



## FLYSAFE – WP 7.3

### D 7.3-2 Report on First FLYSAFE Forum

**Abstract:**

This document is the report on the first FLYSAFE forum, held on the 27<sup>th</sup> of June 2006 at EUROCONTROL headquarters, Brussels.

The report summarizes the objectives and results of the forum and outlines next steps to be made by the FLYSAFE project. Furthermore the document includes the detailed minutes of the forum.

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## Executive Summary

The first FLYSAFE dissemination workshop was held on the 27th of June 2006 at EUROCONTROL headquarters in Brussels. The forum has been an event of broad communication and exchange of information. Many current topics in the field of safety in air traffic have intensely been debated. Many synergies between various research activities and FLYSAFE have been identified.

Since FLYSAFE has various links to the ATC world, actual developments and future trends have been discussed with the ATC world. The discussion helped to facilitate the development of FLYSAFE systems to be compliant to present and future ATC systems.

The forum was dedicated to 3 particular topics:

- Situation Awareness / Conflict detection and resolution
- Operational processes affected by FLYSAFE
- Information / Communication - and the use of Data Link in FLYSAFE

The FLYSAFE forum was an unique event to exchange and interact in this early stage of the project (T0+18 months) with persons whose way of working will be affected by FLYSAFE outcome. More than 60 experts from various disciplines of aviation attended the forum; among them ATM/ATC specialists, Aviation weather specialists, Certification authorities, airframers and Pilots.

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# 1. INTRODUCTION

## 1.1. SCOPE AND OBJECTIVES OF FLYSAFE

### 1.1.1. Background

Air traffic is expected to triple world-wide within the next 20 years. With the existing on-board and on-ground systems, this would lead to an increase of aircraft accidents, in the same, or a higher proportion. Despite the fact that accidents are rare, this increase is perceived as unacceptable by society and new systems and solutions must be found to maintain the number of accidents at its current low level. As safety of flight depends to a large extent on flight crew actions it is essential that crewmembers are supplied with reliable information that can be used at all times. FLYSAFE will develop the required new systems allowing the crew to make the right decision to avoid conflicts caused by weather, traffic and terrain.”

### 1.1.2. Project Objectives

FLYSAFE will be the first decisive big step towards the “VISION 2020” produced by the ACARE, for safety in flight operations. It will allow us to design, develop, implement, test and validate a complete Next Generation Integrated Surveillance System (NG-ISS), going a decisive step further than the emerging integrated safety systems.

FLYSAFE will focus particularly on the areas identified as the main types of accidents around the world: loss of control, controlled flight into terrain, and approach and landing accidents. It will address three types of threats: adverse weather conditions, traffic hazards, terrain hazards, and, for each of them, develop new systems and functions, notably: improved situation awareness, advance warning, alert prioritisation, and enhanced human-machine interface.

FLYSAFE will also develop solutions to enable aircraft to retrieve, timely, dedicated, improved weather information, by means of a set of Weather Information Management Systems (WIMS). These WIMS are able to gather, format and send to the aircraft all essential atmospheric data, as relevant for the safety and efficiency of their flight. This uplinked data will be presented in an innovative and consistent way to the crew. Innovative prediction capabilities will be deployed, both on board of the aircraft and on the ground, to provide warnings which are optimised with respect to the simultaneous constraints of safety and airspace capacity.

### 1.1.3. Description of the work

The project starts with a review of the results of past and on-going investigation of accidents and incidents, the identification of contributing causes, and the definition of ways to address them. The results of this analysis will be used to set up new, high level functional requirements and feed the evaluation tasks with scenarios that will be used to assess new versus state-of-the-art technologies.

The three main types of hazards sources for aviation: adverse atmospheric conditions, traffic and terrain, have led to the creation of three project branches, with a fourth branch dedicated to the development of the Next Generation Integrated Surveillance System itself with the integration of the design solutions.

- “Atmospheric hazards” will develop means to increase the awareness and fidelity on-board aircraft with regard to all major sources of atmospheric hazards (wake vortex, windshear, clear air turbulence, icing, and thunderstorm; in addition, information about visibility for helicopter).
- “Traffic hazards” will develop means to increase the crew traffic situation awareness and provide them with early information on potential traffic hazards along the flight path.
- “Terrain information management” will develop means to increase the crew terrain and obstacle situation awareness and provide them with the terrain and obstacle hazards along the flight path and functionalities that enable the crew to avoid conflicts with terrain and obstacles.

As part of the NG-ISS, innovative system functions will be developed:

- Strategic data consolidation to anticipate any identified strategic risks related to atmospheric phenomena, traffic and terrain, along the planned flight path of the aircraft. This function is to reduce the number of tactical alerts generated inside the cockpit by anticipating those threats and advising the crew where a re-planning is required.
- Tactical alert management to help the crew to manage all alerts generated by the "safety net" functions, such as ACAS, TAWS, and windshear where an immediate response is required.
- Intelligent Crew Support to provide support for the crew in the event that they may make an error or a mistake caused by high workload, fatigue, anxiety, etc, by monitoring flight phase, environment and crew actions.

Standardisation activities will pave the way for the introduction and promotion of future products, thus reducing the time to market. The certification aspects of these new concepts will be taken into account from project start onwards, to at least reveal the areas of certification issues.

Finally, the validation of the complete system, and proof of concept, with both ground and on-board components, will be provided by a set of simulator and flight tests, involving a representative group of pilots.

#### 1.1.4. Expected results

The project will culminate with the production of a complete safety-related integrated system (NG-ISS), embodying all the innovations, connected to a test bed allowing us to activate it, run simulations and to evaluate the safety gains obtainable by future marketable systems based on those features.

The Weather Information Management Systems (WIMS) will be key outcomes from the project. They will have been validated in the project in support of the NG-ISS. They will be used to enhance both the safety and efficiency of air transport through their use for provision of services to other stake-holders in the air transport sector (ATC, airport operators and airlines).

Flight test results will be used to validate the complete chain of weather information processing (aircraft atmospheric data, downlink, WIMS and routine data, uplink, weather data fusion) and to populate a weather database to be used during the full simulation evaluation.

All these results will contribute to achieving the ACARE goal of reducing the rate of accidents by 80% within 20 years.

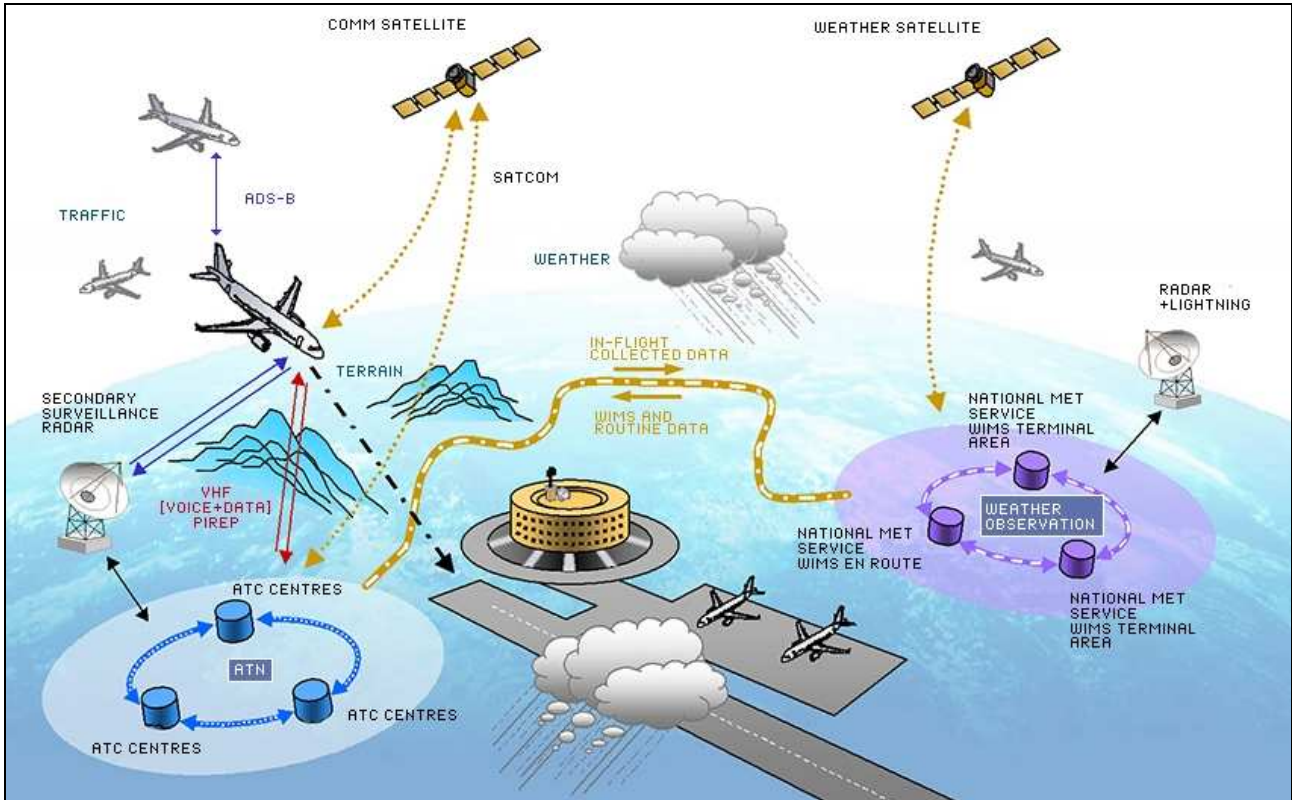


Figure 1: FLYSAFE overall concept

## 1.2. PURPOSE AND SCOPE

The document summarises the key issues discussed at the first FLYSAFE forum. Furthermore it outlines the objectives and results of the forum. In addition, the document contains the minutes of meeting.

## 1.3. DOCUMENT STRUCTURE

This document is divided in 3 main chapters :

- Chapter 1 : **“Introduction”**
- Chapter 2 : **“1<sup>st</sup> FLYSAFE dissemination forum”**  
This chapter describes objectives, agenda and the course of the forum. Furthermore it includes the minutes of the forum.
- Chapter 3 : **“Concluding remarks”**  
This chapter summarizes the results of the forum and gives a qualitative valuation of the forum.

Finally, this document is completed with a set of appendixes which contains guidelines for contents of specific and repetitive project documents :

- Appendix A : **“ACRONYMS”**
- Appendix B : **“LIST OF ATTENDEES”**
- Appendix C : **“FLYSAFE CONTACTS”**
- Appendix D : **“FLYSAFE CONSORTIUM”**

## 2. FIRST FLYSAFE DISSEMINATION FORUM

### 2.1. PREAMBLE

The FLYSAFE project will organise three dissemination forums in total. The target group, format and content will vary through the course of the project.

The first forum followed the intention to introduce the FLYSAFE project to relevant stakeholders. In specific, the first forum was dedicated to ATM/ATC related topics. The goal was to get inputs from experts in this field of aviation, which should be integrated in the design of FLYSAFE systems. Moreover the forum was a platform to identify relevant research projects and initiatives which have overlaps to the FLYSAFE work programme.

The second forum will go a step further and will show first results of the project to the audience. With regards to the work programme and the fact that this forum will take place in the middle of the project course, the 2<sup>nd</sup> forum will focus on traffic (hazards) related topics. The FLYSAFE consortium plans to present the interim results of those Part Task Evaluations (PTE) that have been completed and will be looking forward to open debates with the auditorium about these mid term results.

The third dissemination forum will be, in contrast to the first ones, an open forum. This forum will be held at the end of the project and thus present all results achieved. Furthermore, the FLYSAFE prototypes for the NG-ISS and WIMS will be demonstrated.

### 2.2. OBJECTIVES

#### 2.2.1. General

The overall objective of the WP 7.3 is to disseminate the results of FLYSAFE and inform about the project as widely as possible outside the consortium.

Our main targets for dissemination are the end-users, our future customers, and the authorities that will be involved in the implementation of the on-ground and onboard systems.

One outcome of the External Experts Advisory Group [EEAG] seminar No.1 is that FLYSAFE should expand its cooperation with the ATC world. Therefore the ATC world has been identified as the target group to be addressed with the first dissemination forum. EUROCONTROL has shown a great interest in FLYSAFE and consequently kindly accepted our proposal to conduct a dissemination forum preferably at EUROCONTROL venue. For a venue, EUROCONTROL chose their headquarters in Brussels.

On the 27<sup>th</sup> of June 2006, the first FLYSAFE dissemination forum took place at EUROCONTROL headquarters.

The first FLYSAFE forum had the following top-level objectives:

1. To discuss actual developments and future trends with the ATC world.
2. To facilitate that FLYSAFE develops systems which will be compliant to the present and future in the ATC system.
3. To give the ATC world the possibility to play a part in FLYSAFE in order to increase the acceptance of systems developed within FLYSAFE.

## 2.2.2. Specific

Since FLYSAFE has various links to the ATC world, a specific objective was to discuss actual developments and future trends with the ATC world. The discussion helped to facilitate the development of FLYSAFE systems to be compliant to present and future ATC systems.

In cooperation with EUROCONTROL many relevant issues have been identified in the field of safety of flight, operations and communication in aviation. These topics are listed below:

- Improved hazards detection
- Strategic threat detection
- FIS
- Data link concepts / improvement of dataflow
- Distribution of pilot perceived hazards to ATC authorities
- Definition of the role of meteorologists
- Safety hazards for airport
- Sharing of the integrated image (about hazards) in the cockpit with the ground (ATCOs)
- WIMS - communication between controllers and pilots
- Integration of ground based data in the cockpit
- How could FLYSAFE offer benefits in operation
- Uplink of taxi routes to the cockpit
- Improvement of the communication flow in general
- ASAS / ADS-B data link
- Strategic conflict detection

Thus, these relevant issues have been summarized into three particular topics, which were the main agenda items of the forum:

- Situation Awareness / Conflict detection and resolution
- Operational processes affected by FLYSAFE
- Information / Communication - and the use of Data Link in FLYSAFE

## 2.3. VENUE AND PREPARATION

## 2.4. INVITATIONS

Due to the fact that the first forum was non-public, invitations have been issued by electronic or postal mail only. The invitees list was generated by EUROCONTROL and the FLYSAFE consortium. All major stakeholders have been addressed. The list of stakeholders comprises ATM/ATC experts, weather specialists, pilots, airframer, researchers, certification authorities, airlines. etc. Over 120 people have been invited to the forum.

## 2.5. EXHIBITION, REGISTRATION AND HANDOUTS

### Forum small exhibition

The forum took place at the conference centre on EUROCONTROL HQ in Brussels. A small exhibition composed of FLYSAFE posters has been prepared in the conference room. These posters show depicted the FLYSAFE project, the consortium and notably the two products to be developed: Next Generation Integrated Surveillance System (NGISS) and Weather Information Management Systems (WIMS).

### Registration pack

Each attendee received a registration pack, which consisted of:

- 1 folder in FLYSAFE design
- 1 set of presentation handouts
- 1 agenda
- 1 pen
- 1 name badge
- 1 FLYSAFE leaflet
- 1 lunch voucher

## 2.6. FORMAT

### 2.6.1. Topics

The forum had a duration of one day. In order to get into interaction with the attendees the forum has been shaped like a workshop. This means, that the forum started with an introduction about the FLYSAFE project and two presentations by EUROCONTROL about the European Safety Programme for ATM (ESP) and the SESAR programme. The introductory session built a link between FLYSAFE and EUROCONTROL's activities such as ESP and SESAR.

After this introduction session, the following three identified topics have been discussed under contribution of all attendees:

**Topic I: Situation Awareness / Conflict detection/resolution**

**Topic II: Operational processes affected by FLYSAFE**

**Topic III: Information / Communication and the use of Data Link in FLYSAFE**

All topic discussions lasted 1 hour and the topic discussions were structured in:

- 15 minutes introduction (by the session leader(s))
- 25 minutes brainstorming (by all attendees)
- 10 minutes recap (by the session leader(s))
- 10 minutes break

## 2.6.2. Agenda

The topics listed in chapter 2.6.1 have been transferred into an agenda. The final agenda was developed as follows:

09:00 – 09:05	<b>Welcome</b> <i>Joseph Huysseune - THALES Avionics</i>
09:05 – 09:30	<b>European Safety Programme for ATM</b> <i>Antonio Licu – EUROCONTROL</i>
09:30 – 09:55	<b>FLYSAFE overview</b> <i>Joseph Huysseune - THALES Avionics</i>
09:55 – 10:20	<b>ATM and Met highlights in FLYSAFE</b> <i>Derek Jordan - BAE Systems</i> <i>Thomas Hauf - University of Hanover</i>
10:20 – 10:40	Coffee break in the lobby
10:40 – 11:10	<b>SESAR topics relevant for FLYSAFE</b> <i>Jacques Beaufays – EUROCONTROL</i>
11:10 – 11:20	Break
11:20 – 12:20	<b>Topic I: Situation Awareness / Conflict detection and resolution</b> <i>Wim Huson - Use2Aces</i>
12:40 – 14:00	Lunch
14:00 – 15:00	<b>Topic II: Operational processes affected by FLYSAFE</b> <i>Nima Barraci - Technische Universität Darmstadt</i>
15:00 – 15:20	Coffee break in the lobby
15:20 – 16:20	<b>Topic III: Information / Communication and the use of Data Link in FLYSAFE</b> <i>Okko Bleeker - Rockwell Collins</i>
16:20 – 16:30	Break
16:30 – 17:00	<b>Questions &amp; Answers</b>
17:00 – 17:15	<b>Wrap-up</b>
17:15	<b>Closure of forum</b>

### 2.6.3. Presentations

The presentations held had an excellent quality in content as well as in appearance. All lecturers did an excellent job. In each of the three topic presentations technical discussions took place. The forum was on schedule at any time.

The concept of topic sessions should be retained in future forums if appropriate.

## 2.7. MINUTES OF MEETING

### 2.7.1. Introduction and welcome

As introduction, a short movie summarizing the targets of FLYSAFE and the project scope was shown.

#### 2.7.1.1. Welcome

##### **J. Huysseune, THALES**

J. Huysseune presented the team contributing to the preparation of the first dissemination forum and thanked the EUROCONTROL members who participated to the happening of this event.

He described the historical context of the FLYSAFE proposal and project history wrap-up to put this forum in perspective, together with the need for exchange with the ATM community.

J. Huysseune stated that he is looking forward for fruitful discussion.

#### 2.7.1.2. Agenda

##### **H. Heinen, Diehl Aerospace**

H. Heinen introduces agenda. The agenda was reviewed and agreed upon.

### 2.7.2. Presentation: European Safety Programme for ATM

##### **A. Licu, EUROCONTROL**

Welcome to the FLYSAFE team on behalf of EUROCONTROL management.

The safety action plan was initiated following fatal accidents involving ATM in Europe (Linate, Überlingen). Looking at the causes of these accidents, it was realised that there are many commonalities with the FLYSAFE interest, even though the action plan looks from ground perspective and FLYSAFE from onboard.

The action plan investigated maturity of ANSP and regulator on a state by state basis and, in view of traffic increase, a new ATM safety programme was launched. The focus is on short term improvement (2-3 years programmes: SSAP).

There are five areas in ESP: implementation and support for the common requirements and work with states suffering from lack of maturity, incident reporting and data sharing (towards robust ATM repository), risk assessment and mitigation day-to-day operations (ESARR), system safety defences (most commonality with FLYSAFE) as ground based and airborne safety nets (incl. downlink), safety management enhancement (best practices).

Safety nets for pilots and controllers:

for ATC: prevent/detect infringement of separation minima, restricted airspace, going below SA, approach path monitoring, ACAS RA downlink (under investigation in the feasibility stage but with no standard).

Alert RA issuance: on the ground, too many nuisance alerts, no universally adopted, lack of regulation and have not investigated interactions between safety nets. In addition, lack of training and awareness for the ground based safety nets.

Technical feasibility of RA downlink is close to be concluded and ATM communicates with key players on the operational use and procedures. AIT (removal of call sign ambiguities) is at conceptual phase.

EUROCONTROL provides specifications (requirements & guidance material) for STCA, MSAW, etc.; for the FARADS project (FARADS is about RA downlink) need to demonstrate safety benefits, technical feasibility at no extra cost for aircraft operators and operationally acceptable. All these points are close to favourable conclusion.

Conclusion: there are synergies with FLYSAFE in terms of traffic and terrain hazards.

Final word: we have investigated safer solutions from the ground and from onboard. Now, how about having an integrated view that would allow sharing of awareness between ground and airborne?

**Questions:**

Q: Do you think that integration would go through exchanges like today between relevant groups?

A: We need to share work indeed and there are no excuses for not working towards same awareness for increased safety.

Q: What is the timeframe of FARADS?

A: FARADS has finished phase 2, but more work on the benefits & operational must be done, so timeframe is not in immediate future but it is too difficult to state exactly now.

### 2.7.3. Presentation: FLYSAFE Overview

#### J. Huysseune, THALES

Presentation of the FLYSAFE objectives and the specifics of the project, in particular about the involvement of the MET community to deal with the lack of meteorological surveillance information in the cockpit. The existence of the External Experts Advisory Group (EEAG) was underlined. The EEAG reviews the project progress and gives advice from an operational point of view.

Presentation of the FLYSAFE concept: the focus of FLYSAFE is on the onboard view to address traffic, terrain and weather surveillance based on onboard means and ground means connected via datalink.

Presentation of NG-ISS and the WIMS features through functionality diagrams.

Presentation of the next steps, from detailed specification to integration and pilot evaluation.

Recommendation to interact with SESAR to share our effort in standardisation towards the definition of the "right way to go".

#### Questions:

Q: About the platform at Toulouse, is it only an aircraft platform? How would you develop interactivity with ATM?

A: At Toulouse, we are contracted for integration work and evaluation. However, depending on planning consolidation, we also might have in our simulation environment the capability to interact with a simulated ground station. In any case, after integration work, the NG-ISS will be ported to NLR's GRACE aircraft and ATC simulators.

## 2.7.4. Presentation: ATM and MET highlights in FLYSAFE

### D. Jordan, BAE Systems and T. Hauf, University of Hanover

Discussion of ATM themes in FLYSAFE

- Integrated airborne safety nets to achieved most appropriate prioritization
- Consolidated flight deck situation awareness (airborne and surface)
- ASAS application (S&M highlights)

Weather impact on aviation was illustrated through a movie of re-routing aircraft because of a large thunderstorm in Memphis. Presentation of impact on aviation for wake vortices, clear air turbulence, icing, thunderstorm, volcanic ash, etc. representing a contributing factor in about 14% of accidents and incidents (source: BFU).

FLYSAFE does not work on low visibility as it was foreseen, more progress could be achieved during the time of the project by developing new WIMS products (wake vortex, clear air turbulence, icing and thunderstorm).

WIMS information is elaborated on the ground, tailored to aircraft request and uplinked to be merged with onboard sensed information.

The provision of MET data onboard is compliant with ATM vision. The provision of these data to ATM is the next logical step, although not part of FLYSAFE.

#### Questions:

Q: are you aware that activity on standardisation for MET info?

A: we are aware of the standardisation activities and UKMET and FMET are participating to the working group and the ICAO parallel group.

Q: is the goal to provide no-go boundaries or is it to increase flexibility in operations?

A: the goal of FLYSAFE is to increase hazard awareness and second providing information about hazardous areas (e.g. icing), but not to provide no-go boundaries as the decision should be left to the pilot.

## 2.7.5. Presentation: SESAR topics relevant for FLYSAFE

### J. Beaufays, EUROCONTROL

The need to launch SESAR program is based on traffic growth predictions (double in next 17 years) to define a new ATM system. In addition, there is an evolving air transport landscape (fuel saving pressure, new users like low cost airlines, UAVs, aviation/ANSP becoming more business/concentrated, there is an impact of social pressure for green and safe aircraft and a concentration of suppliers).

SESAR combines initiatives from EUROCONTROL and the European Commission to promote institutional reforms like Single European Sky in March 2004.

The vision 2020 shows a high performance ATM network (gate-to-gate integration, airspace continuum, cooperative ATM through 4D trajectory negotiation, ASAS, CDM, etc.). The future role of controller includes information sharing based on a 4D trajectory and intentions, which requires automated tools to be generated in support of this task.

SESAR is trying to put a cost figure on the turning off fragmentation, accelerate ATM evolution and synchronise developments. SESAR is articulated around 3 phases: definition (2005-2008), development (2008-2012) and deployment (2013–2020). End of 2006, SESAR will deliver its market analysis (value to air transport and role of ATM).

It is planned to create a SESAR Joint Undertaking as for Galileo, but this is still under discussion, with goal to monitor the development and ensure involvement of all concerned actors.

Conclusion: SESAR defines the new ATM system for 2020.

### Questions

Q: Can you explain how the weather topic is dealt within SESAR? Who represents the weather community?

A: Today is still the definition phase, where information is collected on the current performance of the system. At this stage no solution is proposed as it is the case in FLYSAFE. The SESAR consortium and FLYSAFE consortium have partners in common; this could be the way to introduce weather in the discussion.

Q: 4D trajectory is cruise or from gate to gate, does that include the ground movement part?

A: It is from gate to gate. The content of the 4D trajectory is not fully specified yet, but the ground movement will be included.

## 2.7.6. Topic I: Situation awareness / conflict detection and resolution

### W. Huson, Use2Aces

From the presentations, we realise there are two worlds: the ATM and the flight deck. In FLYSAFE though, we have identified connecting themes on which we would like to receive feedback from the ATM community.

One of the problems we run into is that the points of view from ATM and flight deck are different: from different situation perceptions to different roles/tasks. In FLYSAFE we want to treat the weather, traffic and terrain threats in an integrated manner (to avoid use of safety nets) down to sharing situation awareness. However, the information is different, whether sensed or not (e.g. wake vortex detection, radar minimum altitude information display); terrain is handled differently depending on the airport (e.g. Bogota versus Quito) but is not for the flight crew; traffic picture is different for ATCO and flight crew. Moreover, although weather and atmospheric information is now partly shared by ATCO and flight crew, it can have hours delay and be originating from different sensors. Finally, conflict resolution beyond 3min ahead is only feasible for ATCO; the flight crew would need to have medium term awareness of close-by traffic intent.

In ESP, field 4 (system safety defences) has the strongest ties with FLYSAFE concerns. We should promote exchange of information between the two groups. Items could include investigation of international standards common to airborne and ground safety nets, communication between safety nets (see the FARADS project) extended to both ways and not only air-to-ground, expectations from ATM to airborne parties.

The impact of airborne safety nets concern operational procedures (sharing information of avoidance with ATM), windshear and more generally WXR safety nets, traffic (ACAS, runway incursion), terrain (depiction of relevant altitude, etc).

The pitfalls include the different terminology (e.g. definition of short term/tactical and medium term/strategic), the different situational awareness (dissimilar picture), time span (cockpit has less "vision") and conflict resolution is not coordinated.

### Questions

Remark **[terminology]**: concern is the risk of confusion between procedural operations and tactical meaning "unplanned" here. There are short term activities that are planned and under control. There is the worry about use of the word "unplanned", which could bring confusion into ATC wording. Separating tactical from safety net operations is important. → this is an discussion item for the FLYSAFE External Experts Advisory Group [EEAG]

Comment **[coordination item]**: Lots of overlaps between FLYSAFE and FARADS can be seen. A side conference seems to be necessary in order to decide how to proceed. Either side has some rationale on the benefits of RA downlink; collection of the points of view could lead to better picture to aid decision.

Comment: **[coordination item]** SPIN is investigating the use of safety nets on ground (Short Term Conflict Alert) which provides early alert about infringement of separation. One task was to survey the use of safety nets on the ground. It was first through as clearly separated from TCAS which turned out not to be the case, it can overlap or issue its alert after the TCAS RA and that can lead to some problems if the controller is not informed of TCAS RA. This could be one topic of interaction between safety nets and FLYSAFE.

Q: the idea that flight crew must take action to prevent a long term conflict might interfere with the task of air traffic control. What is the point of view on flight crews proposing solutions for conflict resolution before ATC?

A1: **[coordination item]** Not a first idea on that, but there are projects that envisage the cooperative actions between ground and pilot (e.g. in ASAS). If you are in controlled airspace, the final decision is on the ATC, some tasks can be delegated to pilots but making an initiative from the pilot requires that the crew has the full picture; which is not the case. Coordination with ERASMUS seems reasonable (long term research takes account possibility to communicate with FMS in case of strategic conflict detection using 4D trajectory). This is a better option than giving central view to the pilot.

A2: **[roles & responsibilities]** the way things are right now, we shall not mix the roles of pilots and ATC. There

are often cases of pilot trying to prevent conflicts and manoeuvre based on TCAS display but not knowing intent or plans of the intruder. So, separation could get infringed.

Reaction: This is understood, this related to the limitations of the equipment we have today. Here we draw plans based on 2020 vision of aircraft equipment which shall support CDM.

Reaction: pilots are likely to do their own controlling with less interaction of ATM.

Remark: There are some issues about delegation conflict prevention tasks to the cockpit. A lot of research has been done, some results will not be implementable in the next 5 years, but we should look at potential solutions for 2020 and not discard them already.

Remark: the R&D has to turn into operational implementation at some time. There are some grey areas presented today (terminology on tactical/strategic) – at least we will bring improvement in 2020 but not wait for 2020. Some aspects can be implemented before and there are possibilities to exchange (pros and cons of datalinks: up and down).

Reaction **[cooperation item]**: Some of the confusion is that ESP are short term projects, while FLYSAFE aims at 2020. We have not discussed in particular the downlink but we note this is a topic worth investigating.

Q: If we are going to do so much data sharing, what is the impact on data availability and robustness?

A: See the topics III this afternoon.

Q: in the SESAR discussion, we saw numbers for objectives, what are the grounds for these?

A: the figures were fixed by the commissioner on air transport (safety), there are more political than technically grounded.

Q: If you triple traffic, and want to retain the same number of accidents and incidents, than the increase of safety is about 9 which is close enough to the figure of 10 mentioned.

Comment **[enabler for CDM/role&responsibility]** You were talking about long term research, more and more the aircraft will be automated so that pilot workload will be reduced and he will more manage than fly, thus there will be more time for him to manage the situation and share the information with ground ATC, the crew will be more aware of the threats. Today the pilots cannot always devote time to manage the flight. Automation in all flight phases will allow pilot and ATCO to manage the mission and share awareness.

Reaction: If we are willing to develop advance onboard system to resolve conflict it is OK, but if we add the increased traffic, then the individual conflict resolution cannot work. The number of conflicts has to be inversely decreased compared to traffic increase and this is not possible. We need to look at CDM/mitigation of conflicts and not simply transfer the de-conflicting/management to the cockpit. We have to strategically mitigate conflicts.

Reaction: The ATC is refractory to automation. If we think about system to resolve long term conflict it is not working currently. Automation will not decrease ATC workload but rather the other way around.

**[Cooperation item:Terrain]** SPIN Highlight that in the SPIN task force we are looking at short term improvement of safety. In the next step, we would like to better understand the cooperation between ground and airborne safety nets. Commonality would be for example terrain data for MSAW so that the data is consistent on the ground and airborne. This could be a very short term item for discussion.

**[Role&responsibility]** Issue of 4D trajectory: as soon as an aircraft reacts in an uncoordinated way, the scenario is changed beyond simply changing the intent information; this must be taken into account in the system definition. Any uncontrolled traffic must be kept to absolute minimum, i.e. short term evasive manoeuvre.

**[Operational context]** From the experience of EUROCONTROL implementation: we need to show immediate benefits and include the lack of equipment for the traffic, we will fly in mixed environment and this must be taken into account.

## 2.7.7. Topic II: Operational processes affected by FLYSAFE

### N. Barraci, Technical University of Darmstadt

Today's ATC/ATM role is to ensure safe and reliable traffic flow using its complete overview of airspace. The flight crew's role is to ensure safe, on-time and economic flight using a local view around their aircraft. ATC and flight crew need to communicate despite their sharing a different picture; ATC has usually access to meteorological data; however, flight crew only has quality-degraded and limited meteorological information when aloft.

In future ATC, ASAS will require more interaction between crew and aircraft and in-between aircraft. MET information will be improved through down-linking and through onboard consolidation. Finally, ATC and crew should share more their picture. In exchanges between ATC and aircraft, ATC benefits from getting more information from aircraft (ex: NUPII+) like intended flight path; flight crew may better estimate the impact of their changing flight path and the interaction supports ASAS. Communication in between aircraft is supported through ASAS standardisation and will support enhanced situational awareness. Interaction between flight crew and MET could lead to better estimation of weather-related hazardous zones.

The benefits could include more accurate ETO, better situation handling through sharing the same picture (including taxi navigation), and the use of aircraft as source of information.

#### Questions:

**[human factors]** Q: giving pilot more information is new; will this have an effect on the division of labour?

A: this will definitively have an impact on ATC work, but we need to discuss how much ATC will support delegation to flight deck crew and how crew will react to it. We are not sure at the moment.

Q: the intention is to bring up more & more information to the cockpit. Do we have any idea on the impact to crew workload on non nominal conditions?

A: we do not want to display all information available but to select the relevant one. Now, when questioning pilots, the opinions are diverse. We want to find out which elements are necessary for the crew to build situation awareness.

Remark: it is not what is sent to the cockpit but rather what the pilot wants to see. Right now, there is access to amounts of data but it is up to the crew to decide what to see depending on the tasks at hand and this is varying. If the full picture is sent up, maybe they will not decide to select this view for the moment.

A: The discussion is still ongoing in all areas: weather, traffic and terrain. A few keywords have been heard: (1) relevance for the flight, the time, the type of aircraft, (2) availability as optional, (3) attention getting or pop-up of safety critical information. We do take into account not to overload the pilot through these aspects.

**[benefits/cooperation item]** For the benefits, the sharing of safety nets will make them work better; this could be added to the benefits chapter.

**[human factors]** Comment: do not think that sharing the same picture all the time is necessary. Today's tools are useful to comprehend the situation, however getting information about a long term CB from preceding aircraft (when the radar does not see yet) would be fine of course. The definition phase is very important and this aspect should be taken into account.

Comment: about excessive amount of info given to the pilot is one aspect to be considered in prelim safety assessment and possibly in the pilot evaluations. Given that the advantage/disadvantage of shared information would be possible only through collaboration of the 2 communities, maybe there could be a simulation sharing of the NLR facility with real time EEC simulation facility.

A: technically feasible, but there are already plans to couple with NLR tower. What is the additional benefit to couple with EEC real time simulation? The question is more about what to expect from the ground side.

R1: it is just to have some EUROCONTROL involvement in the evaluations.

R2: at EEC, we already work a lot on ASAS and did perform simulations on coupled environment with pilots, access to this could be granted.

[cooperation item] R3: this is an action of EUROCONTROL management to contact FLYSAFE management to shape the cooperation in WPs.

[human factors] Comment: any attempt at integrating information should be proven to be safe in front of the regulators. Questions like is something useful lost in the integration should be addressed.

A: indeed. We could go first for only de-cluttering mechanisms and not touch the items paramount to safety, but this is a big topic for research.

A: we should start by identifying the problem, and proposing solution with just the right amount of information.

## 2.7.8. Topic III: Information/communication and the use of datalink in FLYSAFE

### O. Bleeker, Rockwell Collins

FLYSAFE opens the possibility to provide updates of traffic and weather information to cockpit, note that currently it is not foreseen to have terrain "updates".

For example, sending a thunderstorm object describing areas of hail or icing that the WXR cannot detect because of low reflectivity, and predominant updrafts and downdrafts to determine turbulence. FLYSAFE is about determining these hazardous zones. On the ground there is sophisticated equipment and mathematical models that are more adequate for determining weather hazard zones and predicted hazard trail than the sensor onboard can detect. The features extracted could then be uplinked in a condensed format to complement radar detection performance (hail, ice...) and range (e.g. extend from 20min to 45min).

Current usage of datalink

- for traffic surveillance: ADS-B / TIS-B (note this is surveillance from the ground up), but it is not sure why the full set of traffic information is of use.
- Usage of FIS-B for Notam, Metar
- CPDLC: routine clearances, ASAS instructions, traffic identification
- AOC: general communications email-like (progress reporting, maintenance information)
- Surface movement: ADS-B / TIS-B, multilateration, FIS-B, CPDLC or voice radio (cleared taxi, initial flight plan, etc.), AOC updates

We can then classify communication technologies into communication and surveillance as applications, network and media. Further review of the current datalink technology is presented in matrix format to illustrate potential trade-offs in parameters helpful in choosing adequate datalink (network, frequency, bit rate, standards, deployment). Note that there are no standards for ground systems, anticipating potential difficulties for changes on the ground systems. Also, while Mode S is installed on all aircraft in Europe, Extended squitter is not usable as it requires important modification to aircraft.

Foreseen technologies have been presented to ICAO ACP working group C in March 2006.

In FLYSAFE, we want to determine which datalink through data requirements, recommendations by EUROCONTROL, ICAO, etc., following current programs, evaluating current technologies. The technology issues are summarised in terms of availability, quality, etc. The project will define services and requirements but cannot select the technology as it is an end-to-end problem.

Questions:

Q: about uplinking ground weather radar, how about the downlink of WXR information and dispatch to other aircraft.

A: indeed, using the aircraft as sensor is a major point.

Comment: point at the datalink performance is important as well as process to determine parameters to select technologies. The sooner we can have visibility on size and requirements for these new applications, the best it will be to integrate them on-top of existing technology. Is it the intention to feed the standardization groups with the results of FLYSAFE?

A: we are aware that communication must deal with scarce resources and that not all can be exchanged at high rates. There must be a trade-off between needs and capacity, in this area we are still trying to find our way and have not yet reached a balanced position. We are present and contributing to the standardisation groups and coordinate to have a common FLYSAFE view to show in these groups.

A: in these groups there are more than one representatives of the FLYSAFE consortium (RTCA 206 / WG44).

Comment: THALES air systems are also contributing in FLYSAFE for data compression techniques to increase efficient use of datalink and quality of services requirements.

**[cooperation item]** complement of information for future infrastructure (document COCR to capture future requirements for the communication for the ground part) – first identifications are data sigmet and metar for the met data. We would be interested in feedback on these. The document has been distributed. Do you have interfaces with other projects dealing with the topics e.g. STARR (air-ground datalink).

A: Rockwell-Collins and THALES have joined forces on some of these topics (3G, P34) and industry is actively involved and usually works quicker than the application/market! This time the application comes first.

Q: The application will have to be widely distributed, hence needed a ground infrastructure. Do you address this point?

A: the notion of system-wide information function is well known and as such it is taken into account, however it is not sure we have a foot deep enough in the topic.

**[cooperation item]** A: although we know of other projects in connex topics, it is not sure we have established the correct connection, it is the case with the pan-European network, but we do have willingness to establish proper links.

**[technical]**

Q: we can also think on datalink issues on the surface movement, could we have datalinks in parallel or consider the same link?

A: multi-mode is developing; one function/device on the aircraft can then support multi-waveforms, each having its benefits and answering a particular need.

Remark: there are two sides of the problem: the technology (feasibility) and the service (message, interoperability); the latter being more important. Indeed the technology solution might not be unique and use several spectra with adequate integrity and performance.

Remark: adapt the requirement to the airspace in which the aircraft is flying (gate, oceanic, etc.), like what has been done with COCR.

A: indeed, as the system will find the best media it should find the path most appropriate.

## 2.7.9. Wrap-up

### 2.7.9.1. Items for cooperation / exchanges between FLYSAFE and outside

#### 1) FARADS on RA downlink

There are lots of overlaps between FLYSAFE and FARADS. Either side has some rationale on the benefits of RA downlink, collection of the points of view could lead to better picture to aid decision. Some of the confusion is that ESP are short term projects while FLYSAFE aims at 2020. We have not discussed in particular the downlink but we note this is a topic worth investigating.

→ have side conference to decide how to proceed.

#### 2) SPIN on safety net consolidation

SPIN is investigating the use of safety nets ground (Short Term Conflict Alert) which provides early alert about infringement of separation. One task was to survey the use, it was first through as clearly separated from TCAS which turned out not to be the case, it can overlap or issue its alert after the TCAS RA and that can lead to some problems if the controller is not informed about the RA. This could be one topic of interaction between safety nets.

For the benefits, the sharing of safety nets will make them work better; this could be added to the benefits chapter.

#### 3) SPIN on terrain information sharing (MSAW)

Commonality would be for example terrain data for MSAW so that the data is consistent on the ground and airborne.

#### 4) ERASMUS

There are projects that envisage the cooperative actions between ground and pilot (e.g. in ASAS). If you are in controlled airspace, the final decision is on the ATC. Some tasks can be delegated to the pilot, but making an initiative from the pilot requires that the crew has the full picture which is not the case. This is coordinated in ERASMUS (long term research takes account possibility to communicate with FMS in case of strategic conflict detection using 4D trajectory). This is a better option than giving a central view to the pilot.

#### 5) Evaluations

This is an action of EUROCONTROL management to contact FLYSAFE management to shape the cooperation in WPs.

#### 6) Feedback requested from FLYSAFE

Refer to COCR document to capture future requirements for the communication for the ground part

### 2.7.9.2. Other more technical discussion items

**[terminology]**: one concern is the risk of confusion between procedural operations and tactical meaning "unplanned" here. There are short term activities that are planned and under control. There is the worry of use of the word "unplanned" to bring confusion into ATC wording. Separating tactical from safety net operations is important.

→ This item shall be discussed with the FLYSAFE External Experts Advisory Group (EEAG).

**[roles & responsibilities between ground ATC and flight crew]**

- the way things are right now, we shall not mix the roles of pilots and ATC
- the idea that flight crew must take action to prevent long term conflicts might interfere with the task of air traffic control. What is the point of view on flight crew proposing solutions to conflict mitigation before ATC?
- more and more the aircraft will be automated so that pilot workload will be reduced and he will more manage than fly. Thus, there will be more time for him to manage the situation and share the information with ground ATC
- issue of 4D trajectory: as soon as an aircraft reacts in an uncoordinated way, the scenario is changed beyond simply changing the intent information. This must be taken into account in system definition

**[operational context]**

From the experience of EUROCONTROL implementation: we need to show immediate benefits and include the lack of equipment for the traffic, we will fly in **mixed environment**.

**[human factors]**

- giving pilot information that is new, will this have an effect on labour?
- do not think that sharing the same picture all the time is necessary.
- Any attempt at integrating information should be proven to be safe in front of the regulators. Questions like "is something useful lost in the integration?" should be addressed.

### 3. CONCLUDING REMARKS

Besides the agenda, the invitation process is always a crucial part of organising forums. The quality of the invited people is most important. Some project partners contributed very well to the completion of the invitees list.

The consortium was fortunate to welcome representatives from two national ATC service providers (AVINOR and LVNL). Alas, other European service providers were not able to send representatives. FLYSAFE's intent to benefit from the participation of airports could not be satisfied. The addressed airports were not able to send representatives. Airlines had a great interest in participating to the forum. At forum day only one airline was present, namely Lufthansa Cityline. Other registered airlines had to cancel their attendance on the short term due to work related obligations. As a matter of fact all stakeholders have been broadly approached, e.g IATA and all representatives of airports in Europe, but the result has a potential for improvement. Nevertheless, the FLYSAFE project will put even more effort in the invitation process of future events, in order to increase the number of representatives of ATC providers, airlines and airports.

The positive response the FLYSAFE project received from the attendees supports the idea to hold dissemination forums with relevant stakeholders. The fact that the forum was held at the premises of a major stakeholder facilitated the attendance of EUROCONTROL experts. This approach should be followed in the course of the project.

The format of the workshop was well appreciated due to an introductory session about EUROCONTROL activities and the FLYSAFE project. This was a good way to familiarize the audience with the issues to be discussed during the forum. The long topic sessions went down well also. Each topic session raised a lot of questions to the auditorium which have been answered by extensive technical discussions after each presentation. So, all three major topics as described in chapter 2.6.1 have been covered satisfyingly. The approach of having long topic sessions should be followed in future forums.

During the forum several overlaps to EUROCONTROL activities and research projects have been identified. The forum unveiled links to many R&D initiatives such as FARDS, SPIN, ERASMUS and others. This links will be followed by FLYSAFE. EUROCONTROL expressed their interest in further cooperation with the FLYSAFE project.

A very pleasant result of the forum is that FLYSAFE received new application for its External Experts Advisory Group (EEAG). The purpose of the EEAG for FLYSAFE is to bring operational inputs and return from experience, to interact with the project during the design phase by giving comments on the design approach from different (operational) perspectives and to comment on project results on the best way to go towards marketable products and systems.

FLYSAFE will follow the comments given during the forum and intends to expand the cooperation with notably EUROCONTROL, the whole ATC/ATM community and with other relevant research projects identified.

FLYSAFE is looking forward to its upcoming forums and will be pleased to discuss the progress of the project with the relevant stakeholders in aviation.

**FLYSAFE addresses special thanks to EUROCONTROL for hosting and contributing to the forum, the speakers for their excellent performance; and last but not least all attendees who made the forum a success, not least by their valuable contributions during the topic discussions!**



Figure 2: Forum attendees

## APPENDIX A : ACRONYMS

<b>ACARE</b>	Advisory Council for Aeronautics Research in Europe
<b>ACAS</b>	Airborne Collision Avoidance System
<b>ADS-B</b>	Automatic Dependent Surveillance - Broadcast
<b>AIT</b>	Aircraft Identification Tag
<b>ANSP</b>	Air Navigation Service Provider
<b>AOC</b>	Airline operational control
<b>ATC</b>	Air Traffic Control
<b>ATCO</b>	Air Traffic Controller
<b>BFU</b>	Bundesstelle für Flugunfalluntersuchung
<b>CB</b>	Cumulonimbus
<b>CDM</b>	Cooperative Decision Making
<b>CDM</b>	Collaborative Decision Making
<b>COCR</b>	Communications Operating Concepts and Requirements
<b>CPDLC</b>	Controller Pilot Data Link Communications
<b>EEAG</b>	External Experts Advisory Group
<b>EEC</b>	EUROCONTROL Experimental Centre
<b>ERASMUS</b>	En Route Air Traffic Soft Management Ultimate System
<b>ESP</b>	European Safety Programme for ATM
<b>ETO</b>	Estimated Time in Operation
<b>FARADS</b>	Feasibility of ACAS RA Downlink Study
<b>FIS</b>	Flight Information System
<b>FIS-B</b>	Flight Information Services Broadcast
<b>FMET</b>	Meteo France
<b>ICAO</b>	International Civil Aviation Organization
<b>MET</b>	Meteorology
<b>MSAW</b>	Minimum Safe Altitude Warning
<b>NGISS</b>	Next Generation Integrated Surveillance System

<b>NUPII+</b>	NEAN Update Programme Phase II+
<b>R&amp;D</b>	Research and Development
<b>RA</b>	Resolution Advisory (ACAS)
<b>RTCA</b>	Radio Technical Commission for Aeronautics
<b>SA</b>	Safety Altitude
<b>SESAR</b>	Single European Sky ATM Research Programme
<b>SPIN</b>	Safety nets: Planning Implementation and eNhancement
<b>SSAP</b>	European Strategic Safety Action Plan
<b>STCA</b>	Short Term Conflict Alert
<b>TAWS</b>	Terrain Awareness and Warning System
<b>TIS-B</b>	Traffic Information Services Broadcast
<b>WIMS</b>	Weather Information Management Systems
<b>WXR</b>	Weather Radar

## APPENDIX B : LIST OF ATTENDEES

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## APPENDIX C : FLYSAFE CONTACTS

For further information about FLYSAFE please do not hesitate to contact us!

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Please visit our website: <http://www.eu-flysafe.org>

## APPENDIX D : FLYSAFE CONSORTIUM

### THE 36 PARTNERS OF FLYSAFE:

**Airframers:**

AIRBUS France  
Eurocopter Deutschland  
Dassault Aviation

**System providers:**

Thales Avionics, coordinator  
BAE SYSTEMS  
Diehl Aerospace GmbH

**Research centres:**

DLR (Oberpfaffenhoffen)  
NLR  
ONERA  
CNRS  
TsAGI

**Met Offices:**

UK Met Office  
Météo France

**Universities:**

University of Hanover  
Université Catholique de Louvain  
Technische Universitaet Darmstadt  
Cranfield University  
University of Malta

**Airlines:**

Adria Airways  
Air Malta

**Air Traffic Control authorities:**

AustroControl

**Specialised companies:**

GTD Sistemas de Informacion  
Euro Telematik AG  
Galileo Avionica  
Hellenic Aerospace Industry  
Jeppesen GmbH  
AIRBUS Deutschland  
Rockwell Collins France  
Thales Air Defence

**Specialised SMEs:**

Avionics Research  
AVTECH  
Deep Blue  
Skysoft Portugal  
Hovemere  
USE2ACES  
Thales Laser