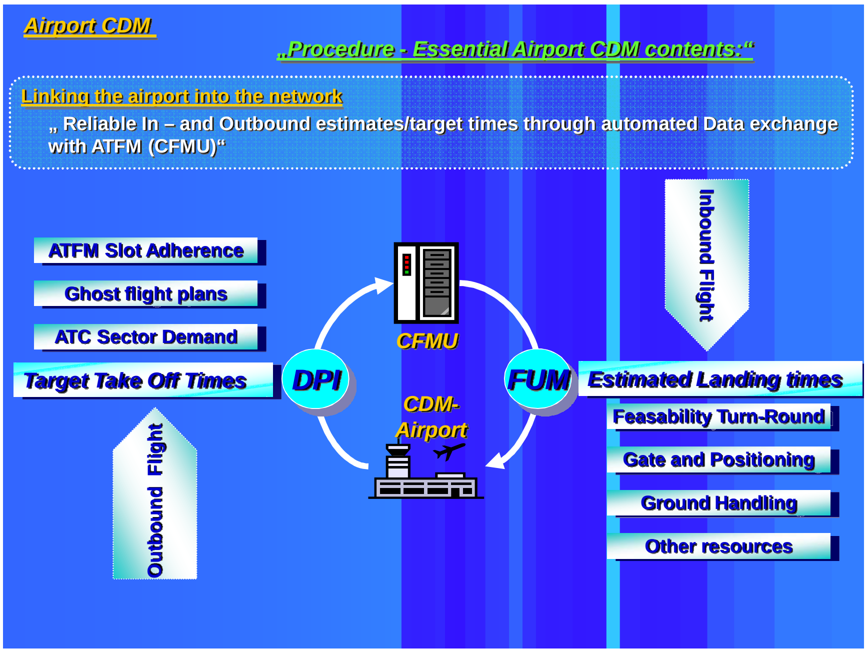


2.5.8 Procedure adherence

The Start-up approvals/push-back clearances are issued taking into account the TOBT and TSAT. The procedure adherence is a major part for all partners for Airport CDM. Especially under adverse conditions procedure adherence allows to stick to commonly agreed planning.

2.5.9 „Linking the airport into the network"

High-quality forecasts times and data for inbound and outbound traffic by means of an automated data exchange with the Network Manager guarantying the linking of the airport into the network.

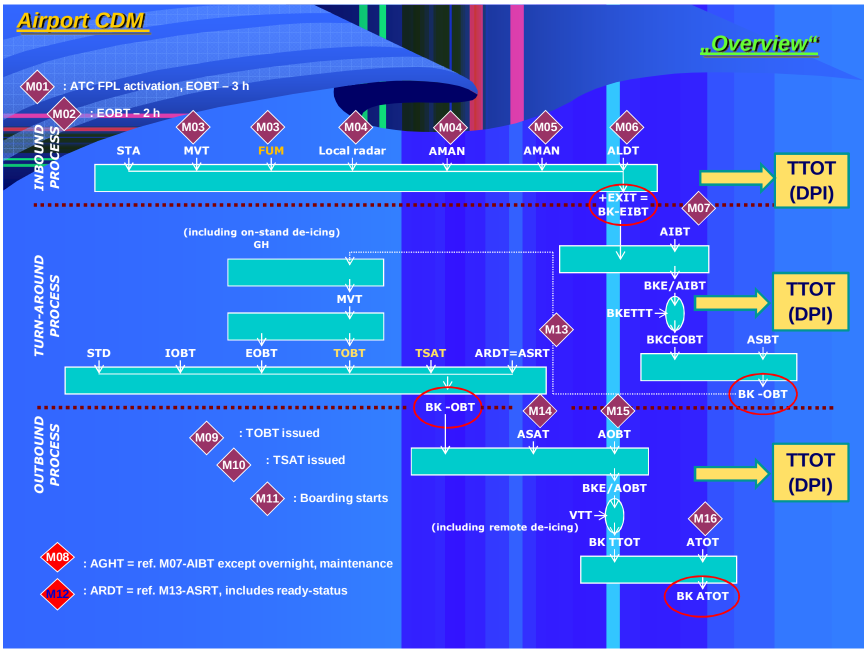


These high quality A-CDM data provide more accurate figures by the Network Manager of aircraft calculated to enter the respective enroute sectors. The question of our deliveries by the Network Manager can be reassessed.

3 PROCEDURE

3.1 Procedure overview

This chart depicts the scope of the Airport CDM procedure at an airport from the time of ATC flight plan activation (EOBT -3h) till take-off. It displays the elements, inbound, turnround and outbound process.



The main aspects of the procedure are sub-divided and described as follows:

- Correlation of flight information – section **3.2**
- Target Off Block Time – section **3.3**
- Target Start Up Approval Time -TSAT – section **3.4**
- De-icing – section **3.5**
- Start Up and Push Back – section **3.6**

3.2 Correlation of flight information

The Airport CDM procedure begins with the transmission of the ATC flight plan to the Airport CDM Portal (airport operator data base).

The ATC flight plan will be correlated with the flight data submitted to the airport as well as with the airport slot (SOBT) included therein. In particular, the focus is on:

- linking inbound and outbound flights
- comparing the airport slot (SOBT) for the outbound flight with the EOBT of the ATC flightplan

This comparison is usually made at the EOBT -3hrs. If the ATC flight plan is filed at a later stage, the commencement of the Airport CDM procedure is postponed to this time.

3.2.1 Airport Slot discrepancy

If the SOBT deviates from the estimated off-block time (EOBT), the contact person of the airline is advised by the A-CDM alerting (CDM alert 02) process to adjust the times accordingly.

3.2.2 Airport slot missing

If no airport slot is available at the time of the expected conduct of the flight, the flight cannot be sequenced and thus not handled or conducted. The A-CDM alerting will inform the responsible aircraft operator (CDM alert 01).
(see EU regulation 95/93 updated by 793/2001)

3.2.3 Points of contact

The airport traffic operation centre is in charge of the activities concerning the correlation of flight information

3.2.4 *Early DPI – data exchange with ATFCM*

An early departure planning information message (E-DPI) is generated and transmitted to ATFCM for flight plans validated in accordance with the sections mentioned above (airport slot available).

Flights with an E-DPI are marked in the ATFCM system as flights from a CDM airport and are then considered accordingly in further processing (e.g. optimised CTOT allocation in accordance with the local target times).
The ATFCM role is fulfilled by the Network Manager.

<u>Example of an Early DPI</u>

-TITLE DPI
-DPISTATUS EARLY
-ARCID DLH3354
-ADEP EDDX
-ADES LTBA
-EOBT 1825
-EOBD 090105
-TAXITIME 0019
-TTOT 1844
-SOBT 1825
-SID CHIEM4S
-ARCTYP A320
-REG DAIPU
-DEPSTATUS
-IFPLID AA123456789
-ORIGIN EDDXDYE

Combination of different flight Information
1. Early DPI towards CFMU

3.2.5 Target-DPI – dataexchange with ATFCM

As a rule, a T-DPI with the status "Target" is generated two hours before the EOBT for all flights for which an E-DPI has been generated. The T-DPI is transmitted to the Network Manager in the same way as the E-DPI.

The T-DPI is used to transmit a Target Take-Off Time (TTOT) to the NETWORK MANAGER. The T-DPI opens a so-called “slot adjustment window” within which the CTOT is adjusted to the relevant reported TTOT in the best possible manner.

If the TTOT is changed by five minutes or more, if taxi times are adjusted by three minutes or more or if the SID, aircraft type or registration is changed, a new T-DPI is generated and transmitted to the Network Manager.

Example of a Target DPI:

-TITLE DPI
-DPISTATUS TARGET
-ARCID DLH3354
-ADEP EDDX
-ADES LTBA
-EOBT 1825
-EOBD 090105
-TAXITIME 0019
-TTOT 1844
-SID CHIEM4S
-ARCTYP A320
-REG DAIPU
-DEPSTATUS
-IFPLID AA123456789
-ORIGIN EDDXYDYE

Combination of different flight information
1. Target DPI towards CFMU

3.2.6 *Estimated landing time*

For the inbound flights, Estimated landing times could be delivered by different sources, e.g:

- AMAN/XMAN information
- Radar information
- Movement message
- FMS information of the aircraft (APR - aircraft position report)
- FUM (flight update message)

The best known information in time will be used to generate the ELDT.

Flight update messages (FUM) are received for flights to an Airport (inbound information). The following operational events trigger the transmission of an FUM:

- estimated landing time (ELDT) minus 3 hours
- modification of the ELDT by 5 minutes or more (parameter 5-15 minutes)
- changes to the ETFMS status, e.g. suspension of a flight.
- Accuracy of ELDT should be as good as possible (e.g -+2 minutes)

The FUM provides an ELDT in advance which allows the system to compare the inbound with the outbound flight plan, i.e. the EIBT with the EOBT.
As well it provides the airport partners with the ICAO information of Inbound flights. These information may be used for local adjustments, e.g.:

- Airport Slot verification (Inbound – SIBT)
- Correlation of related IATA information (e.g. ARCID vs Flight number)

If the calculated EIBT is later than the EOBT of the linked outbound flight plan, the contact person of the airline is notified accordingly. It is expected that the relevant times (delay message - DLA -) or the outbound flight plan (change of aircraft – CHG – or flight plan cancellation – CNL – and new flight plan) will be adjusted in a timely manner.

Furthermore, the ELDT of the FUM has strong effects on:

- optimum gate and position planning as well as further resources planning
- automatic TOBT generation
- further use of resources (e.g. ground handling).

3.2.7 *Feasibility check of TOBT*

Taking into account arrival and departure information ensures the combination, check and adjustment of linked arrival and departure flights. This leads to a feasibility check of the turn round to ensure reliable target information towards the linked process partner.

Check ELDT+EXIT+MTTT versus best known off block time. If the result is smaller than the best known OBT, turnround has to be seen as feasible. As soon as the result leads to a later value, the Aircraft operator will be informed by the means of a CDM alert (CDM07).

This feasibility check will be done permanently till Start up approval.

3.2.8 *Possible Airport CDM alerts*

Potential Airport CDM alerts concerning the combination of different flight information described in section 4.3 include:

CDM01	No Airport Slot available, or Slot already correlated
CDM02	SOBT vs EOBT discrepancy
CDM03	Aircraft Type discrepancy
CDM04	Registration discrepancy
CDM05	First Destination Discrepancy
CDM07	EIBT+MTTT Discrepancy with EOBT
CDM08	EOBT Compliance Alert
CDM13	No ATC Flight Plan Available

Details on the Airport CDM alerts are given in section 4.2.

3.3 Target Off Block Time (TOBT)

The TOBT is a point in time to be monitored and confirmed by the aircraft operator/handling agent at which the ground handling process is concluded, all aircraft doors are closed, all passenger boarding bridges have been removed from the aircraft and thus start-up approval and push-back/taxi clearance can be received.

All ground handling processes, except for push-back and remote de-icing, are based on the TOBT. The TOBT is used as the optimum time for coordination.

TOBT = forecast of "Aircraft ready"

There are two kinds of first TOBT value input into the A-CDM system possible:

- Automatically generated TOBT
- Manual TOBT input

3.3.1 Automatically generated TOBT

At fixed times, a TOBT for the linked outbound flight is generated automatically.

The earliest time for the publication of the automatically generated TOBT is a local parameter.

The Minimum Turn-round Time (MTTT) is applied when the TOBT is generated. The MTTT is a time which is stored in the airport database and depends on the airline, aircraft type and destination airport.
<u>Important dependencies for the automatic initial TOBT generation:</u>

- TOBT **=** EOBT   if: EIBT + MTTT **≤** EOBT
- TOBT **=** EIBT + MTTT   if: EIBT + MTTT **>** EOBT
- TOBT for flights with a CTOT only: if: TOBT + EXOT is before or inside the Slot Tolerance Window

If the TOBT is not automatically generated, it has to be entered by the person responsible for the TOBT as described in section 3.3.3.

Flights which are not subject to a direct turn-round and which do not park on their outgoing position, the TOBT will be generated automatically at xx(time).

Target Off Block Time - TOBT
Definition and automatic generation

3.3.2 *Person responsible for the TOBT*

Aircraft operator have to ensure:

- the nomination of one person responsible for the TOBT,
- the communication with the relevant airline OCC (ATC flight plan/person responsible for the EOBT) and
- the coordination of internal working procedures

The person responsible for the TOBT (generally the handling agent), the airline (for flights without handling agent) or the pilot-in-command (for general aviation flights without handling agent) is responsible for the correctness of and the adherence to the TOBT.

A wrong TOBT leads to disadvantages for further sequencing and/or CTOT allocation of regulated flights. Therefore, the TOBT has to be adjusted as early as possible.

3.3.3 *TOBT input and adjustment*

The following facts have to be taken into account for the input and/or adjustment of the TOBT:

- the earliest possible input of a TOBT (before automatic generation) is EOBT-xx min.
- a manually set TOBT will never be overwritten by an automatically generated TOBT
- the TOBT can be adjusted as often as necessary until the TSAT has been issued
- after the TSAT has been issued, the TOBT can only be corrected XX times (figure has to be fixed by the local projects)
- the entered TOBT has to be at least 5 minutes later than the actual time

As the TOBT is also the basis for further airport processes, adjustments of the TOBT (also if the process is completed more than five minutes in advance) are to be entered by the person responsible for the TOBT.

3.3.4 *Deviations between TOBT and EOBT*

If the TOBT deviates from the EOBT of the ATC flight plan by more than 15 minutes, the airline has to initiate an additional delay message (DLA, CHG). This new EOBT has to be based on the last TOBT.

3.3.5 TOBT deletion

The TOBT has to be deleted in the following cases:
the TOBT is unknown (e.g. technical problems with the aircraft)
the permitted number of TOBT inputs after the generation of the TSAT has been exceeded

If the TOBT is deleted, the TSAT is automatically deleted as well.

If a new TOBT is known and the process shall continue, the person responsible for the TOBT has to enter a new TOBT.

3.3.6 Cancel-DPI – Data exchange with NETWORK MANAGER

As soon as the TOBT for a flight is deleted, a C-DPI message is transmitted to the NETWORK MANAGER. The flight is no longer subject to the special handling process for flights from CDM airports. Then the CTOT is issued on the basis of the flight plan data available at the NETWORK MANAGER until a new DPI (triggered by the new TOBT input) is available for the flight.

-TITLE DPI
-DPISTATUS CNL
-ARCID DLH3354
-ADEP EDDX
-EOBT 1825
-EOBD 090105
-REASON TOTUNKOWN
-ADES LTBA
-ORGN EDDXYDYE

3.3.7 TOBT in case of a change of aircraft

If the aircraft is changed, a change message (CHG - type/registration) has to be sent and the TOBT remains in effect and is allocated to the new aircraft.

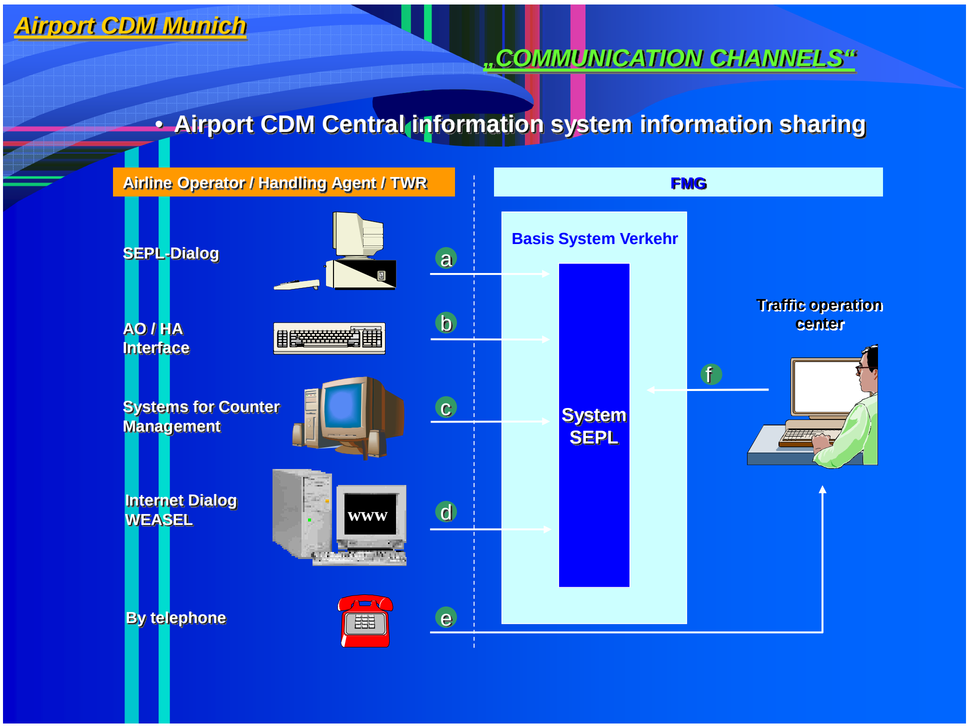
3.3.8 *TOBT reporting channels*

The TOBT is reported and/or adjusted in one of the following ways:

Example Munich:

- Dialog SEPL
- internal system of AO/GH (via interface)
- via phone Airport traffic operation center (+49-89-975-xxxxx)
- dialog “WEASEL” (web based tool)

Chart of the TOBT reporting channels
(example Munich)



3.3.9 TOBT information at the electronic display on position

If available the TOBT may be displayed at the electronic display on position.

Specifics have to be defined locally.

3.3.10 Potential Airport CDM Alerts

Potential Airport CDM alerts concerning the TOBT:

CDM08	EOBT Compliance Alert
CDM09	Boarding Not Started
CDM10	TOBT Rejected or Deleted
CDM11	Flight not compliant with TOBT / TSAT
CDM14	Automatic TOBT Generation not possible

Details on the Airport CDM alerts are given in section 4.23.

3.4 Target Start Up Approval Time - TSAT

The TSAT is the point in time calculated by the Airport CDM sequence planning system at which the start-up approval can be expected.

The pre-departure sequence is based on the flights with a calculated TSAT.

3.4.1 Publication of the TSAT

The TSAT is published XXminutes (parameter has to be definded locally; experience suggestion would be 40 minutes) prior to the valid TOBT.

After TSAT has been published, the TOBT can only be corrected another three times to ensure a stable sequence and CTOT allocation. As a rule, the TSAT remains in effect if the TOBT is changed, unless the new TOBT is later than the calculated TSAT.

The calculation of the TSAT is based on different operational parameters e.g.:

- TOBT
- CTOT (for regulated flights)
- Operational capacity at the airport
- Minimum Departure Intervall (MDI)
- Variable taxitime
- Parking position
- Runway in use
- Landing direction
- Aircraft de-icing (only remote-de-icing)
- Any other defined operational constraints

3.4.2 *TSAT reporting channels*

The TSAT is acknowledged via the same reporting channels as the TOBT:

TSAT or changes of the TSAT will be reported by the person responsible for the TOBT to the Flight Crew/pilot.

Target Start Up Approval Time – TSAT
Reporting channels and changes

3.4.3 Target-DPI „Sequenced“– data exchange with the Network Manager

When the TSAT is generated, a T-DPI message with the status "sequenced" is transmitted to the NETWORK MANAGER for unregulated flights (flights without a CTOT).
Flights for which a T-DPI message with the status "sequenced" has been transmitted have a particular status within the Network Manager system.

The status "target" (section 3.2.5) remains in effect for regulated flights. However, a T-DPI "Sequenced" can be manually generated by the control tower later on; otherwise the T-DPI for regulated flights is issued at the actual start-up time (ASAT).

The transmission of a "Ready" message is no longer required for regulated flights with the T-DPI "Sequenced" (an additional T-DPI can be generated manually if necessary).

The CTOT is adjusted to the local TTOT in the best possible manner.
If the TTOT is changed by five minutes or more, if taxi times are adjusted by three minutes or more or if the SID, aircraft type or registration is changed, a new T-DPI is generated and transmitted to the Network Manager.

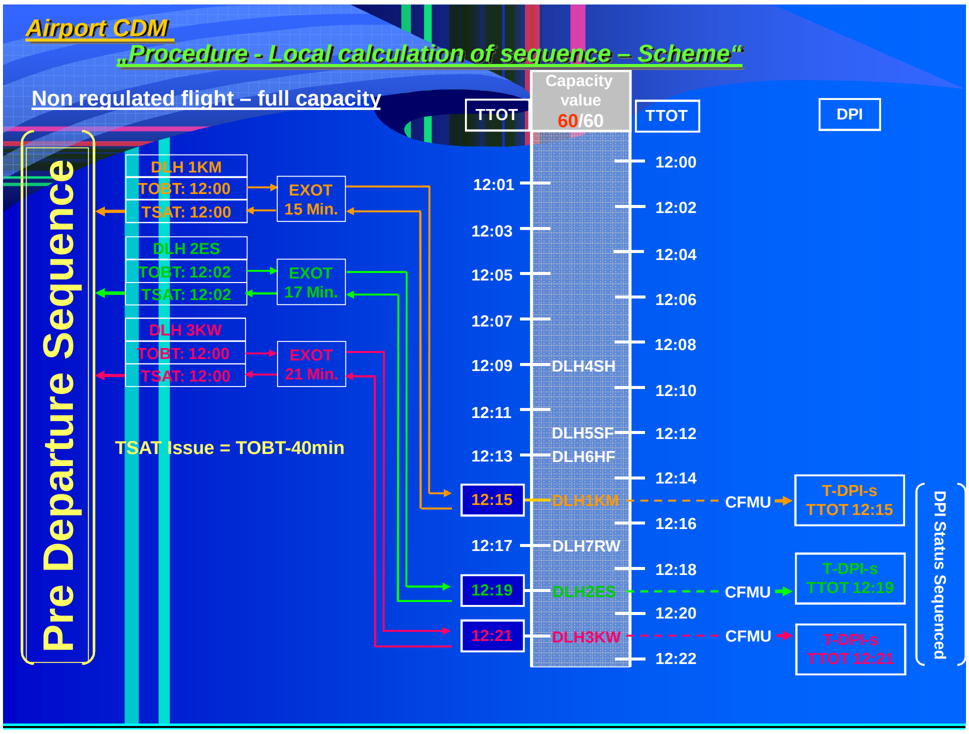
<u>Examples of the target DPI (status sequenced):</u>

-TITLE DPI
-DPISTATUS SEQ
-ARCID DLH3354
-ADEP EDDX
-ADES LTBA
-EOBT 1825
-EOBD 090105
-TAXITIME 0019
-TTOT 1844
-SID CHIEM4S
-ARCTYP A320
-REG DAIPU
-DEPSTATUS
-IFPLID AA123456789
-ORIGIN EDDXYDYE

Target Start Up Approval Time – TSAT
Example of Pre Departure Sequencing / change/ adverse situations / alerting

3.4.4 Example of TSAT and DPI generation

Picture below shows a principle example of TSAT and DPI generation.
Algorithms may vary from CDM airport to CDM airport.



3.4.5 Changes within the sequence

After the TSAT has been calculated, flights within the area of responsibility of a person responsible for the TOBT can be switched. Flights with CTOT cannot be switched. If flights have a CTOT, it must be assured that these flights can still stick to the slot after the sequence change.

In exceptional cases, the changes within the sequence can also be coordinated with the ATC control tower.

3.4.6 TOBT and TSAT handling in extreme situations

If the TOBT and the TSAT deviate from each other by more than xx minutes (parameter), local rules may apply for special treatment of such flights.

3.4.7 Possible Airport CDM Alerts

Potential Airport CDM alerts concerning the TSAT include:

- CDM08 EOBT Compliance Alert
- CDM10 TOBT Rejected or Deleted
- CDM11 Flight not compliant with TOBT / TSAT
- CDM12 TSAT Not Respected by ATC

Details on the Airport CDM alerts are given in section 4.2.

3.5 De-icing

In general there are two kinds of de-icing processes possible:

- Position de- icing
- Remote de-icing

3.5.1 *De-icing on position*

De-icing procedure for de-icing on position/stand and there connection into the A-CDM process has to be defined locally.

3.5.2 *Remote de-icing*

Aircraft de-icing times must not be taken into account for the calculation of the TOBT, because de-icing request and the approximately de-icing period will be the basis for the calculation of the TSAT. Therefore de-icing should be requested as early as possible.

In case of de-icing the DPI message to the Network Manager will contain the additional status "De-Icing"

Example of a Target DPI „sequenced" with de-icing status:

-TITLE DPI
-DPISTATUS SEQ
-ARCID DLH3354
-ADEP EDDX
-ADES LTBA
-EOBT 1825
-EOBD 090105
-TAXITIME 0019
-TTOT 1844
-SID CHIEM4S
-ARCTYP A320
-REG DAIPU
-DEPSTATUS DEICING
-IFPLID AA123456789
-ORIGIN EDDXYDYE

Aircraft De-Icing

3.6 Start-Up and Push-Back

Start-up (ASAT) and push-back (AOBT) clearances are issued taking into account the TOBT and TSAT. The following rules shall apply:

- The aircraft has to be ready for start-up and/or remote de-icing at TOBT
- in principle the timeframe for start-up approval and en-route clearance is TSAT +/- five minutes
  - The pilot should request start-up approval and en-route clearance TSAT +/- five minutes
  - Clearance Delivery issues the start-up approval and en-route clearance depending on TSAT and the current traffic situation
- The push-back/taxi clearance has to be requested not later than five minutes after the start-up approval has been issued
- In case of delays Clearance Delivery has to be informed. Otherwise the TOBT will be deleted and has to be re-entered.

Start Up and Push Back

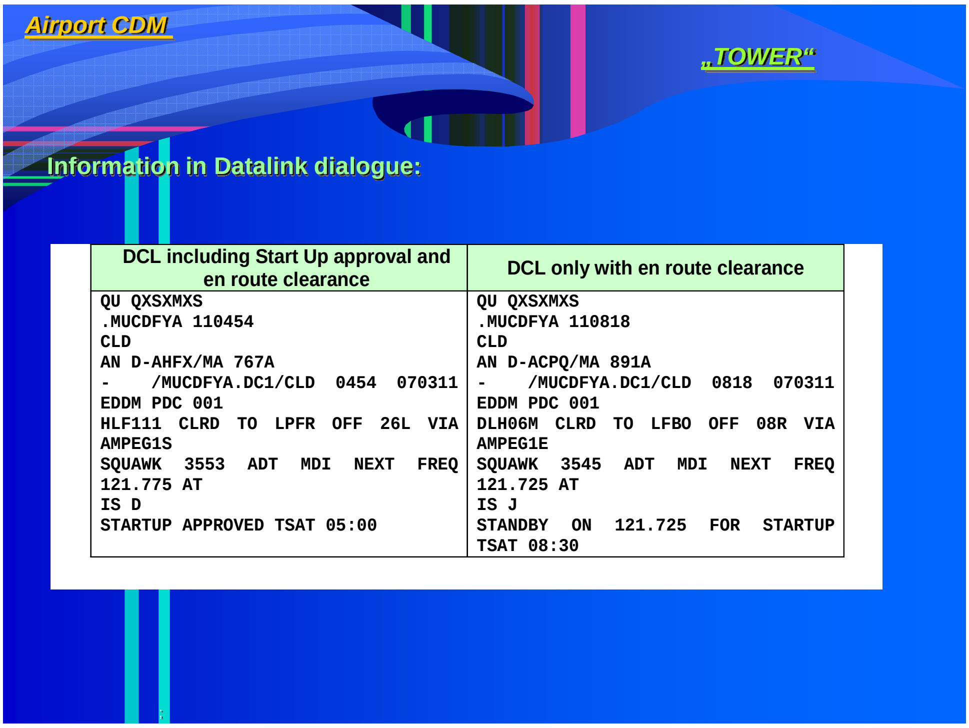
3.6.1 *Datalink Clearance - DCL*

The published procedures and the time parameters published in the AIP AD 2 EDDx continue to apply to datalink departure clearances (DCL).

The TSAT is transmitted via CLD (departure clearance uplink message – issue of the start-up approval and en-route clearance by Clearance Delivery).

„Start Up approved TSAT <hh:mm>“

The push-back/taxi clearance has to be requested at TSAT +/-5 minutes.



DCL including Start Up approval and en route clearance	DCL only with en route clearance
QU QXSXMXS .MUCDFYA 110454 CLD AN D-AHFX/MA 767A - /MUCDFYA.DC1/CLD 0454 070311 EDDM PDC 001 HLF111 CLRD TO LPFR OFF 26L VIA AMPEG1S SQUAWK 3553 ADT MDI NEXT FREQ 121.775 AT IS D STARTUP APPROVED TSAT 05:00	QU QXSXMXS .MUCDFYA 110818 CLD AN D-ACPQ/MA 891A - /MUCDFYA.DC1/CLD 0818 070311 EDDM PDC 001 DLH06M CLRD TO LFBO OFF 08R VIA AMPEG1E SQUAWK 3545 ADT MDI NEXT FREQ 121.725 AT IS J STANDBY ON 121.725 FOR STARTUP TSAT 08:30

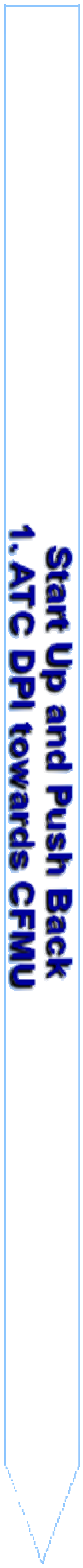
example Munich

3.6.2 *ATC-DPI (A-DPI) – data exchange with the NETWORK MANAGER*

At the Actual Off-Block Time an A-DPI will be sent to NETWORK MANAGER. The “slot adjustment window” is closed and the CTOT can no longer be changed automatically by NETWORK MANAGER.

<u>example ATC DPI</u>

-TITLE DPI
-DPISTATUS ATC
-ARCID DLH3354
-ADEP EDDX
-ADES LTBA
-EOBT 1825
-EOBD 090105
-TAXITIME 0019
-TTOT 1844
-SID CHIEM4S
-ARCTYP A320
-REG DAIPU
-DEPSTATUS
-IFPLID AA123456789
-ORIGIN EDDXYDYE



4 COMMON SITUATIONAL AWARENESS / INFOMATION SHARING

Transparency for all partners involved is the basis for conducting the Airport CDM process. IT interfaces, dialogue systems, alert messages, data exchange with the NETWORK MANAGER, telephone coordination etc. ensure common situational awareness for all partners. This reporting and information routines have to be defined locally.

4.1 Display system of the NETWORK MANAGER - CFMU CHMI

For the time being the CFMU is the relevant ATFCM unit. Information on the Airport CDM data exchange with the NETWORK MANAGER can be obtained in the different display options via the available NETWORK MANAGER reporting channels (CHMI).

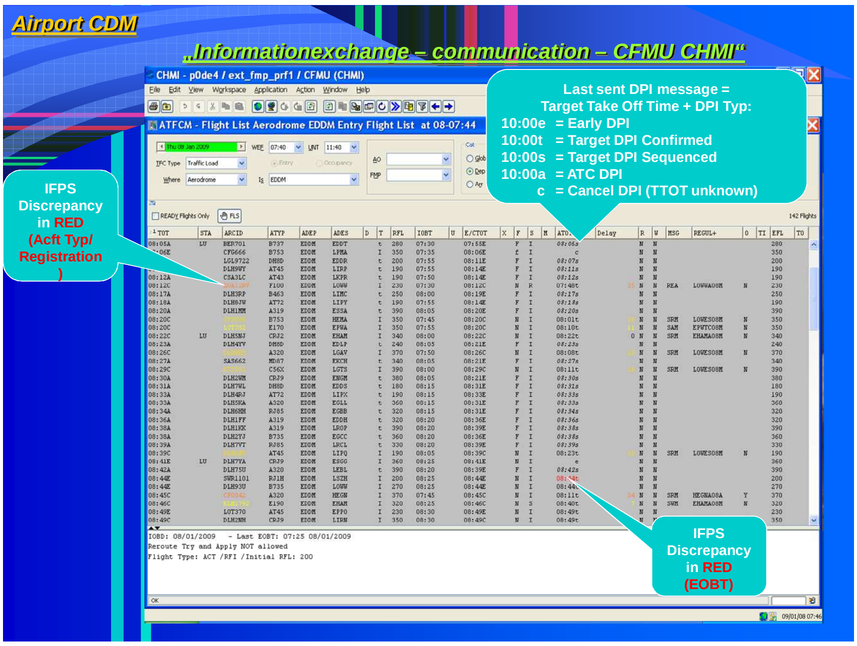
Access to the NETWORK MANAGER CHMI can be requested from Eurocontrol online:

www.eurocontrol.int/cfmu

4.1.1 NETWORK MANAGER CHMI flight list

The flight list contains information on:

- TTOT
- transmitted DPI type
- IFPS inconsistencies
- EOBT inconsistencies
- „Ready status“



4.1.2 NETWORK MANAGER CHMI flight data

Details on the Airport CDM data exchange are given for selecting individual flights from "Flight Data" (directly or from the flight list).

4.1.3 NETWORK MANAGER CHMI flight data

All exchanged (transmitted and received) messages can be retraced in the "operational log" option of selected flights.

4.2 Airport CDM alerting

Due to European harmonisation/standardisation, Airport CDM alerts bear the same code all over Europe.

4.2.1 Contact address and information

In order to receive Airport CDM alert messages, all airlines/handling agents have to provide a valid contact address (e-mail) for the Airport operator.

It is also possible to provide several contact addresses for one airline (e.g. referring to a specific alert), if necessary.

In order to ensure optimal process handling and sequencing, it is highly recommended to provide this address (or several addresses) as well as information on necessary changes.

4.2.2 Airport CDM alert messages

CDM01 "No Airport Slot available, or Slot already correlated"

DLH1AB/LH123

CDM01

1002171200UTC

(IATA/ICAO Location Indicator)

AIRPORT SLOT SOBT 1200 UTC NOT AVAILABLE OR SLOT ALREADY CORRELATED.

IMMEDIATE UPDATE OF ATC FLIGHT PLAN EOBT 1100 OR REQUEST NEW AIRPORT SLOT.

NOTE: THE AIRPORT CDM PROCESS WILL BE SUSPENDED UNTIL RECEPTION OF YOUR RECTIFICATION.

CDM02 "SOBT vs. EOBT discrepancy"

DLH1AB/LH123

CDM02

1002171200UTC

(IATA/ICAO Location Indicator)

ATC FLIGHT PLAN EOBT 1200 IS NOT CONSISTENT WITH AIRPORT SLOT SOBT 1100 UTC.

IMMEDIATE UPDATE OF AIRPORT SLOT OR ATC FLIGHT PLAN EOBT NEEDED.

CDM03 "Aircraft Type discrepancy"

DLH1AB/LH123

CDM03

1002171200UTC

(IATA/ICAO Location Indicator)

AIRCRAFT TYPE INCONSISTENCY BETWEEN ATC FLIGHT PLAN <ARCTYP> AND AIRPORT DATABASE <TYP>.

IMMEDIATE UPDATE OF ATC FLIGHT PLAN OR AIRPORT DATABASE NEEDED.

NOTE: THE AIRPORT CDM PROCESS WILL NOT BE SUSPENDED BUT START UP / PUSHBACK CLEARANCE WILL NOT BE GRANTED UNTIL DISCREPANCY IS RESOLVED.

CDM04 "Aircraft Registration discrepancy"

DLH1AB/LH123

CDM04

1002171200UTC

(IATA/ICAO Location Indicator)

AIRCRAFT REGISTRATION INCONSISTENCY BETWEEN ATC FLIGHT PLAN <REG> AND AIRPORT DATABASE <REG>.

IMMEDIATE UPDATE OF ATC FLIGHT PLAN OR AIRPORT DATABASE NEEDED.

NOTE: THE AIRPORT CDM PROCESS WILL NOT BE SUSPENDED BUT START UP / PUSHBACK CLEARANCE WILL NOT BE GRANTED UNTIL DISCREPANCY IS RESOLVED.

CDM05 "First Destination discrepancy"

DLH1AB/LH123

CDM05

1002171200UTC

(IATA/ICAO Location Indicator)

DESTINATION INCONSISTENCY BETWEEN ATC FLIGHT PLAN <ADES> AND AIRPORT DATABASE <DEST>.

IMMEDIATE UPDATE OF ATC FLIGHT PLAN OR AIRPORT DATABASE NEEDED.

NOTE: PLEASE CLARIFY WITH AIRPORT TRAFFIC OPERATION CENTER TEL: 123456789.

CDM06 "Non-Airborne Alert"

DLH1AB/LH123

CDM06

1002171200UTC

(IATA/ICAO Location Indicator)

NO INFORMATION THAT INBOUND FLIGHT IS AIRBORNE, EIBT 1200 MIGHT NOT BE RESPECTED.

CHECK OUTBOUND FLIGHT AND ATC FLIGHT PLAN AND UPDATE IF REQUIRED.

CDM07 "EIBT + MTTT discrepancy with EOBT"

DLH1AB/LH123

CDM07 "EIBT + MTTT discrepancy with EOBT"

DLH1AB/LH123

CDM07

1002171200UTC

(IATA/ICAO Location Indicator)

EIBT 1300 OF INBOUND DLH1AX/LH122 + MTTT 0030 IS NOT CONSISTENT WITH OUTBOUND ATC FLIGHT PLAN EOBT 1300.

CHECK OUTBOUND FLIGHT AND ATC FLIGHT PLAN AND UPDATE IF REQUIRED.

NOTE: THIS IS AN ADVISORY ALERT ONLY AND THIS FLIGHT REQUIRES MONITORING AS THE OUTBOUND FLIGHT MAYBE DELAYED.

CDM08 "EOBT Compliance Alert"

DLH1AB/LH123

CDM08

1002171200UTC

(IATA/ICAO Location Indicator)

RECEIVED TOBT 1300 IS OUT OF ATC FLIGHT PLAN EOBT 1230 TOLERANCE WINDOW. IMMEDIATE UPDATE OF ATC FLIGHT PLAN EOBT NEEDED.

NOTE: EOBT AND TOBT SHALL NOT DIFFER BY MORE THAN 15 MINUTES. THE AIRPORT CDM PROCESS WILL NOT BE SUSPENDED BUT START UP / PUSHBACK CLEARANCE MAY NOT BE GRANTED UNTIL DISCREPANCY IS RESOLVED.

CDM09 "Boarding Not Started"

DLH1AB/LH123

CDM09

1002171200UTC

(IATA/ICAO Location Indicator)

AT TOBT 1300 - 10 MINUTES BOARDING WAS NOT INITIATED.

UPDATE TOBT IF NEEDED.

NOTE: THE AIRPORT CDM PROCESS WILL NOT BE SUSPENDED BUT START UP / PUSHBACK CLEARANCE MAY NOT BE GRANTED.

CDM10 "TOBT Rejected or Deleted"

DLH1AB/LH123

CDM10

1002171200UTC

(IATA/ICAO Location Indicator)

TOBT 1300 WAS REJECTED OR DELETED.

NEW TOBT REQUIRED.

NOTE: THE AIRPORT CDM PROCESS IS SUSPENDED UNTIL RECEPTION OF YOUR RECTIFICATION.

CDM11 "Flight not compliant with TOBT / TSAT"

DLH1AB/LH123

CDM11

1002171200UTC

(IATA/ICAO Location Indicator)

FLIGHT NOT COMPLIANT WITH TOBT 1300 / TSAT 1300.

THIS FLIGHT WILL BE RE-SEQUENCED ON RECEIPT OF NEW TOBT.

NOTE: THE AIRPORT CDM PROCESS MAY BE SUSPENDED UNTIL RECEPTION OF YOUR NEW TOBT.

CDM12 "TSAT Not Respected by ATC"

DLH1AB/LH123

CDM12

1002171200UTC

(IATA/ICAO Location Indicator)

AT TSAT 1300 + 5 MINUTES AIRCRAFT HAS NOT BEEN GRANTED START UP OR PUSHBACK.

THIS FLIGHT NEEDS TO BE RESEQUENCED.

<u>CDM13 “No ATC Flight Plan Available”</u>

NO ARCID/LH123

CDM13

1002171200UTC

(IATA/ICAO Location Indicator)

THE ATC FLIGHT PLAN IS NOT AVAILABLE.

SUBMISSION OF NEW ATC FLIGHT PLAN NEEDED.

NOTE: ATC FPL <ARCID> HAS BEEN CANCELLED AND THE AIRPORT CDM PROCESS IS SUSPENDED.

<u>CDM14 “Automatic TOBT Generation not possible”</u>

DLH1AB/LH123

CDM14

1002171200UTC

(IATA/ICAO Location Indicator)

THE TOBT COULD NOT BE AUTOMATICALLY GENERATED BECAUSE IT DOES NOT MATCH WITH THE ASSOCIATED CTOT 1330.

MANUAL INPUT OF TOBT REQUIRED.

NOTE: THE AIRPORT CDM PROCESS IS SUSPENDED until reception of your rectification.

5 PUBLICATION

5.1 Aeronautical Information Publication (AIP)

The Airport CDM procedure at an Airport will be published in the National Aeronautical Information Publication.

5.2 Airport User Regulations (FBO)

The Airport CDM procedure at an Airport will be published in the airport user regulations, too.

FABEC Implementation Phase

NTM / DIK - SWAP RTS

EC Information

Attachment N.6

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

DOCUMENT SUMMARY

Objective : Executive Summary of FABEC NTM / DIK – SWAP Real Time Simulations	
Origin : SC OPS	**Audience** : FABEC Provisional Council, ANSCB, ASB, AFG, European Commission

Title : FABEC NTM / DIK – SWAP Real Time Simulations
Reference : FABEC_AFG_EC Information_Annex N6_v0 1

Version : 0 1	**Date** : 13.03.2012	**Status** : ☑ Draft ☐ Released	**Classification** : ☐ Public ☑ FABEC limited ☐ Addressees limited

DOCUMENT CHANGE RECORD

Version	Status	Date	Reason for changes	Author of changes
0.1	Draft	13.03.2012	Initial draft based on detailed RTS report	AFG

QUALITY CONTROL

Name: Manuel De Klerck	**Signature**:
Function: AFG Quality Manager	
Date:	

EXECUTIVE SUMMARY

This document is the validation report of the large scale Real Time Simulation (RTS) conducted at EUROCONTROL Experiment Centre, of the SWAP airspace reorganisation proposal developed within the FABEC - Nattenheim-Diekirch (NTM/DIK) hotspot Task Force.

The objective of the SWAP validation activities was twofold:

- Assess the operability and acceptability, from the controller perspective, of the SWAP Version 1 (V1) and Version 2 (V2) airspaces;
- Provide initial trends regarding the related expected benefits in terms of safety (removal of current Hot spot), efficiency (optimised distance/time flown and ensured military mission effectiveness) and capacity (optimised airspace usage and reduced controller workload).

The SWAP validation methodology consisted of a series of two Real Time Simulations, the second of which built upon the first and increased the scope. These simulations were expected to address the NTM/DIK hotspot issues and are complementary to the other “hot spot projects” identified in FABEC (e.g. Northern Airspace).

The large scale RTS followed a small scale simulation (prototyping session of 4 days) that focused on specific issues at the interface between Reims/Geneva Area Control Centres in the SWAP V2 airspace. Its content and focus were defined and agreed by the SWAP Sub Working Group and SWAP simulation Core Team. The main large scale RTS objective was to provide an initial comparison between current airspace and two variants of SWAP airspace by providing trends over identified Key Performance Areas (KPA). Results are mainly expressed in terms of:

- Operability: Controllers subjective feedback on the feasibility and acceptability of the proposed airspace organisations;
- Safety: Both objective and subjective data on workload and on any safety issues.

The RTS took place at EUROCONTROL Experimental Centre and lasted 2 weeks from 16th to 30th of April 2010. There were 35 controller positions with 6 different HMIs involving a total of 46 controllers from 5 ANSPs and 7 ATC centres: Skyguide (Geneva and Zurich), DSNA (Reims and Paris), Belgocontrol, French Air Force (FAF) and EUROCONTROL (MUAC). The simulated airspace was based on the current network and the agreed FABEC SWAP V1 and V2 designs with the addition of elements of the Paris HARMONIE project. It included ATC sectors from Reims, Geneva, Zurich, and Paris with a portion of CANAC and MUAC ACC airspace. The proposed route networks had new transfer levels for flights leaving Reims and new CBA/TSA boundaries were developed for the French military areas. The traffic samples were derived from actual traffic although adaptations (e.g. traffic increase) were made to meet stakeholders’ needs and the simulation objectives. Results were obtained from 21 measured exercises analysed over a 1 hour period.

The subjective view of the controllers was that the SWAP V1 airspace was rejected by the majority (80%). The bottleneck at GTQ was considered more problematic in the Reims sectors and there was increased complexity for arrivals and departures in/out of Geneva. As a consequence the V1 network was not considered feasible and was seen as potentially degrading today’s level of safety and capacity.

The SWAP V2 airspace was accepted by 90% of participants and considered feasible for the main En-Route controllers tasks (separation management, conflict detection and traffic delivery). The segregation of northbound and southbound flows provided a better organisation of traffic in the Reims sectors and removed the current hot spot between Reims and Geneva. In the lower Geneva sector, when CBA25 was active, the traffic was found easier to handle than today. The subjective view of the controllers was that SWAP V2 did not degrade safety and capacity with half of the participants suggesting that both could be even improved. Objective results on distance flown and the ability to achieve the agreed transfer levels show no degradation of today’s flight efficiency and quality of service. In terms of transfer levels between Reims and adjacent sectors, the RTS concludes that of the options tested FL200 was the best for Zurich arrivals and suggests that aircraft transferring between Reims and MUAC/CANAC could be delivered at higher flight levels than in the case today. For Paris arrivals, the use of even levels (with FL340 max and aircraft released early with the option for Paris controllers to effect a turn) seems to be the most acceptable.

The military participants expressed equivalence in terms of military mission effectiveness between the SWAP airspaces and today’s situation.

Although a major part of the SWAP V2 airspace has been assessed and validated by the RTS, it still requires agreement on dimension of current military areas (e.g. CBA22), the definition of new SIDs and STARs in/out of Geneva airport and a new route north of GTQ into Germany airspace to segregate the flows.

FABEC Implementation Phase

DOVER Phase II RTS

EC Information

Attachment N.7

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

DOCUMENT SUMMARY

Objective : Executive Summary of FABEC DOVER Phase II Real Time Simulations	
Origin : SC OPS	**Audience** : FABEC Provisional Council, ANSCB, ASB, AFG, European Commission

Title : FABEC DOVER Phase II RTS
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Version	Status	Date	Reason for changes	Author of changes
0.1	Draft	13.03.2012	Initial draft based on detailed RTS report	AFG

QUALITY CONTROL

Name: Manuel De Klerck	**Signature**:
Function: AFG Quality Manager	
Date:	

EXECUTIVE SUMMARY

The DVR Phase II simulations were organised at Brétigny EEC in order to validate the airspace design developed by the Dover Working Group (DVR WG), in a common RTS. The simulated airspace design aims at alleviating the bottleneck around DVR/KOK and, where possible, improving the flight profiles.

This simulated airspace design is composed of following parts:

Reshaping of the cross border area 1 (CBA 1), with or without lateral extensions (CBA1 “Part” and CBA1 “Full”).

- Introduction of a new route structure for eastbound traffic with:
  - associated traffic assignment rules that were specified for each of the new ATS routes and CDRs. (traffic is assigned to the routes in function of the respective airports of departures in the London TMA, so-called TA-1);
  - revised transfer conditions for the eastbound traffic from LAC to Brussels ACC and to MUAC
- Improved (higher) descent profile for traffic to the Brussels TMA/EBCI/EBLG and EHBK, with two simulated variants:
  - Scenario EBBR1: Traffic delivered from LAC to MUAC (FL300) and then from MUAC to Brussels ACC (FL250), or:
  - Scenario EBBR2: traffic delivered from LAC to Brussels ACC (FL240 before FIR/UIR boundary)
- Earlier transfer of northbound traffic from Reims to MUAC (scenario EHAM1, transfer approximately 22 NM before the UIR boundary and cross-over EHAM arrivals/LFP* departures done by MUAC) compared to the existing situation, referred to as scenario EHAM2 (traffic transferred approximately at the UIR boundary, Reims UAC responsible for crossing EHAM arrivals/LFP* departures
- Revised sector boundaries along the French/Belgian boundary (involving Reims UAC, Paris ACC, Brussels ACC and MUAC).

The impact (directly and indirectly) of this new design within the current structure was verified, different transfer conditions (EBBR1/2, EHAM1/2) and various military activations were tested. As a result of a previously completed Prototype RTS traffic assignment 1 (TA 1), whereby traffic is sorted by aerodrome of departure, was used for all exercises.

Over the course of the two-week RTS 16 exercises (plus 2 additional exercises testing a scenario with the presence of an AWACS aircraft in the concerned airspace) were completed involving 29 air-traffic controllers from the participating ANSPs. Following measured sectors were simulated:

- Brussels ACC sectors WHN and WL;
- Maastricht UAC sectors BWH and KOL;
- Swanwick LAC sector S15;
- Paris ACC sector TB, including the MOPIL flow artificially;
- Reims UAC sectors UN and UB;
- Military: Belga Radar.

A total of 8 organisations repeated during the two weeks were simulated examining a variation of the CONOPS (current vs. new), military activation (WE, Part and Mil Full) and transfer condition (EBBR2/EHAM2 vs. EBBR1/EHAM1).

The increase of available vectoring airspace with the reshaped CBA 1 and the ability to handle departures and arrivals flows on separated routes is perceived as a significant operational improvement. Because of these benefits, controllers of all involved ANSPs regard the activation of the full CBA1 as a source of extra workload resulting from increased vectoring for circumnavigation.

Controllers of LAC and Brussels ACC emphasised the increased airspace for vectoring aircraft. LAC controllers experienced an improved ability to present traffic to MUAC and Brussels ACC, while MUAC controllers emphasised a reduction in workload handling LFP* departures and EHAM arrivals. Controllers of Paris ACC regard the fact that the BELDI-KUTEX route remains available with the Mil Part configuration as an important driver for facilitating the separation of EBBR and EBCI arrivals more easily from LFP* departures.

Similarly, Reims ACC regards the preserved BELDI-DENUT route in the Mil Part configuration as beneficial for handling EHAM arrivals and LFP* departures. Because of these benefits, controllers of all involved ANSPs regard the activation of the full CBA1 as a source of extra workload resulting from increased vectoring for circumnavigation in relation to the Mil Part configuration.

In general the new route structure allows more predictability for the sectors directly involved and will make additional routes flight-plannable thus more efficient.

From the viewpoint of MUAC, the new route structure is a formalisation of current working practices whereby traffic is vectored and delivered to MUAC on parallel tracks. Although the MUAC ATCOs consider the new route structure as operationally acceptable for the KOL and BWH sectors, they do not expect a capacity increase for these simulated sectors.

However, NATS expects a potential reduction in workload per flight which will enable a more streamlined transfer of traffic across the FIR boundary coupled together with an improved climb profile for LTMA departures and a significantly improved descent profile for Brussels TMA arrivals.

Due to the improvements across the FIR boundary there is a potential that the TMVs of the KOL and BWH sectors may be more often reached. This would lead to a shift of the bottleneck more to the east around the REMBA area (where the three new routes converge to the existing single ATS route) and continuing into the DIK/LUX/NTM bottleneck. Moreover, although the three route structure should enable higher profiles for traffic from the London airports, MUAC controllers expect that any increase in traffic volume of the eastbound flow, will have a negative impact on the climb profiles of departures from Amsterdam (southbound) and from Paris airports (northbound).

For Brussels ACC, the new route structure allows for more vectoring airspace for eastbound traffic and the availability of the new arrival route for the Brussels inbounds is considered as a potential contributor to reduce workload. A procedure between Brussels ACC and MUAC needs to be developed for when EBD-07 is active to allow traffic to descend below FL250. The simultaneous activation of the full CBA1 and EBD-07 significantly reduces the vectoring airspace around COLSY.

Within the scope of the simulated airspace, the initial concerns with regard to the interaction with the new route structure, additional bunching at CMB and achievement of current restriction at MOPIL, were investigated and did not reveal any indication supporting these concerns.

Additionally, the impact on the current civil-military coordination procedures on the new route structure was investigated. The RTS demonstrated that these procedures were not impacted and achievable in the re-designed airspace.

The new transfer conditions for the eastbound traffic were acceptable to all partners. However, certain agreements (ASM/ATFCM) have to be put in place to revert to current procedures and strict adherence to these new transfer conditions is required. More in particular, EBBR1 (traffic inbound Brussels TMA via MUAC) was considered as feasible, provided that all parties could adhere to the agreed transfer conditions. MUAC controllers felt ready to accept the extra workload of this added traffic in order to allow more efficient flight profiles. However, they also suggested to have alternative procedures to revert to the current sector sequence (LAC-Brussels ACC) in order to avoid that other streams (mainly London departures) would be penalised at certain busy times. Especially the activation of the CBA1 “full” greatly complicates the handling of this flow. (Note: due to the structure of the RTS there was no opportunity to simulate this proposal and therefore the potential of any impact on other traffic flows has not been identified or assessed)

The new transfer conditions between Reims UAC and MUAC (EHAM1) were considered acceptable by MUAC. The advantage of having the Northbound traffic earlier on frequency compensates the added responsibility to perform the EHAM/LFP* cross-over. The EHAM2 scenario corresponds to the current procedure

Due to conflicting flows in UB sector and in the sectors above (KN, HN), Reims is not able to respect EHAM1 transfer of communications conditions, while it is for EHAM2.

The majority of controllers considered the safety aspect to be at least maintained or improved by the design assessed. However, certain issues were identified and need to be addressed (e.g. the current practice of giving direct routeing south of BULAM/DENUT/TEBRA would bring westbound traffic close to the new most northerly ATS route).

Paris ACC controllers raised the issue that the close proximity of TBM sector to the X005 route starting at FL145 would create a safety problem caused by potential conflicts between traffic on X005 with slow descents to EBBR or with slow climbers departing from LFP*.

The conclusion was unanimous; the new DVR Phase II CONOPS should be implemented, taking into account that:

- some modifications were identified and will have to be further developed and included into the final design;
- The new sector boundaries are included as an integral part of the changed airspace design;
- The possibility to revert to the current sector sequence for traffic to the Brussels TMA (i.e. LAC-Brussels ACC) must be investigated to avoid overloading the KOL in case of CBA Mil Full or during periods of high traffic demand;
- The improvements in the DVR/KOK area will benefit the profiles of Brussels TMA arrivals and LTMA departures whilst harmonising the interface between LAC and BELGO or MUAC. However in order to recognise the full benefits associated with the proposed airspace design and to avoid potentially shifting the bottleneck to the East of Belgium around the NTM/DIK area a solution must be found.

The following recommendations were formulated:

- The necessity of full activation of all extensions of CBA 1 (Mil Full) has to be investigated.
- To get the full benefit of the proposed new route structure it has to be extended further East.
- An alternative AWACS track should be investigated.
- Transfer procedure NATS-MUAC needs to be further fine-tuned.
- Transfer procedure Paris ACC-Brussels ACC needs to be revised.
- EBBR1 should revert to EBBR2 during periods of sector overload in KOL.
- Organise local simulations where deemed necessary.

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FABEC Implementation Phase

LoA AMRUFRA

EC Information

Attachment N.8

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

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LoA Change Proposals

LoA : Amsterdam ACC / Maastricht UAC **Planned Implementation Date : 11/03/2010** **AP-2889**

Page	Paragraph	TX	TB	PC	Item	Reason	Source
3	7	X			"-Oost" deleted	Editorial correction	MS/PRO (Olaf Oomes)
3	7	X			Signatories: "Date" inserted	Conformity with Common LoA Format	MS/PRO (Olaf Oomes)
5	Agreed CAB			X	Agreed Common ATC Boundary updated	Details in POD R-495	MS/PRO (POD R-495)
B4	B.3.1.9	X			Lateral limits RKN B Area adjusted	Details in POD R-495	MS/PRO (POD R-495)
B4	B.3.1.10	X			NAPSI Area deleted	Details in POD R-495	MS/PRO (POD R-495)
B4	B.3.1.10	X			AMOSU Area inserted	Details in POD R-495	MS/PRO (POD R-495)
B4	B.3.1.11	X			New paragraph decribing the KLEVE HI Area	Details in POD R-495	MS/PRO (POD R-495)
B7	Sectorisation			X	Picture updated	Details in POD R-495	MS/PRO (POD R-495)
B8	Sectorisation			X	Picture updated	Details in POD R-495	MS/PRO (POD R-495)
B9	SASKI etc.			X	UZ291 added	Details in POD R-495	MS/PRO (POD R-495)
B10	MOLIX etc.			X	UZ292 and UZ28 added	Details in POD R-495	MS/PRO (POD R-495)
B11	Twenthe Area			X	Picture updated	Details in POD R-495	MS/PRO (POD R-495)
B13	Almelo etc.			X	Picture updated	Details in POD R-495	MS/PRO (POD R-495)
B14	SPY/PAM			X	Picture updated	Details in POD R-495	MS/PRO (POD R-495)
B15	JOJO track			X	Picture updated	Details in POD R-495	MS/PRO (POD R-495)
C3	C.2.2.1.2		X		Under Delta.... RENDI deleted	Details in POD R-495	MS/PRO (POD R-495)
C3	C.2.2.1.3		X		"TEBRO" substituted by "NAPRO"	Details in POD R-495	MS/PRO (POD R-495)
C7	Appendix		X		COP TEBRO substituted by COP NAPRO	Details in POD R-495	MS/PRO (POD R-495)
C7	Appendix		X		COP RENDI deleted	Details in POD R-495	MS/PRO (POD R-495)
D1	D.2.1.1		X		All brackets deleted	Editorial correction	MS/PRO (POD R-495)
D2	D.2.1.2		X		All brackets deleted	Editorial correction	MS/PRO (POD R-495)
D3	D.2.1.3		X		ATS Route (U)Y282 / UP73 deleted	Details in POD R-495	MS/PRO (POD R-495)

D3	D.2.1.3		X		All brackets deleted	Editorial correction	MS/PRO (POD R-495)
D3	D.2.1.3.1	X			NAPSI deleted throughout entire text	Details in POD R-495	MS/PRO (POD R-495)
D3	D.2.1.4		X		(U)L603 an T150 deleted	Details in POD R-495	MS/PRO (POD R-495)
D3	D.2.1.4		X		TEBRO substituted by NAPRO	Details in POD R-495	MS/PRO (POD R-495)
D3	D.2.1.4.1	X			"SONEB at or above FL210" i.s.o. "SONEB above FL210"	Details in POD R-495	MS/PRO (POD R-495)
D4	D.2.1.4.2	X			Several changes throughout text	Details in POD R-495	MS/PRO (POD R-495)
D4	D.2.1.4.3	X			TEBRO substituted by NAPRO (2x)	Details in POD R-495	MS/PRO (POD R-495)
D4	D.2.1.4.3	X			".... provided flights ...... via SONEB" deleted	Details in POD R-495	MS/PRO (POD R-495)
D6	D.2.2.3		X		UP199 deleted	Requirement MUAC	MUAC
D6	D.2.2.3		X		Onder COP RKN the UL980 added	Editorial correction	MS/PRO (Niels van Zuijlen)
D7	D.4.1	X			Textual changes	Details in POD R-495	MS/PRO (POD R-495)
E2	E.2.2.2		X		Several changes	Details in POD R-495	MS/PRO (POD R-495)

END