ELEVENTH AIR NAVIGATION CONFERENCE

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Agenda Item 4: Capacity-enhancement measures
4.2 Regional measures
:

AIR TRAFFIC MANAGEMENT SYSTEMS ARCHITECTURES: MEETING THE REQUIREMENTS OF TRAFFIC GROWTH

(Presented by Italy)

SUMMARY

The forecast growth of air movements worldwide calls for a more logical and feasible transition from present day ATM facilities to an efficient, safe/secure new generation of systems with a high degree of functional interoperability.
The eFDP fi project by STNA and ENAV is an example of the development of an essential core element of the ATM system that implies conceptual changes to ATM systems architectures.

REFERENCES

Vision of Aeronautics in 2020 EU DG RESEARCH
EUROCONTROL strategy 2000+
ACARE SRA

1. INTRODUCTION

1.1 According to ICAO: “The general objective of ATM is to enable aircraft operators to meet their planned times of departure and arrival and adhere to their preferred flight profiles with minimum constraints and without compromising agreed levels of safety”.

1.2 ATM systems are the infrastructure within which aircraft operate. Their basic requirements are to confer safety, in an efficient manner, to those who fly, throughout their trajectory, in all weather conditions.

1.3 These requirements have taken particular value over recent years when periodic stressing of resources has indicated the need to revise the performance of the ATM infrastructure so that it is more logically dimensioned and structured compared to the present.

1.4 It is not a simple task to rationalize a system in operation, that cannot be halted for a major overhaul and that is, at times, irremediably conditioned by political constraints. Yet ICAO, European Organisation for the Safety of Air Navigation (EUROCONTROL), International Air Transport Association (IATA) and the European Commission are succeeding in the promulgation of projects which challenge the basis of air traffic management and that anticipate a shift in their operating paradigm, in the belief that capacity, efficiency, safety/security are surmountable barriers when service providers and airspace users recognize the economic advantages and feasibility of pursuing such goals.

1.5 This paper indicates a roadmap of development activities that ensure the Single European Sky initiatives are met in time.

2. METHODOLOGY

2.1 The first step in this "rationalization" process is to recognize that the ATM system, as a complex of sub-systems, would benefit primarily from a new generation of flight data processors (FDPs) with a very high degree of functional interoperability. Flight data processors, formerly known to be more or less useful data bases, are taking a leading role through their interfaces with air traffic flow management (AFTM) and automatic dependent surveillance (ADS) links with the aircraft. As such FDPs will be, increasingly, the planning instrument for trajectory management from gate to gate.

2.2 For economic reasons, the development in question would need to be performed in one step, rather than deriving performance through (and being constrained by) a bottom-up series of adaptations of legacy systems. This first step, to be followed by enhancements to surveillance and communications would then be a second stage of architectural redesign of the ATM system. The new generation of FDPS is however strictly related to the success of three European projects: the eFDP-FI — France/Italy; the iTEC-eFDP — Spain/Germany and the new FDPS Maastricht UAC — Eurocontrol.

2.3 This eFDP approach would appear to be limited to a technology-driven improvement. It is, however, conditional on the success of airspace restructuring to accommodate the seamless contiguity of European Civil Aviation Conference (ECAC) skies and also by regional upper airspace control centres who would also benefit from the development, as already indicated in the SES initiative by the European Commission.

2.4 The "revolutionary" aspect of technology is offered by the development of open source middleware what will encompass the eFDP and the other components of the ATM system. The open source nature of this layer would make possible a very important feature for ATM systems beyond functional interoperability — that of scalability and portability whose requirements would be fully supported.

2.5 A key component for the physical implementation of the architecture is the middleware, consisting of a set of enabling services that allow multiple processes running on one or more machines to interact across a network.

2.6 The software infrastructure supporting the ATM system architecture could be compliant with the Corba Componenet Model (CCM) standard specification.

2.7 Middleware standards products should be used for openness, interoperability and scalability purposes, but the basic capabilities provided by COTS products seems not to be sufficient to cover all requirements for mission critical distributed computing infrastructure.

2.8 Abstraction layer for ORB and operating system, the configuration and plugging capability, the infrastructure repository, naming, event, persistence, transaction, time and clock, life cycle, system management, trace, recording and playback, load balancing, security, data distribution, fault tolerance, safety. This would therefore cover system requirements for all ATM components of the system. Maximum use of COTS components would of course concur to the lowering of development costs.

2.9 A traditional FDP:

a) provides the processing of flight plan data and other related information to support air traffic controllers during the planning and progress phases of flights;

b) produces flight planning, trajectory prediction, coordination between sectors and with adjacent ATS units; and

c) transfer of flight control between sectors.

2.10 An innovative FDP like the eFDP fi:

a) supports improved interoperability (ATC-ATC, ATC-aircraft via datalink, ATC-aircraft operator, ATC-aerodrome operator, uses a design that optimises the plug of future products, the connection to other ATC systems and the adaptation to new technology or standards;

b) eFDP projects asks for a product that is:

1) compliant with advanced Operational Requirements inherited from EATCHIP/EATMP and eFDP experiences;

2) enabling interoperability;

3) having a high modular decomposition (also called fine grain approach);

4) using well-defined business interfaces and standards (component model, interface definitions, …);

5) supporting the possibility to plug new ATM components or COTS; and

6) available by 2007-2015 according to the different projects' phases.

c) all the actors involved in ATM express a "need" for interoperability, but it is extremely difficult to have all of them around the same table;

d) both interoperability and architecture standards are very different from "electrical connection" or "minimum performance" standards: they require an agreed language for the definition of data, operations and interfaces and UML has not always a built-in solution;

e) these standards should be "future oriented" but "architecture-centric process" and "component based design" are relatively young approaches not yet completely explored; and

f) the production of interoperability and architecture standards shall be supported by advanced tools for design which requires a certain level of configuration to be effectively used.

3. CONCLUSIONS

3.1 The conference is invited to note the contents of this paper so as to be aware that the eFDP fi development has started and is designed from start to solve the air transport needs in one bold step.

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