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Copy: David Bowen (SESAR JU)

White Paper on automation in the field of Air Traffic Management

Dear Sir,

In the frame of informal discussions, Airbus and the following staff associations of pilots and controllers: ECA, IFATCA and ATCEUC have been working together on the appropriate consideration of automation in the field of Air Traffic Management R&D.

Preliminary information regarding this activity has been presented to the SESAR JU on May 8, 2015.

As a result of this collaborative effort, we are pleased to provide you with a White paper on "Automation in the field of Air Traffic Management" signed by ECA, IFATCA, ATCEUC and AIRBUS.

Please note that this document will be further enriched with some guidance material.

We are confident that this document will represent a solid input to the ATM R&D activities conducted in the frame of SESAR 2020.

Best regards,

Bruno LEY
Airbus SAS – Engineering Department
Head of Multi Program Projects and ATM Engineering

Activity followed by Daniel Ferro (Airbus Engineering – ATM team)

Automation in the field of Air Traffic Management
A White Paper

1 - Introduction

This paper is produced by an informal working group composed by Airbus, ATCEUC[1], ECA[2] and IFATCA[3]. It aims at submitting recommendations to improve the Air Traffic management (ATM) R&D, especially with regard to the Single European Sky goals, by providing a considered and informed position taking optimum use of generic capabilities brought by Automation & Assistance to the operators.

More specifically, this paper aims at fostering the consideration of appropriate automation opportunities for the needed development of powerful, efficient ground ATM functionalities.

2 – Current state of the art of automation

There is not a single view on (not a single definition of) the current automation of ATM functionalities, or even of the ones explored in R&T (SESAR).

Numerous implementations of ground based tools are ahead of many of the current Research areas in particular when it comes to ATM tools. These examples are however limited to regional, local and sometimes only sector solutions. The linkage of all these practices has the potential to e.g. significantly increase capacity and efficiency for the overall air traffic.

The fact that each of the ATC units has their own local solution (to meet the global standards which guarantees interoperability and future seamlessness) has led to a fragmentation of the ground infrastructure. The service providers together with some ATM Manufacturers already started to coordinate new developments independently of local solutions

On the other hand, modern Flight Data Processing systems with fully automated flight plan data exchange, dynamic and adaptive mid- and short term conflict detection, intra sector coordination tools, download of airborne parameters and some of the CFMU management of flight plans (as early as at the end of 90's) are good examples of past and present ground developments with regard to automation.

There is a perceived need as well as the potential to go beyond the current state-of-the-art to enhance the ATM processes defined in the frame of ATM R&D.

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[1] Air Traffic Controllers European Unions Coordination
[2] European Cockpit Association
[3] International Federation of Air Traffic Controllers' Associations

3 - Near term opportunities and challenges in SESAR 2020

Progressively from the first step of the SESAR deployment, more accurate information will be available to ATM processes: e.g. wide implementation of either EPP[4] and/or 4D Trajectory sent by Flight Operations Centres (and military equivalents) during the planning phase (ex. Extended Flight Plans[5]). This will be used during flight execution to enhance the ground Trajectory Predictor, and will provide the necessary 4D trajectory data accuracy environment.

There is clearly an increasing opportunity to enhance the global Air / Ground ATM processes via the right understanding of global ATM automation, supported by data-link communication between respective Air and Ground Automation & Assistance functionalities.

Addressing the issues of interoperability on the ground is another major objective for the coming decade. Tighter connection of Network and Airports Operations plans, Wide Information Sharing enabled by SWIM, richer, more accurate and up to date weather information, among others, are important enablers paving the way to more efficient processes automating today's routinely and repetitive low level activities and/or assisting the operators in the awareness and decision making.

Likely, future ATM operations will face an increased diversity of aircraft equipage, of Airspace Users supporting information, and this will increase the complexity of data handling. In any case, the legal status of data used by ATM systems, for instance coming from external sources (FOC, A/C …) will need to be clearly based on Operational Safety analyses and agreement of all stakeholders.

SESAR 2020 will offer a favourable frame for R&D in the direction of more federated developments due to a reduced number of projects. In many of these projects there is the opportunity to set up working group(s) (composed of key representatives of, in particular, ANSPs, Professional Staff Organisations and of Industry) tasked with analysing the opportunities for automation and assistance and exploring the possible developments, including the identification of most sizing failures, fall-backs, and degradations with detailed description of the roles of the human and of the supporting systems..

In short, the informal group believes in the high potential of important automation breakthroughs for future ATM enhancements, supporting new and powerful[6] functions and processes, enabled by more accurate data and the need to complement such developments with supporting regulation and standards[7].

Last but not least, there is an absolute need to take into account the necessary balance between the efficiency created by automation and the human capability (assisted by more basic functions). The human decision needs to always take primacy over a system, independent of the automation level. This is particularly valid for recovery from non-nominal and/or degraded modes of operations.

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[4] EPP stands for Extended Projected Profile and includes A/C position and 4D trajectory predictions down-linked to the ANSPs.

[5] Might be seen, in short, as a "4D ATC Flight Plan"

[6] In particular as regards their performance (accuracy, reliability, redundancy aspects, requirements on supporting hardware and software); most often, is where the breakthroughs lie …

[7] Ex. ED-133, FIX M, others based on IT (IP communications …)

The group is developing Guidance Material to be followed in the whole development process in an additional document.

4 - Experience from past airborne evolutions

The airborne domain has experienced significant enhancements to safety, flight efficiency and regularity, cost-efficiency and comfort of operations.

Automation of Cockpit functions in the broad sense, starting with basic systems regulations, attitude control, later auto-pilot and auto-thrust, automatic position & path computation, flight and trajectory management, utility systems functioning, monitoring and assistance to the management of failures, fly-by-wire … were enabled thanks to the combination of three pillars:

- Advanced functionalities supported by hardware and software having the adequate Development Assurance Level (integrity, robustness to failures …)

- Data of appropriate quality (accuracy ; reliability and integrity ; availability …) ; the quality itself being known, or at least modelled, with the aim to be taken into account by the above described functions, including the switching between nominal, degraded and emergency modes

- Operational procedures to efficiently implement the above evolutions, with the support of the needed training

It must also be recognised that new risks have been introduced that needed to be mitigated.

5 – Concrete application to SESAR 2020

Advanced functionalities need to be sufficiently well explored at V1 & V2 maturity stages before assessment of their efficiency and of their feasibility, and before a decision is made to implement or withdraw in V3-like representative prototypes.

Below is a short sample of ATM processes that undoubtedly are worth being addressed with advanced automation:

- XMAN to manage the Traffic of the Top 5 airports in Europe : a good illustration for global automated ATM processes enabled by :
    - Automated ground functions (e.g. : AMANs, IOP/SWIM)
    - Data-link clearances (CPDLC)
    - Efficient Airborne Navigation functions (to implement instructions)
    - Accurate A/C 4D trajectory transmitted by ADS-C and/or other A/C derived data

- More efficient Dynamic Demand Capacity Balancing, Complexity Management
- Enhanced Conflict Detection ;
- Improved contextual Conflict Information : Availability of instantaneous Probing or What-if possibilities
- Enhanced Runway incursion prevention
- Reduction of house-keeping tasks like frequency changes...

6 - Conclusion

The finality of this Paper is to draw the attention of SJU and additional stakeholders to the importance of the capabilities offered by intelligent automation developments as a key contribution to ATM enhancements. Existing capabilities will need to be further implemented and/or evolved at a pan-European level.

The informal group composed by Airbus, ATCEUC, ECA and IFATCA, believes that the exploration of such capabilities must be performed in the frame of the SESAR 2020 R&D programme with the right experts and the appropriate effort prior to decisions for prototyping and validation at V3 level or beyond (e.g. Very Large Scale Demonstrations).

Airbus, as candidate member of SESAR 2020 and ATCEUC, ECA and IFATCA, as Professional Staff Organisations, are ready to provide their expertise via illustration of existing airborne and ground developments. As an accompanying measure, the group is developing a document on methodology and best practices for appropriate integration/synergy between humans and automation/assistance tools.

For Airbus	For ATCEUC	For ECA	For IFATCA
Airbus Group Human Factors Executive Expert	President	Executive Board Director Technical Affairs	Executive Vice President Technical
Florence Reuzeau	**Volker Dick**	**Álvaro Gammicchia**	**Duncan Auld**

Appendix – References

- IFATCA "Technical & Professional Manual – 2014"

- IFATCA : "A statement on the future of Global Air Traffic Management by IFATCA" (Feb. 2007)

- IFALPA/ECA Vision Statement "The Future of Air Navigation"

- SESAR 16.5.1 "Identification and Integration of Automation Related Good Practices"(D04), December 2012

- ARP 4754/ED-79A "Guidelines for development of civil aircraft and systems" (Aerospace recommended practice / European directive)