SIXTH FRAMEWORK PROGRAMME

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Aeronautics and Space

SPECIFIC SUPPORT ACTION

Publishable Final Activity Report

AAA

AIRCRAFT AND ATM AUTOMATION

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Project coordinator organisation name :

Académie Nationale de l'Air et de l'Espace

Project coordinator name :

Bernard Ziegler

Draft, 1

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1- PROJECT SUMMARY

An international colloquium on "**Aircraft and ATM automation**", organised by the Académie Nationale de l'Air et de l'Espace (ANAE) and the Association Aéronautique et Astronautique de France (AAAF) and sponsored by the European Commission, the Toulouse Municipality, the Conseil Général de la Haute-Garonne, the French Civil Aviation Authority (DGAC) and Airbus, took place on the 17, 18 and 19 October 2005 at the Institut Aéronautique et Spatial, Toulouse.

The subject under study was unexpected: **Are we moving towards full automation of the Air Traffic System, including aircraft and traffic control?**

Systems automation in air transportation has greatly evolved in the past fifty years due to a growing demand and the double ambition of maintaining the safety rate whilst improving efficiency.

In addition, implementation of Galileo will provide integrity, continuity, availability and precision for global positioning. It could even pave the way to total aircraft automation.

It was felt that a colloquium at international level (including US participation) was the most effective way of stimulating an open exchange on this subject so as to reach a better understanding of the goals to be reached.

Introduced by Jean-Claude Bück, ANAE President, and Stuart Matthews, FSF President, and closed by Michel Scheller, AAAF President, the colloquium brought together over thirty speakers[1] from all over the world. Assad Kotaîté, ICAO President, addressed participants via a video to emphasise the importance of modernising the air transport system.

With the aid of moderators of international renown, four themes were tackled[2]:

- Overview of current situation
- Future visions
- Transition phase
- Priorities

All the main aeronautics organisations were represented, including Eurocontrol, Sesame, Boeing and Airbus, European and American administrations, etc.

The colloquium aimed to encourage discussions into optimising automation for aircraft and air traffic control centres. Full automation was not the prime objective of discussions. The transition period during which fully and non-fully automatic planes would co-exist in fully and non-fully automatic airspace was also considered.

The colloquium ended with a round table involving leading players from the expanding world of air transport.

More than 200 participants from the aeronautics world and associated sectors attended over the three days[3].

A consensus was reached on the need to use automation to deal with the growth in air traffic, to ensure that safety levels are maintained and to improve efficiency, although transition difficulties were identified.

[1] Cf programme, appendix 1, p12
[2] Cf programme, appendix 1, p12
[3] Cf list of participants, appendix 2, p16

2- OBJECTIVES

2.1 Background

The rapid growth in air traffic is leading to congested airspace and airports. The high level of safety currently achieved is in danger of becoming insufficient due to difficulties in traffic management and the psychological impact of an increased number of hull losses.

Automation of airborne tasks has been the major factor in increasing flight reliability and safety. One of the main innovations for aircraft was the introduction of *fly-by-wire controls*. Statistics show that accident rates are cut by half in more highly automated aircraft and it is generally accepted that aircraft automation will become more and more sophisticated. Some actions still have not been included in on-board flight management software but there is no particular difficulty to their insertion.

On the contrary, Air Traffic Management has been less automated; *electronic aids* to controllers are permanently being developed and introduced but the controller still has the last word. ATM automation, whether in en-route phases, approach or climb, raises many more problems than aircraft automation, especially in the airport airspace where traffic is congested and flight parameters constantly changing.

2.2 Goals

It is essential to persuade European leaders of the benefits of automation for increasing efficiency of air transportation. At the same time it is important that any evolution in the system take into account all the different parameters. The colloquium set out to address the various issues raised.

Its first goal was to gather together leading players from the various fields of international aircraft operations:

- airlines and pilots, ATM organisations, aircraft and systems manufacturers, passenger and cabin crew
- organisations, psychologists, aviation authorities, IATA, European Commission.

Its second goal was to encourage a pooling of information at the highest level on current automation initiatives.

Its third goal was to encourage an exchange of views on future automation projects within a timescale of twenty years in an effort to promote harmonious development of automated systems.

The colloquium proceedings (CDROM), which will be sent to all participants and interested parties, will circulate the information as widely as possible. A booklet containing a résumé of discussions and conclusions and a number of recommendations for the attention of the relevant authorities will also be published and disseminated.

3- PROJECT MANAGEMENT

3.1 Project management

ANAE carried out the general management of the project and was the interface between the Commission and the partnership, for both managerial and scientific/technical aspects.

Two committees were set up:

- A *Programme Committee*: an international group in charge of defining subjects to be treated, of contacting specialists for lectures and/or round tables; Bernard Ziegler, former viee-president of Airbus, member of ANAE, was President of the programme committee;
- A *Steering Committee*: a national group which chose the conference site, organised the conference schedule, managed the mailing and the diffusion of the announcements and took charge of finances. The Steering Committee met roughly once a month during the project duration. The Coordinator acted as chairman of the Steering Group, with the responsibility of carrying out correct procedures and meeting all deadlines and obligations.

The Project Coordinator was responsible for:

- executing the Project Work Program
- organising and coordinating the work to guarantee consistency, progress and final issue of the whole project
- assisting the Commission Officer by monitoring day to day progress with the project and informing him of all developments which could significantly affect the result of the project
- collecting all technical, financial, administrative information and deliverables in order to monitor the progress of the project and check that the technical and financial aspects remained in accordance with the work plan defined in the proposal
- preparing templates for dissemination presentations, requests analysis, mailings
- drafting the agenda for steering group meetings
- solving any technical, financial, ethical, administrative or contractual issues or conflict when needed
- providing the official channel between the partners and the European Commission.

3.2 Communication

- **A preliminary announcement** was printed and sent out with the dates, venue and other information concerning the colloquium to individuals or organisations. It was also included in mailshots of other institutions.
- **The definitive programme**, with identification of speakers and organisations and registration details, was sent six months later. It too was included in other mailshots.
- **Email bulletins** were sent regularly to interested parties and organisations.
- A number of **press releases** were sent to reinforce the profile of the colloquium[4] to specialist and generalist media and interested organisations.
- **Mail shots** were sent to ANAE contacts, both individual and institutional.
- ANAE's own publications, and those of its partners, drew attention to the colloquium.

[4] Cf press reviews, appendix 3, p19

4- WORK PERFORMED

4.1 Milestones

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Wp 1														
Wp 1 deliverables	D1						D2						D3	D4
Wp 2														
Wp 2 deliverables													D5	D6
Milestones	Pre-programme						Programme						Colloquium	Proceedings

4.2 Work Package List

Work package No	Work package title	Lead contractor No	Person-months	Start month	End month	Delivery No
1	Management and upper support	1	8 *	T_0	14	D1,D2,D3, D4
2	Conference general organisation	1	4	T_0+3	14	D4,D5,D6
	TOTAL		12*			

4.3 Deliverables List

Del. no.	Delivery name	WP no.	Lead participant	Person-months	Nature	Dissemination level	Delivery date (proj. month)
D 1	Conference announcement, call for papers and programme	1	1	2*	D	PU	1
D 2	Programme and registration forms	1	1	2*	D	PU	7
D 3	Report and future activities stemming from conference conclusions	1	1	2*	R	RE	11
D 4	Final report and cost statements	1	1	2*	R	RE	14
D 5	Conference documents	2	1	2	D	PP	11
D 6	Conferences minutes	2	1	2	R	PU	14
			TOTAL	12*			

** NB: 1,5 months of WP1 were provided free of charge by ANAE members and other specialists*

4.4 Work package description

Work package number	1	Start date or starting event:	1
Activity Type	Management activities		
Participant id	ANAE		
Person-months per participant:	8*		

Work accomplished

- Main responsibility for the colloquium
- Management of the project

Description of work

- Refining the subjects to be dealt with in the conference
- Preparing, editing and disseminating the conference announcement and call for papers
- Contacting specialists for presentations and round tables, collecting candidate presentations, selecting speakers and moderators
- Publishing and disseminating the conference registration form
- Selecting the conference site
- Setting up proposals for future activities stemming from the conference
- Publishing project management report, final report and cost statements

Deliverables

1: Conference announcement, call for papers and programme
2: Final programme and registration forms
3: Report on future activities stemming from the Conference conclusions
4: Final report and cost statements

Milestones

Month 1: first announcement, month 7: programme and registration form, month 13: colloquium; month 14: minutes elaboration

Work package number	2	Start date or starting event:	3
Activity Type	Activities specific of the support action		
Participant id	ANAE		
Person-months per participant:	4		

Work accomplished

- Granting needed technical support to the conference

Description of work

- Organising the conference schedule.
- Managing Registration (filing, invoicing, etc)
- Analysing and preparing documents for the conference.
- Preparing and editing all documents for dissemination and delivering them, as project internal documents, to wp 1 for approval.
- Editing the conference minutes, round table synthesis and speaker's publications (CDs).

Deliverables

5: Conference documents: month 7
6: Conference minutes: 14

Milestones

Month 13: conference documents, month 14: colloquium minutes

** NB: 1,5 months of WP1 were provided free of charge by ANAE members and other specialists*

5- END RESULTS

The colloquium's ambitions to gather together an international pool of experts so as to set up an exchange of views fully succeeded: speakers were of a very high calibre, from all the main European and American organisations, industries and institutions. All expressed their satisfaction at the unfolding of the colloquium and at the quality of discussions that had taken place.

Attendance was also high (more than 200 participants) thanks to a sustained publicity campaign involving press releases, mail shots, direct contacts, etc.

The quality of attendance meant that the colloquium enabled a pooling of knowledge on this state of the art subject. Discussions focused around the following question:

> *Is automated air transport -with enhanced reliability, reduced environment contamination and improved profitability– an unacceptable, desirable or inevitable solution?*

and brought out clearly that automation of the air transport system could only increase and that, as a result, it was necessary to define optimal orientations for the evolution of automated systems.

Such orientations can be resumed as follows:

a) Improved flight safety

The current safety level is close to 10-7/h which translates as a fatal accident every 4 weeks on average. If air traffic doubles (as is envisaged towards 2014-2018) and under the optimistic hypothesis that the rate of collisions will grow linearly, there will be a fatal accident every two weeks, and by 2025-2030, one every week. Although passengers will still benefit from the same safety level in real terms, the psychological impact projected by the media would be unacceptable. It is therefore imperative to progress to a probability of fatal accident of 10-8/h, and this constraint must be factored into the future design of automated systems for aircraft and ATM.

b) Dual approach

It was decided that two relatively independent approaches must be pursued:

- **The first approach** would be a systematic study of the evolution in aircraft and ATM automation in order to satisfy safety constraints within the current framework of air transportation. The incidence of each new stage of automation on potential total automation in the future would have to be assessed, but studies during this first stage would not be motivated by the notion of total automation.
  This theme would also have to take into account the rapid development of **UAVs** which pose some major problems directly linked to safety when they move out of reserved flight envelopes. An initial overview of military UAVs could rapidly be drawn up but the evolution of technologies used by UAVs and forecasts for future development would have to be constantly monitored, particularly since UAVs will undoubtedly soon be used in the civil domain, for freight transportation for instance.
  A hierarchy of systems to be automated would have to be elaborated.
- **The second approach** would immediately be orientated towards total automation of the air transportation system. An initial subject might deal with the optimal structure for a UAV, first for freight transport, then for passengers, based on currently existing UAVs or those in design stage. The different moving elements would have to be identified: aircraft, UAVs, ground vehicles…

Studies into these two apparently distinct approaches would have to be carried out in total synergy.

c) Continuous aircraft automation

Current aircraft are close to being fully automated on the basis of flight data memorised in the FMS. Future automated aircraft might receive ground data into their computer systems but it is likely that the flight management system on board could modify certain data received from the ground in order to optimise flight and make it safer. Such modifications could be transmitted to the ground and diffused to flight management centres. This brings to light a complex problem, that of the coexistence of mixed automated and non-automated aircraft and, above all, that of mixed automated and non-automated control centres.

d) ATM automation

"Automating control centres" has no meaning: it is very difficult to compute the chains of thought that go on in the brain and to say that controllers will be "replaced" by computers is meaningless. The problem will have to be profoundly rethought on the *ab initio* level of global traffic management. Aircraft trajectories will result from calculations effected on the ground and on board. One single worldwide positioning system must be used (WGS-84 or its future versions) and the parameters of these trajectories will be transmitted locally to aircraft in a local space that remains to be defined.

e) Evolution of UAVs for passenger transport

UAVs are aircraft with no pilot on board, which fly automatically after loading flight data, and which have the possibility of rerouting, either by see and avoid or remote-controlled from the ground. Ground control, and therefore ground-air-ground liaison, is thus necessary even if the drone is flown automatically.

It was considered that two situations would have to be studied:

- a delimited airspace devoted to UAVs alone
- mixed airspace, with piloted and non-piloted traffic co-existing

The first case would seem to present no insoluble problem but is not realistic because it would call for specific UAV airports with dedicated airspaces between them, a situation difficult to envisage in the dense airspace of Europe in which cross-overs would be inevitable.

The second case is trickier to manage, but more realistic.

The psychological aspect was acknowledged to be crucial; all agree that there would need to be a technical supervisor on board who could not resume control of the plane but could send digital or vocal messages to the ground to inform ground technical supervisors of incidents or anomalies.

f) Managing the long transition period

This problem was considered even more difficult to resolve. It is of course impossible for the change to an automated system to happen worldwide on a given date at a given time. So the long period during which automated aircraft would co-exist with humanly piloted planes, in which airspaces dedicated to automatically managed automated aircraft would exist alongside human-controlled airspace, etc. It was agreed that studies should begin immediately into such mixed traffic scenarios, in parallel with the studies into traffic automation.

The colloquium proceedings are transmitted to all participants and other interested parties.

More detailed conclusions and recommendations from the colloquium will be contained in the recommendations booklet which will be drawn up shortly.