GeoSpatial Technology in Air Traffic Management

Validation of Real Time Airspace Status Information Exchange Process

Alessandro PRESTIGIACOMO
EUROCONTROL Network Manager Directorate/Operations Planning Unit

Conference on New Advanced GNSS and 3D Spatial Techniques
University of Trieste, Italy - Feb. 18, 2016
Overview

• EUROCONTROL in brief
  – Network Manager

• Single European Sky Air Traffic Management Research (SESAR) programme

• Flexible Use of Airspace (FUA) concept
  – Advanced FUA (AFUA) concept

• ATM Data Modelling
  – Aeronautical Information Exchange Model (AIXM)

• Flexible Airspace Management (FAM) project
  – Validation of Real Time Airspace Status Information Exchange Process (EXE VP710)
MISSION
Founded in 1960, today EUROCONTROL is a civil-military organisation committed to building, together with its partners, a Single European Sky that will deliver the air traffic management (ATM) performance required for the twenty-first century and beyond.

MEMBERSHIP
EUROCONTROL is an intergovernmental organisation with 42 Member States. The European Community signed an Accession Protocol in 2002. Member States include all of the EU States.
The Network Manager

The Network

- 2.27 million passengers per day
- 27,000 flights per day
- 1,940 aircraft operators
- 520 airports
- 65 control centers
- 42 EU/non-EU states

Airports in the Network

Airports in the Network work better when all services, from ATC to baggage-handling, are connected with each other and the network.

Airspace Design & Capacity Planning

We work with all our stakeholders to create an efficient, flexible and dynamic airspace structure and to extract maximum capacity from the network.

Civil-Military Coordination

Flexible use of airspace. The military free up airspace when they are not using it.

Bad Weather

Causes 13% of primary delay. We work to reduce the disruption and keep the network resilient.

Manage Scarce Resources

100% of requests met in 2013 central code allocation for 20 states.

Crisis Management

We coordinate the management of responses to any crisis which impacts on aviation in Europe.

Data Sharing

Aeronautical services providing information for the flight, from airspace closures to weather.

Flow Management

Since 1995

We manage surges in air traffic so as to minimise impact on the network. Flow management minimises fuel burn and emissions by holding aircraft on the ground so as to avoid congestion in the air.

200,000 TONNES OF FUEL
600,000 TONNES OF CO2
SAVED YEARLY

Flight Efficiency Initiative

Launched in 2013

We offer aircraft operators the most efficient routes on the day of operation.

32,644 MINUTES
202,700 NAUTICAL MILES
SAVED IN 2014

Savings for the environment

18-02-2016

Geospatial Technology in ATM
Flight Demand Excess
Over Airport Capacity in 2030
(Departures and Arrivals, Scenario A)

- Below 5%
- 5%-10%
- 10%-15%
- 15%-20%
- 20%-25%
- Above 30%

ESRA
EUROCONTROL Statistical Reference Area

Canaries  Azores
Improved ANS operations productivity

Lean and efficient use of ANS infrastructure

Increased collaboration and operational predictability

Improved airport performance and access

Improved flight trajectories

Inclusion of all air vehicles into the airspace

Enhanced safety and security
SESAR: solutions

**En-route**
- ASM and advanced FUA
- Free route
- Enhanced STAM
- Advanced RNP
- CTA
- Enhanced safety nets
- ASAS spacing
- Automated support for traffic complexity assessment
- Trajectory based tools
- Mission trajectory
- Time-based separation for final approach
- Information sharing and business trajectory
- CTOT to TTA for ATFCM purposes
- Sector team operations
- Enhanced TMA using RNP based operations
- Digital integrated briefing
- AMAN/DMAN integration including multiple airports
- UDPP
- CNS rationalisation
- Approach and departure separations
- Collaborative NGP
- Initial SWIM*
- DMAN synchronised with pre-departure sequencing
- AMAN extended to en-route airspace
- Initial trajectory information sharing
- DMAN integrated with surface management constraints
- LVPs using GBAS
- Integrated surface management DL
- Automated assistance for surface movement planning and routing
- Collaborative airport
- Integrated surface management

**Airport**
- Remote tower
- Ground situational awareness
- Airport safety nets vehicles
- Enhanced airport safety nets
- Airport safety nets
- AMAN synchronised with pre-departure sequencing
- LVPs using GBAS
- Integrated surface management DL
- Collaborative airport
- Integrated surface management

**Operational Changes**
- PCP Essential Operational Changes
- New Essential Operational Changes

**Geospatial Technology in ATM**
Military training areas

More than 9000 military aircrafts

2510 Military elementary sectors

Source:
EUROCONTROL Military Statistics 2014
EUROCONTROL NM - AIRAC 1513
FUA concept

- Airspace no longer designated as purely "civil" or "military", but considered as one continuum and allocated according to user requirements.

- Any necessary airspace segregation is temporary, based on real-time usage within a specific time period.

- Contiguous volumes of airspace are not constrained by national boundaries.

- The practical application of the FUA concept relies on:
  - national Airspace Management Cells (AMCs) for the submission of Airspace Use Plan (AUP) and Updated Use Plan (UUP);
  - Centralised Airspace Data Function (CADF) for the dissemination of information to aircraft operators through:
    - daily European AUP and UUPs (EAUP/EUUP) via Network Operations (NOP) Portal;
    - eAMI message for those using B2B service.
AFUA concept

• Introduces performance driven operations based on the management of Airspace Configurations.

• Provides processes that support the use of more dynamic and flexible elements as made available through Advanced FUA.

• Describes a seamless, Collaborative Decision Making (CDM) based, ASM/ATFCM process with a real time management of Airspace Configurations as well as a continuous sharing of information among all ATM partners enabled by advanced technology developed within SESAR.
Geography Mark-up Language (GML):

- based on Extensible Mark-up Language (XML).
- ISO standard for encoding geospatial information.
- A feature is an "abstraction of real world phenomena" (ISO 19101); its state is defined by a set of properties.
- Community-specific application schemas:
  - AIXM - the Aeronautical Information Exchange Model
  - WXXM - the Weather Exchange Model
  - FIXM - the Flight Information Exchange Model
AIXM

• Supports aeronautical information collection, dissemination and transformation throughout the data chain.

• Two main components:
  – AIXM Conceptual Model;
FAM project

• Step 1 - Advanced Flexible Use of Airspace (AFUA):
  – new Airspace Reservation design principles (VPA);
  – real time airspace status data exchange;
  – ATC/ASM/ATFCM systems interoperability.

• Step 2 - Dynamic Airspace Configurations (DAC):
  – ASM merged with Demand and Capacity Balancing (DCB) into fully integrated ASM/ATFCM/ATS CDM layered process;
  – Fully dynamic Airspace Configuration as a tool for integrated capacity management process;
  – Airspace Building Block architecture;
  – Automated Support for dynamic sectorisation and constraints management.
EXE VP710: Objectives

- Increase ATM network efficiency through enhanced situational awareness.
- Share real time airspace status data among ATM actors concerned.
- Validate benefits within the DCB process establishing the RTSA update between pertinent systems ATFCM/ASM/ATC.
- Demonstrate system interoperability in regard to the airspace status update process, focusing on the newly introduced VPA design principles.
- Validate applicability of SWIM technical profile (B2B connection) and data exchange format (AIXM 5.1).
- Perform Network impact assessment on the ground of RTSA update, define list of eligible flights subject for rerouting.
- Share result of the impact assessment with pertinent ATM actors and facilitate a new flight planning cycle for the eligible flights.
EXE VP710: Use cases

A. RTSA information exchanged between ASM support systems.
B. Reservation during EAUP/EUUP execution.
C. In-flight ARES request or modification.
D. Early release of airspace.
EXE VP710: Results

- Over a 2 hour period of flight operations, 70 flights impacted by the activated ARES.
- 45 were proposed on a longer route for circumnavigation.
- 12 were proposed a shorter route (-74 NM).
- Average mileage difference is 5NM per flight.

The new predicted demand (right picture) shows a significant overload of the downstream sector.
EXE VP710: Achievements

- RTSA data successfully distributed and processed automatically.
- ARES data consistent among systems involved.
- + 17% overall effectiveness of airspace usage.
- - 1,79% fuel consumption (> 2000 Kg CO₂).
- 0,92% ÷ 1,36% Direct Operating Costs gain.
Thank you.

Any Questions?

Alessandro PRESTIGIACOMO
EUROCONTROL Network Manager Directorate/Operations Planning Unit

alessandro.prestigiacomo@eurocontrol.int
+32 272 93793
EUROCONTROL
Rue de la Fusée, 96
1130 Brussels, Belgium