FLYSAFE – WP 7.3

D 7.3-3 Report on Second FLYSAFE Forum

Abstract:

This document is the report on the second FLYSAFE forum, held on the 17th to 19th of September 2007 together with the fifth ASAS-TN2 Workshop in Toulouse.

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 second FLYSAFE dissemination workshop was held on the 17th to 19th of September 2007 together with the fifth ASAS-TN2 workshop in Toulouse. 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 traffic and ASAS topics, actual developments and future trends have been discussed together with the attendees of the ASAS-TN2 workshop. The discussion helped to facilitate the development of FLYSAFE systems to be compliant to other work on ASAS manoeuvres and traffic in general.

The forum was dedicated to 4 particular topics:

- Impact of Icing and Turbulence on Safe Separation
- On-board Wake Prediction & Alerting System
- Experiments on the Impact of Wind on ASPA-S&M Manoeuvres
- ATSA-SURF – Enhanced Situation Awareness Under Adverse Weather Conditions

The FLYSAFE forum was a unique event to exchange and interact in this stage of the project (T0+29 months) with persons that work in comparable fields of activity regarding traffic developments.

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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.

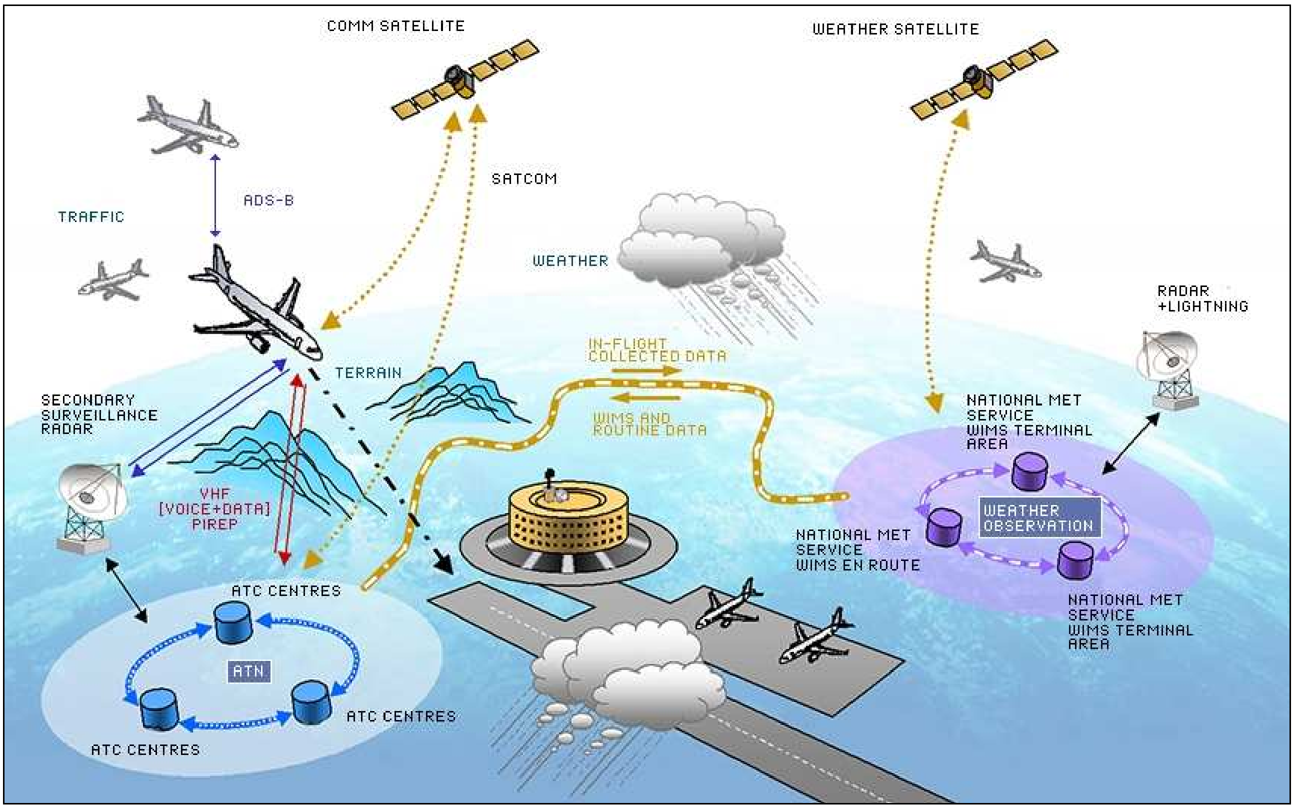

Figure 1: FLYSAFE overall concept

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 : "**2nd FLYSAFE dissemination forum**"
  This chapter describes objectives, agenda and the course of the forum. Furthermore it includes the minutes 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**"
- Appendix E : **2nd Forum – Impressions**

2. SECOND 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 went a step further and showed first results of the project to the audience. With regards to the work programme and the fact that this forum took place in the middle of the project course, the 2nd forum focus was on traffic (hazards & procedures) related topics. The FLYSAFE consortium presented the interim results of traffic developments that have been completed and took advantage of 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 Objectives

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.

The Link to ATC has been handled quite well through the External Experts Advisory Group [EEAG] and the first FLYSAFE Forum in June 2006. The schedule of the project foresaw that most of the FLYSAFE innovations would be in a development stage at the time of the second forum so the decision has been made to focus this forum on the traffic aspects in FYLSAFE. Those are represented by impacts on certain atmospheric conditions on separation and on ASAS manoeuvres which are target of FLYSAFE research. These topics grant a big communality with the fifth workshop of the ASAS-TN2 program so the offer from the ASAS-TN management to join both events was kindly accepted.

On the 17th to 19th of September 2007, the second FLYSAFE dissemination forum took place at Atria Mercure Hotel in Toulouse.

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

1. To inform guests and ASAS-TN2 people about the relevant traffic developments in FLYSAFE

2. To bring the impacts of atmospheric hazards to the attention of the developers working on ASAS topics.

3. To discuss the interim results of ASAS-TN2 and FLYSAFE work and thus to improve the work on further steps.

2.2.2. Specific objectives of the 2nd FLYSAFE dissemination forum

The objectives of the 2nd FLYSAFE forum, as joint event with the ASAS-TN2, follows the following objectives:

- Facilitating the cooperation with other projects
- Increase the interest for FLYSAFE
- Clarify certification aspect / identify concerns
- Increase the acceptance of FLYSAFE products and concepts (WIMS, NGISS)
- demonstration of the technological competence of the consortium and every single partner
- campaigning for the WIMS in the context of ASAS applications

2.3. VENUE AND PREPARATION

Due to the joint nature of the second FLYSAFE forum the preparation had to be thoroughly coordinated between the FLYSAFE WP 7.3 and ASAS-TN2. In addition to several phone conferences three dedicated preparation meetings were arranged. The first meeting was held on the 24th of April during the fourth ASAS TN2 workshop in Amsterdam, the second on the 11th of May at THALES in Toulouse and the third on the 13th of June as well in Toulouse.

2.4. EXHIBITION, REGISTRATION AND HANDOUTS

At the first evening of the ASAS-TN2 workshop – the 17th of September – a small exhibition of FYLSAFE developments was prepared including posters, a display of the FLYSAFE teaser video, a running demonstration of FYLSAFE applications on two Laptops and a mock-up of the embedded graphic generator board developed by DIEHL Aerospace.

2.5. FORMAT

2.5.1. Topics

The forum was organised as one session within the ASAS-TN2 workshop. The session was planned to last 3 hours and 40 minutes including discussion with the auditorium.

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

- **Topic I :** Impact of Icing and Turbulence on Safe Separation
- **Topic II :** On-board Wake Prediction & Alerting System
- **Topic III:** Experiments on the Impact of Wind on ASPA-S&M Manoeuvres
- **Topic IV:** ATSA-SURF – Enhanced Situation Awareness Under Adverse Weather Conditions

2.5.2. Agenda

The topics listed in chapter 2.5.1 have been transferred into an agenda. The final agenda was developed as follows:

Time	Presentation Title	Presentation content	Speaker
14:00 – 14:20	**FLYSAFE overview**	- Standard presentation - Focus on NGISS	Marc Fabreguettes, THA
14:20 – 14:50	**Impact of icing and turbulence on safe separation**	- impact on vertical separation - turbulence, wake vortices(no functional), icing - show how WIMS will help	Andrew Mirza, UKM Patrick Josse, FME
14:50 – 15:20	**On-board wake prediction & alerting system**	- Objectives of on-board wake prediction & alert - Functional description - ADS-B as enabling technology - Application examples (focus on ASAS)	Andreas Reinke, A-D
15:20 – 15:50	Coffee break		
15:50 – 16:20	**First measures of the impact of wind on Sequencing&Merging manoeuvres**	- wind and vector / merging - results of verification tests of wind impact - speed-control limits and authority - Wind and Remain Behind	Derek Jordan, BAE *Deputy speaker: Nima Barraci, TUD*
16:20 – 16:50	**ASTA-SURF - Enhanced situation awareness under adverse weather conditions**	- Airport Moving Map (AMM) for better positional awareness - Surface Movement Awareness & Alerting System (SMAAS) - Impact on airport operational constraints - Presentation addresses bad visibility	Nima Barraci, TUD *Deputy speaker: Derek Jordan, BAE*
16:50 – 17:30	Panel session: Discussion and Feedback		Chairmen: Marc Fabreguettes, THA & Wim Huson, U2A
17:30 – 17:40	Conclusions from panel session & Closing remarks		Chairman: Marc Fabreguettes, THA

2.5.3. 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 four 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.

2.6. MINUTES OF MEETING

2.6.1. Introduction

This session was chaired by Marc Fabreguettes (THALES Avionics) and Wim Huson (Use2Aces), with Fraser McGibbon (BAE Systems) as the secretary.

This session gave a broad overview of the FLYSAFE project, and described the airborne Next Generation Integrated Surveillance System (NG-ISS). The NGISS is enhanced by a number of ground-based advanced Weather Information Management Systems (WIMS). The impact of weather on specific ASAS applications was discussed, focussing on ASPA-S&M and ATSA-SURF applications. Finally, some of the FLYSAFE Traffic Part Task Evaluation results were presented.

2.6.2. Review of the briefings

2.6.2.1. FLYSAFE Overview: Marc Fabreguettes (THALES Avionics)

Brief description

Air traffic is expected to triple world-wide within the next 20 years. With the existing onboard and ground systems, this may lead to an increase in aircraft accidents. As safety of flight depends to a large extent on flight crew actions, it is essential that crew members are supplied with reliable information that can be used at all times. FLYSAFE is developing the required new systems allowing the crew to make the right decision to avoid conflicts caused by weather, traffic and terrain.

FLYSAFE focuses particularly on the following areas identified as the main types of accidents around the world: loss of control, controlled flight into terrain, and approach and landing accidents. It addresses three types of threats: adverse weather conditions, traffic hazards and terrain hazards. For each of these it develops new systems and functions, notably improved situation awareness, advance warning, alert prioritisation, and enhanced human-machine interface.

The three main types of hazard 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 (NG-ISS) 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: Weather Information Management Systems (WIMS) (wake vortex, windshear, clear air turbulence, icing, and thunderstorm).

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

- 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 replanning is required.

- Tactical alert management to help the crew manage all alerts generated by the "safety net" functions, such as TCAS, TAWS, and windshear (i.e. for those situations where an immediate response is required).

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

The FLYSAFE consortium groups 36 partners from 14 EU countries and Russia. Universities, research centres, national meteorological bodies, equipment manufacturers and airframe manufacturers all contribute to the development and evaluation of the program outputs.

The FLYSAFE program started in February 2005 and will end in June 2009. Major developments are nearly finished and successive integration tasks on two test platforms will start shortly. Finally two campaigns of flight tests will specifically focus on evaluation of the FLYSAFE WIMS.

2.6.2.2. Impact of Icing and Turbulence on Safe Separation: Andrew Mirza (UK Met Office)

Brief description

Icing and turbulence are known hazards to the safe and efficient conduct of a flight. Icing affects aerodynamic performance and turbulence affects the health and safety of cabin crew and passengers. Both atmospheric phenomena could cause unplanned changes to vertical and horizontal position to avoid these hazards; hence to possible reductions in minimal separations in controlled airspace.

With the predicted global increase in air traffic movements, the adverse impact upon surrounding traffic caused by changes in vertical or horizontal position of one aircraft may become more common. Similarly, with higher traffic density it is possible that terrain and atmospheric conditions combined may limit further options available to flight crew to escape from any adverse conditions affecting their flight path.

Within FLYSAFE, knowledge of the current and future states of the atmosphere is considered desirable as a means to mitigate unplanned changes to the flight path, especially with respect to adverse weather conditions. Up-linking the most up-to-date and most relevant weather information could enable the flight crew to make more informed decisions regarding their current and future flight path. Such decisions, or changes to the intended flight path could be made before the aircraft leaves the ground. The aircraft only requires a subset of weather data, however provision of the master data to all interested users like ANSP's and AOC's could enable for more collaborative decisions that affect air traffic movements in anticipation of changes in the atmospheric state.

Centres for national meteorological services and meteorological research are collaborating within FLYSAFE to develop the means for generating and delivering the most up-to-date information regarding the current and future states of the atmosphere: with respect to identified hazards for aviation (icing, turbulence, thunderstorms and wake vortices); at variable spatial resolutions (1km to 40km) and time horizons (minutes, hours, or days ahead).

Key issues in the presentation

- Two scenarios were considered in which aircraft separation changes unexpectedly:
    - Vertically, due to clear air turbulence;
    - Horizontally and vertically, due to in-flight icing.

- Greater awareness of the 4D evolution of the atmosphere could provide better management of aircraft movements so as to maintain safe separation whilst avoiding hazardous volumes of space.

- FLYSAFE's vision of greater situation awareness could support this by:

    - Up-linking more frequently data indicating the spatial extent, evolution and intensity of areas of adverse atmospheric conditions;

    - Customising the requests for data to the intended flight path of each aircraft;

    - Providing forecasts of the state of the atmosphere, flight crew would have sufficient time to plan their actions thus reducing unexpected changes in vertical/horizontal separations.

2.6.2.3. On-board Wake Prediction & Alerting System: Andreas Reinke (Airbus Deutschland)

Brief description

Wake vortices have been a known danger to safe and efficient air transport for many years, and they are the reason for dedicated ICAO aircraft separation minima during take-off and approach. The low number of serious incidents indicates that these current standards are safe, although they do not completely prevent serious incidents during unfavourable conditions. In addition, the lack of wake turbulence separations during cruise flight leaves room for wake-induced upsets under specific conditions (e.g. climb/descent with small separation, low turbulence and adverse wind condition).

The number of such events could increase in line with the forecast increase in air traffic movements. Considering also the growing range of aircraft sizes (including the introduction of Very Light Jets), advanced technologies to assure the safety of flight operations are constantly being evaluated.

New airborne wake encounter prevention systems are being evaluated in the context of the FLYSAFE project. Such systems require validated sensors and models to inform the crews about potential severe wake encounters during all phases of flight. Model-based wake prediction could rely on the emerging ADS-B technology, improved knowledge of atmospheric parameters on wake vortex behaviour and should be seen in the context of integrated surveillance functions, possibly including ASAS applications.

The FLYSAFE objective is to demonstrate the functionality and applicability of an airborne Wake Encounter Prevention System (WEPS) as part of the Next Generation Integrated Surveillance System (NG-ISS)

Key issues in the presentation

- Severe wake encounters are rare but can occur under very specific conditions.

- Wake encounter prevention functions may become operationally feasible and contribute to enhance safety and capacity.

- Availability of mature and capable sensors as well as necessary data link is uncertain.

- Wake encounter prevention must be regarded as part of wider surveillance function and is likely to interact with ASAS.

2.6.2.4. Experiments on the Impact of Wind on ASPA-S&M Manoeuvres: Stephen Broatch (BAE Systems)

Brief description

ASPA-S&M (Airborne Spacing – Sequencing and Merging) is part of the "Traffic" functionality of the Next Generation Integrated Surveillance System (NG-ISS) being developed by FLYSAFE. Automatic execution of the S&M manoeuvre via the FMS and autopilot has been developed and the speed control mechanisms have been updated to take this into account. The ASPA-S&M algorithms used in FLYSAFE are based on those developed by the Requirements Focus Group (RFG) which currently do not make any specific provision for the effect of wind.

In order to determine the sensitivity of different S&M manoeuvres to the effect of steady air flows, a number of experiments have been performed. When comparing time and distance spacing manoeuvres, different responses to wind effects can be expected, based on the way that the respective spacings are defined.

A test scenario was developed, containing a route with turns into and away from a steady wind. This route was then used for Remain Behind manoeuvres with distance and time spacings in wind speeds of 0, 50, 100 and 150 knots.

These experiments show that time spacing manoeuvres are not sensitive to different wind speeds, although the initial capture period is altered, because of the own-ship's ability to achieve the specified spacing value behind the target aircraft. However, distance spacing manoeuvres are sensitive to wind speeds over 50 knots, to the extent that the specified spacing is only just maintained at 100 knots and the manoeuvre cannot be maintained at 150 knots, in which case an automatic manoeuvre termination is generated.

One particular implication of these results is that time spacings must be selected carefully to ensure that legal safe-separation rules, which are defined in terms of distances between aircraft, are not inadvertently infringed during time spacing S&M manoeuvres in real-world wind conditions.

Key issues in the presentation

- Distance spacing is more sensitive to wind than time spacing.
- Wind impact is seen in the severity of the speed adjustments required to maintain distance spacing.
- Speed demands can exceed actual aircraft performance, potentially leading to manoeuvre termination.
- Wind of 150 knots resulted in manoeuvre termination for distance spacing, whereas time spacing was stable.
- ATC time spacing instructions must respect wind effects to ensure separation limits are not infringed at turns into wind.

2.6.2.5. ATSA-SURF – Enhanced Situation Awareness Under Adverse Weather Conditions: Claudia Fusai (Deep Blue) and Christoph Vernaleken (Technische Universität Darmstadt)

Brief description

Surface Movement is one of the most challenging phases of flight. Night or degraded visibility conditions (e.g. with airport markings obscured by snow and at airports not familiar to the flight crew) may cause excessive workload and increase the risk of disorientation while taxiing an aircraft. This does not only impair the efficiency of surface operations, which is important in view of growing air traffic, but can also lead to serious incidents and accidents, of which runway incursions (i.e. the incorrect presence of an aircraft on a runway) are most safety-critical.

FLYSAFE proposes solutions to enhance airport situational and traffic awareness to help flight crews overcome the problems they currently meet on the airport surface, both in good and low visibility conditions.

On the airport surface, pilots refer to two different kinds of awareness: global and local awareness. Global awareness is used to maintain ownship positional awareness relative to the gate and other airport features. Without global visual navigational references incorrect taxi turns are more likely and complete disorientation is possible. Local awareness refers to an immediate area of a route: the centreline and lights, the taxiway edges, the edge lighting, and taxiway signage.

Even if pilots have means to orientate themselves on the airport surface, sometimes they still may end up in error. Errors are the product of many concurrent events: deficiencies in the visual airport surface environment (non standard markings, markings obstructed by high grass, etc.), ineffective communications between controllers and crews, last minute taxi route changes, or high workload. Errors are more likely to happen in low visibility conditions, when global awareness is strongly affected and local awareness is degraded.

Over the past decade, the electronic airport moving map display has evolved both in research and industry, and is now widely accepted as the core technology to increase the flight crew's situational awareness in terms of position on the airport surface. Building on the foundation of an airport moving map, the FLYSAFE system proposes a Surface Movement Awareness and Alerting System (SMAAS) that includes the following additional features:

- Visualisation of taxiing instructions;
- Visualisation of the active runway;
- Visualisation and alerting system for closed runways;
- Display of traffic on or close to the airport surface, such as landing and departing traffic;
- Traffic alerting system referred to taxiing traffic conflict and runway incursion.

Key issues in the presentation

- Flight crews use different means for orientation on the airport surface, but sometimes pilots still experience difficulties during taxiing.
- Taxiing difficulties are more frequent in low visibility conditions due to the lack of global visual references and degraded local visual cues.
- With respect to NOTAM information, the advent of airport moving map technology adds a disparity in the conspicuousness of information, resulting in the danger that a runway that is displayed without any closure markings on the airport moving map might be perceived as open even if contrary NOTAM information exists on paper elsewhere in the cockpit. In other words, the unrestricted runway presentation of the same RWY on the airport moving map might have a stronger influence on the mental model of the airport that the crew builds. This calls for an integrated representation of PIB/NOTAM and airport moving map information.
- Human attention is limited and particularly when people are deeply involved in a task, there is a high risk of overlooking some information. Alerts draw the attention in the event that some important information goes unnoticed.
- The alerting concept developed must be integrated with an aircraft's general flight warning philosophy, wherever possible.

Afterword

During the presentation, the audience was shown a short video clip of a group of six people, three dressed in black and three in white, each team passing a ball between each other. Half of the audience was asked to count the total number of passes between the white team and the other half of the audience was asked to count the number of "bouncing" passes between the white team.

Mid way during the clip, a gorilla walks through the group, waves at the camera, then exits. The purpose of this was to demonstrate that if you are told to focus on a particular task, you can fail to see other significant events. It was interesting to note that only very few members of the audience appeared to spot the gorilla (or at least admitted to it!).

2.6.3. Panel session, discussion and feedback

Frank Alexander (Northwest Airlines)	Regarding the runway moving map display, what are the ADS-B-in requirements and costs? There seems to be a reliance on ADS-B. Also, it was requested to Stop putting everything in the FMS (e.g. weight problems).
Christoph Vernaleken (TUD)	In FLYSAFE, ADS-B-in is addressed from human factors and functional perspectives. The project has studied what is feasible, and whether these alerts are desirable and useful from flight crew perspective. ADS-B-in is identified as a candidate but we are not limited to this technology. Could also look at TIS-B and maybe future technologies in 10 to 15 years. We are aware of issues with regard to the traffic datalink with respect to high level warnings, but we are sure it is very important to add these functions. Number of airport surface incidents in the US this year is worrying. FLYSAFE is far from putting something on an aircraft but the requirements need to be studied in detail. With regard to the FMS, what FLYSAFE is proposing to add to the system is is small considering advancing solid state technology and the general increase in computing power.
Wim Huson (Use2Aces / FLYSAFE)	Reminded the audience that the FLYSAFE time frame is to 2020 and these functions will not be add-ons to existing FMS technology introduced 25 years ago.
Frank Alexander	Everything safety related is very important to operators. It is the airlines who have to foot the bill so where these functions reside is very important. Frequently, people use the term “it’s only software” but this is also expensive. Other ways of achieving the same objective should be explored (e.g. is on the aircraft always the best solution?).
Tom Graff (NASA)	Is there a regulatory issue? As pilots do make wrong turns today, must we wait until 2025 for a solution? Graphics requirements are such that we are not going to put moving maps on Navigation Displays. Should consider an EFB solution.
Lars Lindberg (AVTECH)	I would like to remind people of the Milan Linate accident where SAS colleagues were lost. Trials will soon be taking place in Stockholm to demonstrate some of these capabilities. I also do not consider that everything must go into the FMS. Agree that it will take too long with an ND solution. Has FLYSAFE looked at the feasibility of an EFB?
Christoph Vernaleken	Airport moving map on an EFB is not part of current studies but is in the concept mainly to address retrofit. The FLYSAFE philosophy is to use the ND as future line fit option. Recognised that retrofit to older airframes may not be possible. The current evaluation at TUD is looking at an ND solution as this is the superior solution from a conceptual point of view. It is still to be decided what solution will prevail which would be adapted to economic constraints.
Phil Hogge	Recognised this is an important issue. An FMS upgrade is expensive and this needs to be balanced with the speed of bringing in an initial solution (e.g. EFB).
Christoph Vernaleken	Agreed with this statement.
Vinny Capezzuto (FAA)	We should be considering a bundle of capabilities. If we consider a whole spectrum of applications, it becomes affordable. It is hard to quantify (cost) random events and it is challenging to find a solution for everyone. On the ground, all obstacles and vehicles need to be equipped. We can’t get any more safety benefits from what we have today and it’s time to put something in the cockpit.
Tony Henley (BAE Systems)	Raised the point that from a Human Factors point of view, how good is it if you only have some traffic and not all of it, and how would this affect providing advisories to

	the pilot.
Pierre Gayraud (Thales Avionics)	Referred to the ACSS presentation which will be given in session 4.
Doug Arbuckle (JPDO)	This is a good set of functions, but US regulators are concerned with putting too much on an EFB. Is there scope for a study into the pros and cons of different solutions (EFB, ND, and so on). Pointed out that we in the research community often want everything, but we need to remember to analyse the pieces.
Christoph Vernaleken	This is something we will look into. Regarding further the FMS issue, we're not planning on putting all functions into the FMS, but to extract some data and we are looking into using the MCDU as an interface to some functions, for example NOTAM upload. Recognised that complex solutions may have certification problems.
Mel Rees (EUROCONTROL HQ)	For timescales of 2020, SESAR has identified IEEE 802.16 as a future ground based communications system which provides high data uploads for FMS loading at the gate. This could be considered. Also encouraged consideration of an alternative to ADS-B for the additional information that will be required. Also pointed out that ACAS is turned off until entering the active runway so might not be useful for checking on taxiway.
Bob Darby (EUROCONTROL HQ)	As we are in the process of writing rules for applications that will become operationally live in 2 to 3 years, there will be no possibility to change the ADS-B datalink before the 2015 timescale. We need to respect what is going to be used in the short timescale. Commented that some of the FLYSAFE traffic weather terrain elements are also in the CAPSTONE programme and wondered if FLYSAFE has taken anything from CAPSTONE and what could FLYSAFE add. *(No member of the FLYSAFE team was able to respond on CAPSTONE.)* Also acknowledged that the experiments into the effects of wind of S&M showed that time based spacing had advantages over distance based.
Alan Groskreutz (AENA)	Spoke in favour of time based separation. A lot of times this new way of looking at separation might increase capacity, but only by helping realise unused capacity.
Phil Hogge	What about using a separation application on the ground?
Andy Barff (EUROCONTROL EEC)	Integrity of traffic data is the critical issue. Once this is achieved, then we need to consider the problems in how to go from assisting visual separation to using the cockpit display for ground movement. The safety driver is significant and we might need to wait a while until there is a means of providing high integrity data. In Europe the focus has been on A-SMGCS for controllers but we need this surveillance data on displays in cockpit. Can we do this rapidly as the benefits seem great?
Jean-Pierre Magny (FAST)	Different types of aircraft mix create problems for spacing. Recommended to do simulations involving various types of aircraft.
Tom Graff	The number of surface accidents caused by (collisions with) other traffic is probably smaller than those caused by being in the wrong place (i.e. disorientation). It is more complex to display other traffic so this should not delay the introduction of moving map displays.
Christoph Vernaleken	Fully supported the comment. There is encouragement in FLYSAFE for a moving map technology and this should not necessarily be part of a set. There needs to be a packaged approach and a stepwise integration of technologies, beginning with an airport moving map, and a movement on to using the traffic data only when the data

	are good enough.
Vinny Capezzuto	We have considered integrity but what about accuracy? Current accuracy (90m is considered good) is such that it could mean you are on a runway instead of a taxiway. Therefore, this information should be advisory to the pilot. Also need to make sure this is not too expensive.
Lars Lindberg	Some studies (FAA / Transport Canada) have shown that for a 20% increase in traffic, there could be a 140% increase in runway incursions *(figures confirmed on page 9 section 9.5 of "Report on Runway Incursions"[1] from the Canadian Department of national Defence, directorate of Flight Safety – see footnote for link to this document)*.
Vinny Capezzuto	Could not confirm the figures but agreed that it is not a linear relationship.
Wim Huson	What kind of timescale do we envisage if we need to think about weather information availability? Will there be any cost involved for the airlines?
Andrew Mirza (UK Met Office)	The timescales for development of weather products from FLYSAFE are aligned to the SWIM network being developed by EUROCONTROL, but whether the data will be available through what is in FLYSAFE or what is from EUROCONTROL is unclear. In terms of cost, this is not known. In FLYSAFE, there is a network of ground weather processors and equipment needed to store the data, and aircraft need avionics to access the data. Meteorological suppliers need equipment to supply the data. FLYSAFE is trying to keep development running in parallel with EUROCONTROL.
Wim Huson	Will weather updates be available earlier for the ground than the air?
Andrew Mirza	Yes, standard web browsers could be used to access the data.
Marc Fabreguettes (Thales Avionics)	FLYSAFE is a research project and is working on upstream solutions to limited problems which might find their place in future standards. With regard to WIMS (Weather Information Management Systems), when FLYSAFE ends in 2009, if important for the safety of flight, we will need to set up a different structure. This will be up to some of the FLYSAFE weather partners.
Bob Darby	There have been OTIS trials based on CPDLC and these have been well accepted by the pilots involved. Hence, there is already a means to provide the data.
Andy Barff	If UPS are using a traffic display for M&S, are they going to switch off the moving map display when they get onto the ground?
Tony Henley	Understands that they don't plan to, but there is a different symbol set for vehicles on the ground. Also, the present information is useful and powerful, but we have to be careful how it is used. We should not start to use it to move around the airfield at high speed.
Phil Hogge	We should separate what is an ATSAW function and perhaps a future one like ASEP-SURF.
Vinny Capezzuto	For the ACSS equipment, Philadelphia provides an environment to see how this works out in practice. RTCA is defining what the conflict detection tools should look like. At present, this is only on 1090 but it is hoped to use multilateration and transmit this out as TIS-B. However, there is the issue of false targets, but these are all experiments to learn from.
Christoph Vernaleken	FLYSAFE is looking at what needs to be equipped. The current policy assumed is that all aircraft and vehicles on manoeuvring areas should be equipped. However,

	baggage trucks, for example, are not a threat in the places that matter and could mean displays become cluttered.
Vinny Capezzuto	The FAA spectrum office will not allow more than 200 vehicles to be equipped. A draft AC has been issued on the subject. Interference with SSR, overhead TCAS and MLAT are concerns. The use of a different link is another possibility (e.g. MLS band for tugs). The power levels and quantity of emitters on the surface needs to be defined.
Lars Lindberg	Regarding navigation accuracy on the ground, we need another decimal. However, this will lengthen the message so we would have to consider ways to reduce the message size. For example, in Stockholm, higher resolution is used for ground vehicles but certain assumptions can be made (e.g. for incoming aircraft, they will land on the runway)
James Hanson (Helios)	Are there any thoughts about alignment of algorithms for alerting controllers and those for alerting pilots? It would be concerning if there are differences.
Christoph Vernaleken	We first need to look at trigger conditions, e.g. what constitutes a runway incursion? This should be standardised between air and ground. Something to be addressed is the availability and integrity of data. The algorithms may not necessarily be the same or identical. For example, consider the case that one aircraft aborts its take off and remains on the runway surface while another aircraft lines up. A condition for an alert would occur when the aircraft lining up commences take-off. But how can you detect its intention to take off? From a ground surveillance point of view, use of a speed threshold is possible. By contract, on board the aircraft, there are a number of systems that can give information much earlier, even before the aircraft starts to roll. This would not be available in a purely ground system. Operation in other parts of the world, or regional airports which are not as well equipped must also be considered. It is a complex task to make an onboard system capable of operating stand alone where there is no supporting ground infrastructure. Interoperability with other regions is another important issue.
David Zammit-Mangion (University of Cranfield)	With regard to non-commonality of air and ground algorithms, there are issues such as common mode errors. The concept of conflict detection is different on ground and in the air. I don't foresee a concern over different methods for alerting.
Tony Henley	Will new technology for wake vortex detection change the picture much?
Andreas Reinke (Airbus)	Yes, there are models for wake vortex prediction based on airborne or ground systems, or a combination of both.
Tony Henley	Can it be done on a day by day dynamic basis (e.g. separation changes on a daily basis)?
Andreas Reinke	There are already some solutions at Frankfurt Airport, e.g. good forecast horizon times. What does not exist is a global accepted standard to get it implemented right away.
Frank Alexander	We also need to consider where the application belongs, whether on the ground or in the air, to avoid duplicating cost and equipment.
Andreas Reinke	Agreed

2.6.4. Conclusions from Panel Session and Closing Remarks

Conclusions from the panel session and closing remarks were given by Wim Huson of Use2Aces, a partner in the FLYSAFE project. Wim is leader of the FLYSAFE External Experts Advisory Group.

It was noted that there is only one ANSP, Austrocontrol, among the FLYSAFE partners. It would be desirable for FLYSAFE to obtain the input of more people with an ATC background both for developing specifications and to participate in the External Experts Advisory Group. This would help provide a more global point of view for integration of ATC concepts.

FLYSAFE is carrying out research towards implementation in the 2020 timeframe. Some general reactions from the audience indicated that certain results would be attractive to the aviation community somewhere between now and 2020. However, FLYSAFE results must be seen as building blocks to be used for future policy decisions. The aim of FLYSAFE is to develop technological enablers, thus it is too early to consider business cases for future implementations.

It was also stated that the FLYSAFE project group will disband after 2009 and it will be up to commercial partners to follow up the results of the project.

One of the main issues identified during the discussion was how airport moving maps are seen as a first step to improve safety during taxi and runway operations. As such, it was expressed that it would be desirable for moving maps to be made available as soon as possible without waiting for a possibly more complete solution (e.g. with traffic information) which would be expected to be introduced later.

Concerns were voiced about overloading the Navigation Display (ND) with too much traffic related information. This is a view which is shared by FLYSAFE. However, in the FLYSAFE long term vision, the proposed solution to display additional traffic functions is not to use an Electronic Flight Bag (EFB) but rather to use prioritised, pilot-selectable display options.

Similarly, the possibility of overloading the FMS was mentioned. Again, this is a view which is shared by FLYSAFE. However, in the FLYSAFE long term vision, the solution lies with enhanced FMS performance.

It was also reported that Weather Information Management Systems (WIMS) data (both forecast and nowcast) will be available to ATC centers and AOCs, and uplinked to aircraft. While uplink to aircraft might take longer to implement, WIMS information will be available to ANSPs before 2020 (perhaps via SWIM), which will benefit flight crews as ATC will be able to divert them around areas of bad weather.

Other major issues brought up included datalink bandwidth and end-user costs, as well as position accuracy and integrity. Finally, there was general consensus that time based separation is strongly preferable to distance based separation.

APPENDIX A : ACRONYMS

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

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

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Airframers:
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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
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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:
Avitronics Research
AVTECH
Deep Blue
Skysoft Portugal
Hovemere
USE2ACES
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APPENDIX E : 2ND FORUM – IMPRESSIONS