



FLYSAFE – WP 7.3

D 7.3-4 Report on Final FLYSAFE Forum

Abstract:

This document is the report on the final FLYSAFE forum, held on the 25th to 26th of March 2009 at the NLR premises in Amsterdam.

The report summarizes the objectives and results of the forum and includes the detailed minutes of the forum.

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Executive Summary

The final FLYSAFE dissemination forum combined with the FLYSAFE presentation day was held on the 25th to 26th of March 2009 at the NLR premises in Amsterdam. The forum has been an event of broad communication and exchange of information. Many current topics in the field of safety in the air traffic system have intensely been debated. Many synergies between various research activities and FLYSAFE have been addressed.

The forum was organised like a conference with presentations, demonstrations and simulator visits in parallel. This introduced the opportunity for all attendees to visit the NLR flight simulator [GRACE], ATC simulator and Tower simulator [NARSIM] facilitating the new FLYSAFE functionalities.

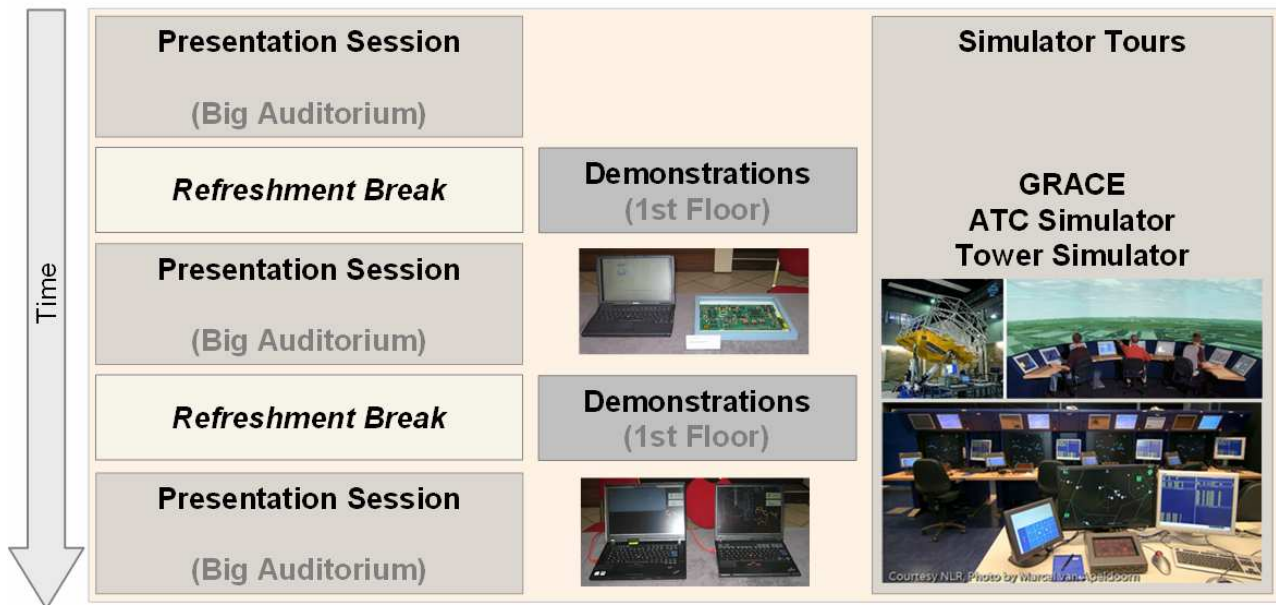


Figure 1: Final Forum structure

The FLYSAFE forum was a unique event to exchange and interact with persons that work in comparable fields of activity and to pass on information to subsequent projects. In addition the press was invited to spread information about the project publicly. A TV spot about this event was sent on the Dutch National News.

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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 by society as unacceptable 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 developed 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 was the first decisive step towards the "VISION 2020" produced by the ACARE, for safety in flight operations. It allowed 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 focused 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 addressed three types of threats: adverse weather conditions, traffic hazards, terrain hazards, and, for each of them, developed new systems and functions, notably: improved situation awareness, advanced warning, alert prioritisation, and an enhanced human-machine interface.

FLYSAFE also developed 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 is presented in an innovative and consistent way to the crew. Innovative prediction capabilities have been deployed, both on board the aircraft and on the ground, to provide warnings about critical flight hazards. This leads into the computation of alternative flight paths to circumnavigate these hazards. The corresponding algorithms are optimised with respect to the simultaneous constraints of safety and airspace capacity.

1.1.3. Description of the work

The project started 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 was 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” developed means to increase the awareness and fidelity on-board aircraft with regard to all major sources of atmospheric hazards (wake vortex, wind-shear, clear air turbulence, icing, and thunderstorm; in addition, information about visibility for helicopter).
- “Traffic hazards” developed 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” developed means to increase the crew terrain and obstacle situation awareness and provide them with alerting for terrain and obstacle hazards along the flight path. Functionalities that assist the crew in avoiding conflicts with terrain and obstacles are also provided.

As part of the NG ISS, innovative system functions have been developed:

- Strategic data consolidation to anticipate any identified risks related to atmospheric phenomena, traffic and terrain, up to 40 minutes ahead 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 wind-shear where an immediate response is required.
- Intelligent Crew Support to provide alerts and advisories for the crew in the event that they make an error or a mistake caused by high workload, fatigue, anxiety, etc, by monitoring flight phase, environment and crew actions.

Standardisation activities undertaken as part of the FLYSAFE project pave the way for the introduction and promotion of future products, thus reducing the time to market. The certification aspects of these new concepts have been 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 are provided by a set of simulator evaluations involving a representative group of pilots. In addition selected system components were tested in flight trials.

1.1.4. Expected results

The project finished the production of a complete safety-related integrated system (NG ISS) that embodies all the innovations. This system has been connected to a test bed. Pilot Evaluations were still going on at the time of the final forum. The target is to evaluate the safety gains obtainable by future marketable systems based on those features.

The Weather Information Management Systems (WIMS) are key outcomes from the project. They have been validated in the project in support of the NG ISS. They will be used in the future 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 have been 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% until the year 2020.

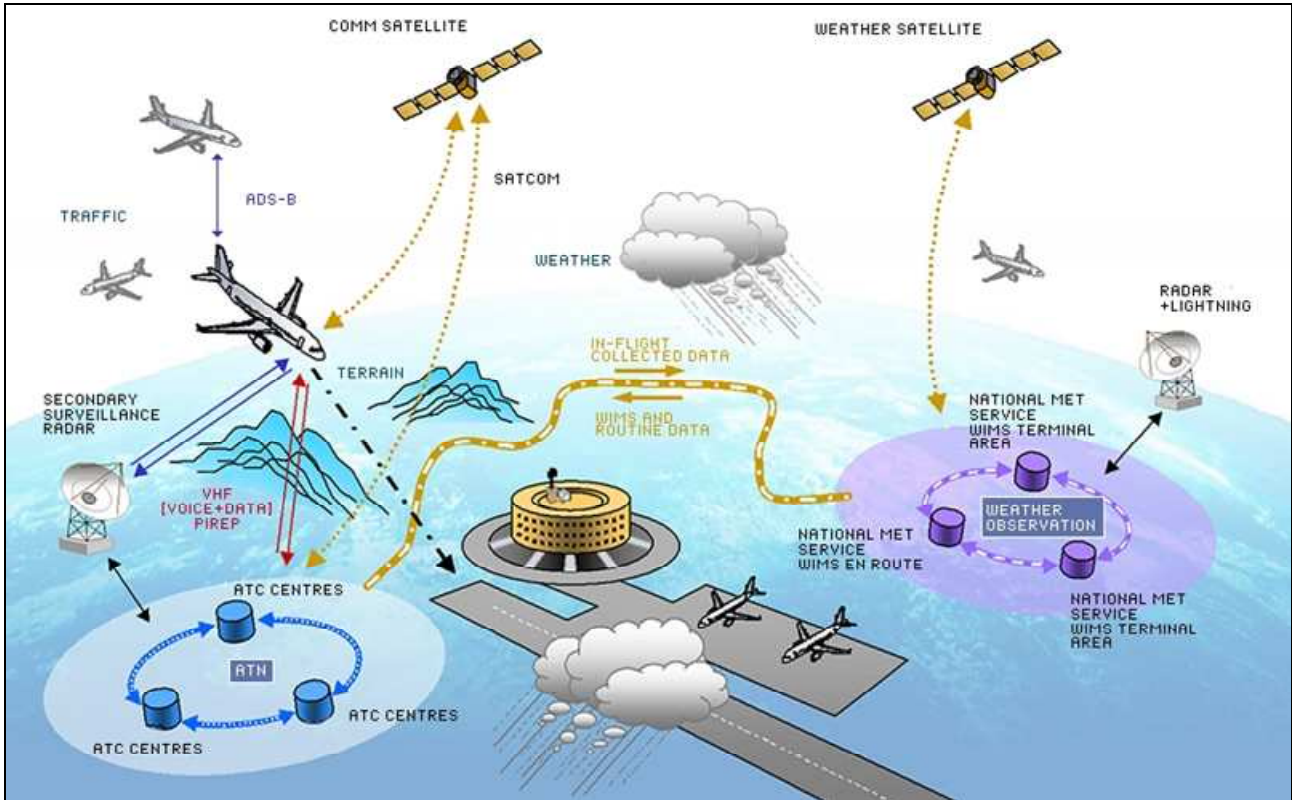


Figure 2: FLYSAFE overall concept

1.2. PURPOSE AND SCOPE

This document is the report on the final FLYSAFE forum, held on the 25th to 26th of March 2009 at the NLR premises in Amsterdam.

The report summarizes the objectives and results of the forum and includes the detailed minutes of the forum.

1.3. DOCUMENT STRUCTURE

This document is divided in 3 main chapters :

- Chapter 1 : **"Introduction"**
- Chapter 2 : **"Final FLYSAFE dissemination forum"**
This chapter describes objectives, agenda and the course of the forum.
- Chapter 3 : **"Minutes of the final FLYSAFE dissemination 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. FINAL FLYSAFE DISSEMINATION FORUM

2.1. PREAMBLE

The FLYSAFE project organised three dissemination forums in total. The target audience, format and content varied through the course of the project.

The first forum was intended to introduce the FLYSAFE project to relevant stakeholders. Specifically, 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 into the design of FLYSAFE systems. Moreover the forum was a platform to identify relevant research projects and initiatives which have overlaps with the FLYSAFE work programme.

The second forum went a step further and showed the 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, the 2nd forum focus was on traffic (hazards & procedures) topics. The FLYSAFE consortium presented the interim results of traffic functionality development and took advantage of open debates with the audience about these mid term results to refine selected aspects of the system.

The third and final dissemination forum (which is the subject of this document) was, in contrast to the first two, an open forum. This forum was held near the end of the project and thus presented the key technologies and concepts developed during FLYSAFE. Furthermore, the FLYSAFE systems were demonstrated in the NLR simulation environment - this is the same environment as that used for the main task evaluation which was taking place on either side of the forum.

2.2. OBJECTIVES

2.2.1. General Objectives

The overall objective of the WP7.3 is to disseminate the publishable results of FLYSAFE and information about the project as widely as possible outside the consortium.

Our main target audience for dissemination are (a) the airlines and air traffic control service providers in their role as end-users, our future customers, and (b) the authorities that will be involved in the required rulemaking, safety assessment and certification of the newly developed on-ground and on board systems.

The final Forum was held in parallel with the FLYSAFE presentation day.

2.3. SPECIFIC OBJECTIVES OF THE FINAL FLYSAFE DISSEMINATION FORUM

The final FLYSAFE forum had the following objectives:

- Dissemination of our publishable results
 - to other projects
 - to EEAG members
 - other external persons that have been involved or interested in FLYSAFE
- To increase the interest in FLYSAFE as a project
- To increase the acceptance of FLYSAFE products and concepts (e.g. WIMS, NG ISS)
- Demonstration of the technological competence of the consortium and every single partner

2.4. SPECIFIC OBJECTIVES OF THE FLYSAFE PRESENTATION DAY

The objectives of the presentation day were:

- Showing the running system of the main task evaluation and the test environment to:
 - European Commission
 - Other projects
 - EEAG members
 - FLYSAFE partners
 - other external persons that have been involved or interested in FLYSAFE
- Demonstration of the technological competence of the consortium

2.5. INVITATIONS

Due to the public nature of the forum a total of 404 persons were sent an invitation. The focus was on members of other projects such as SESAR, CleanSky and ALICIA. Attendees of previous FLYSAFE forums and EEAG members have been invited as well.

For convenience, a website was set up that provided detailed information about the event and venue. Participants were requested to register well in advance to the forum using a form on the website. A total of 110 registrations were received.

2.6. REGISTRATION AND HANDOUTS

During arrival and before the start of the event, all participants were asked to register at the welcome desk where they received a personal badge. As the number of expected persons exceeded the capacity of the boats booked for the social event an image on the reverse of the badge indicated if one was booked for the dinner cruise. Finally all attendees could join the social event.

Each attendee received a registration pack, which consisted of:

- 1 folder in NLR design
- 1 set of presentation handouts
- 1 agenda
- 1 pen
- 1 notepad
- 1 FLYSAFE leaflet

2.7. FORMAT

The bottle-neck for the presentation day was the capacity of the simulators. The total number of guests for the forum and presentation day was expected to exceed 80 persons but the GRACE simulator can only be visited by groups of 8 persons (4 in the simulator, 4 in the control room). In addition either the Tower or the En-Route Radar simulator can be used, depending on the scenario used in GRACE. The objective was to define a structure that minimises waiting times for attendees while allowing everybody to see the simulators.

Therefore a parallel approach was defined. Presentations, Demonstrations and Simulator visits were done in parallel so that the guests could choose areas that were of most interest to them.



Figure 3: Final Forum structure (single half day)

As NLR staff present at the conference had been offered to visit rehearsal sessions, every visitor has been in the position to participate in these sessions.

2.8. ROOM ALLOCATION

The large auditorium at NLR can host up to 120 persons. The room is on the 2nd floor. An elevator for disabled persons is available but the main stream of attendees will have to use the stairs.

On the first floor several smaller rooms are available.

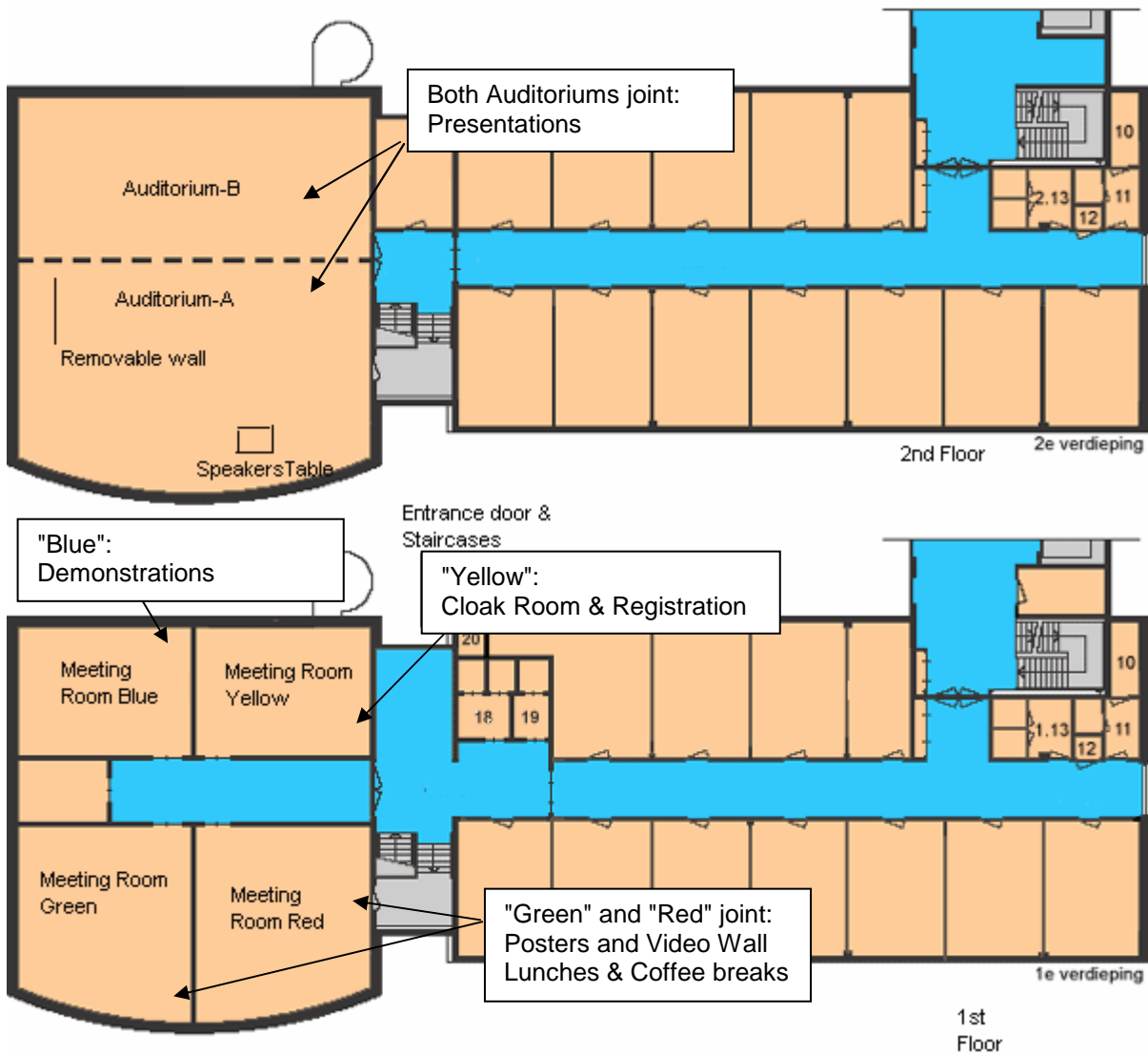


Figure 4: Room allocation

2.9. PRESS SESSION

At the 25th of March starting at 10:30 the press was invited to interview the project coordinator about the project and the final forum. Several Dutch journalists and a camera team joined the press session. In consequence a TV spot was shown on the 25th evening and the 26th in the Dutch National News.

2.10. DEMONSTRATIONS

Several demonstrations were placed in the "Blue" room, as a small exhibition. The room was accessible all the time. During the breaks the responsible FLYSAFE partners were present to answer questions regarding the presentations.

The following demonstrations were prepared: Traffic Demonstration, Weather Demonstration, NG ISS Demonstration (including Intelligent Crew Support and Strategic Data Consolidation Demonstration), a Helicopter Meteo Monitor, a Graphic Generator Demonstration and the FLYSAFE Computer Based Training Tool.

In addition, during the refreshment breaks the FLYSAFE video was shown on a video wall.

2.11. AGENDA

Wednesday the 25th of March 2009

Guests are requested to make appropriate reservations for simulator tours using the list available from the conference secretary during the forum.

Please keep in mind that the simulation facilities are running in parallel to the main conference

11:30	Welcome, registration and light lunch		60'
12:30	Welcome to the FLYSAFE project / Activities and Logistics	Wilfred Rouwhorst	10'
12:40	Welcome to NLR	Fred Abbink (General Director)	15'
12:55	Introduction of EC representative	Stephanie Stolz	05'
13:00	Project Overview	Marc Fabreguettes & Thomas Hauf	45'
13:45	NG ISS Why, what, how	Michael Jirsch	30'
14:15	Refreshment break		30'
14:45	Ground based weather expert systems & NG ISS and weather	Bob Lunnon & Thomas Gerz	45'
15:30	NG ISS and traffic	Derek Jordan	30'
16:00	Refreshment break		30'
16:30	NG ISS and terrain	Laurence Mutuel	30'
17:00	Helicopter NG ISS requirements	Wolfgang Kreitmar-Steck	20'
17:20	Questions and discussion	Wim Huson	40'
18:00	Conference day 1 concludes		

Wednesday night: Social event

DINNER CRUISE

The boats will arrive at the NLR site where you can board at 19:00. The dinner cruise will take 2 hours.

At approx. 20:00 - 20:15 the boats will return to NLR, where you will arrive at 21:00.

Thursday the 26th of March 2009

Guests are requested to make appropriate reservations for simulator tours using the list available from the conference secretary during the forum.

Please keep in mind that the simulation facilities are running in parallel to the main conference

08:30	<i>Registration, Welcome</i>		30'
09:00	Welcome to the second day	Marc Fabreguettes	'5
09:05	Simulation testing	Laurence Mutuel & Wilfred Rouwhorst	45'
09:50	Flight tests; initial results	Patrick Josse, Marcel Verbeek & W. Kreitmair-Steck	45'
10:35	<i>Refreshment break</i>		25'
11:00	Involving the end users and other stakeholders	Wim Huson	30'
11:30	Panel Discussion: Subjects you asked us to cover	Marc Fabreguettes	45'
12:15	FLYSAFE wrap up /initial conclusions	Marc Fabreguettes	15'
12:30	<i>Conference Day 2 Concludes</i>		

A light lunch will be served near the main conference facilities.

2.12. PRESENTATIONS

The presentations were of excellent quality in content as well as in appearance. Electronic copies of all the presentations are provided

- a) in the folder "presentations" if you are viewing this file from the minutes-DVD or
- b) on the FLYSAFE project website (www.eu-flysafe.org)

3. MINUTES OF THE FINAL FLYSAFE DISSEMINATION FORUM

3.1. WELCOME

Rob Ruigrok from NLR replaced Wilfred Rouwhorst who was still involved in the interview with the Dutch press during the welcome. He introduced the Forum organisation and management team who were indicated by a green badge as well and announced the organisation and logistic aspects of the forum.

Afterwards Mr. Fred Abbink, the General Director of NLR gave a short overview about the history of NLR and expressed his positive expectations about the event.

3.2. INTRODUCTION OF EC REPRESENTATIVE

The EC was represented by Stephanie Stoltz standing in for Hans-Josef von den Driesch who was ill. The project reviewers Andreas Eckel and Peter Hecker were present as well.

Stephanie Stoltz stated that FLYSAFE is one of the most expensive projects except for the JTIs (Joint Technology Initiatives). Therefore the EC has high expectations that all investments in focused work will be build into a coherent system that will be demonstrated.

3.3. PROJECT OVERVIEW

The project overview was split into two parts. The general Project overview was given by Mr. Marc Fabreguettes from Thales, who is the project coordinator. The focus was on the working process, general objectives and the interaction with other projects. No questions were raised during the presentation.

The second part went more into the details of the motivation of FLYSAFE and the role of Aviation accidents, efficiency and atmospheric hazards. It was presented by Mr. Thomas Hauf from the Leibniz University of Hanover. The talk explained that with an increasing air traffic volume even with a low, near constant accident rate the risk for an increase in the total number of accidents becomes significant. It was identified that weather hazards contribute to a high number of accidents. Mr. Hauf showed the weather hazards that FLYSAFE addresses and the link between safety and delays caused by weather phenomena.

3.4. NG ISS WHY, WHAT, HOW

Michael Jirsch from Diehl Aerospace presented the Next Generation Integrated Surveillance System which was developed in FLYSAFE. He expressed the importance of Integrated Projects for the Industry, because this is the only opportunity to develop and test integrated functions like the Strategic Data Consolidation of FLYSAFE, which need detailed information about weather, traffic and terrain hazards in a single integrated system. The presentation explained the operation of the Conflict Resolution functions, the Intelligent Crew Support system and the flight deck displays.

3.5. GROUND BASED WEATHER EXPERT SYSTEMS & NG ISS AND WEATHER

This presentation was given in two parts. The first part "Weather Information Management Systems (WIMS) and Onboard Applications I - Clear Air Turbulence and Icing" was presented by Bob Lunnon from the UK Met Office. This part covered the operation of the ground based WIMS products for Clear Air Turbulence and Icing as well as for Routine Weather data and atmospheric state information. The importance for SESAR was highlighted. In addition the onboard weather fusion function was described.

Mr. Thomas Gerz from DLR took over for the second part "Weather Information Management Systems (WIMS) and Onboard Applications II - Aircraft Wake Vortices and Thunderstorms" which focused on ground and onboard prediction of Wake Vortices and Thunderstorms and their impact on safety and capacity.

3.6. NG ISS AND TRAFFIC

Derek Jordan from BAE Systems talked about the traffic functions which have been developed in three strands covering: airport taxi operations, runway operations and Airborne Spacing Applications. Several examples of the traffic functionalities, the output on the displays and alerting were shown.

3.7. NG ISS AND TERRAIN

The presentation about terrain was given by Laurence Mutuel from Thales. The focus was on the new FLYSAFE functions compared with current Terrain Avoidance and Warning Systems (TAWS), the obstacle warning functions and the enhanced terrain displays.

Questions:

Q: (Gerard Temme - Netherlands Civil Aviation Authority): Are you using the terrain database for navigation? These databases are not certified for navigation. How are you going to show that you can use the database for navigation? To avoid traffic/terrain/weather – you change the route, but the data is not reliable enough. You may be heading into hazard.

A: This is an enhancement of TAWS – which is designed for surveillance not navigation – no routing is suggested with respect to terrain. TSAGI did try it (in their Approach Router) – but it is not the intention to use the existing database and certification for navigation. For weather, the project objective is to show functionality. Certification, etc. is a subsequent research area (i.e. after FLYSAFE).

Q: But what if you are hitting the avoid mode?

A: It is then up to the pilot to decide how to avoid – no cues are supplied for direction, just a caution/warning. It is borderline but on the correct side of the line.

Q: (Bob Lunnon to Gerard Temme): How do you recommend certification for weather?

A: (Gerard Temme) Make it so reliable that you are allowed to use it for navigation.

3.8. HELICOPTER NG ISS REQUIREMENTS

The helicopter NG ISS requirements were presented by Mr. Wolfgang Kreitmair-Steck from Eurocopter Germany. The main difference between fixed wing aircraft and rotorcraft regarding the NG ISS is the low operational ground clearance, which requires much higher resolution and accuracy of terrain and obstacle databases. In addition data transfer using a Satcom antenna is much more difficult because of the rapid

movement of the helicopter and because the beam can be blocked by the rotors if not placed carefully. The results of the HMI assessment were shown.

No questions were raised during this presentation, but at the end Mr. Kreitmair-Steck added to the discussion after the previous presentation: we do need a certified terrain and obstacle database, especially for helicopter operations. We need to find ways to validate and certify – we need to make a big effort in this direction.

The first day's presentations ended as planned at 17:20. Participants were asked to use the time to write down questions and comments for the next day's panel discussion. While the last group was visiting the Simulators, others visited the demonstration room until the boats arrived for the dinner cruise. This marked the end of the first day of the FLYSAFE forum.

Day 2 Presentations:

3.9. SIMULATION TESTING

Laurence Mutuel from Thales presented the FLYSAFE approach of part task evaluations (PTE) which was necessary due to the high complexity of the full system. The several PTEs described were performed not only to make the integration of the full system easier, but also to test those functions which did not need the full integrated system. This approach made it easier to manage the main task evaluation.

Lesson learned: While developing complex systems, start by thinking about procedures if you are coupled to an ATC environment.

Wilfred Rouwhorst from NLR took over to present the objectives and the set up of the main task evaluation which was still on-going at the time of the forum. The presentation was rather short because most of the participants had seen the set up already during the simulator tours.

3.10. FLIGHT TESTS

The three flight test presentations were held by Patrick Josse from Météo France, Marcel Verbeek from NLR and Wolfgang Kreitmair-Steck from Eurocopter Germany. The focus was on the set up of each flight test, the objectives and preliminary results (the data which was collected during the flight tests is still being analysed).

Questions:

Q: Bob Lunnon: Geostationary satellites for SATCOM? Is it suitable for remote areas?

A: (Wolfgang K-S) It depends on INMARSAT coverage. We expect coverage will increase over 5-10 years to cover much broader regions. We also expect equipment price will decrease to become affordable for helicopters and small aircraft.

Q: Eric Lussiez: Time of transmission of weather information from ground radar to reception on aircraft?

A: (Wolfgang K-S) Refer to Bob

A: (Bob Lunnon): At present, 5 minute updates in WIMS – total delay (i.e. data latency) is less than 20 minutes. If there is a need for a faster rate, the existing technology can be adapted.

Q (Gerard Temme): Did you also integrate ground proximity alerts with weather and how did you deal with display clutter?

A (Wolfgang K-S / Wilfred R): Not in these flight tests – however we are looking at this as well. FLYSAFE helicopter flight tests focused on WIMS connections to on-board systems. The goal of integrating terrain situation in the cockpit displays was not part of the FLYSAFE helicopter flight tests.

3.11. INVOLVING THE END USERS AND OTHER STAKEHOLDERS

Wim Huson presented the FLYSAFE concept of the External Expert Advisory Group (EEAG) and previous forums which were used to get external parties involved and to make use of external knowledge. He pointed out that this was extremely useful for the project but that the funding of those persons who are not participating to the project is a problem.

Stephanie Stoltz answered that the EC has taken this issue into account by introducing a new category for the involvement of external experts in future research projects. Those activities will be funded by 100%.

3.12. PANEL DISCUSSION

The panel discussion was chaired by the project coordinator Marc Fabreguettes.

Q: How do you minimise display cluttering?

A: (Thierry Ganille): It is difficult to show everything at the same time. Ideas were shown to the EEAG and solutions created shown in PTEs.

Colour coding of TAWS (Green Red Yellow): change into other colours (brown for ground, grey) to distinguish between weather (which retains the Red Green Yellow colours) and terrain.

Show weather as textures and transparencies. This led to interesting results and comments from pilots. We are still looking at this – e.g. dynamic presentation, changing priority.

A: (Wim Huson): In the simulator, you have seen that the pilot cannot tune intensity of different graphic layers (no brightness). This is not the final answer, it is a step in the development.

Q: How does the fusion of CB WIMS data work?

A: (Wim Huson) Data fusion fuses CB bottom and top volumes independently. Fusion computes the spatial correlation of CB volumes and weather radar and outputs those areas that are seen by both inputs as CB fused polygons. In addition, CB fused products add altitudes, severity, direction and trends (from WIMS Raw data).

Q: (Thomas Gerz): In HUD views, there is fused traffic and terrain. Question to pilots "what about weather as well?"

A: (Peter Cox, EEAG): That is too complicated for a HUD view. Better in head down for the Pilot Not Flying (PNF). Manufacturers typically only have one HUD - for the captain. You lose the principle of the PNF monitoring Pilot Flying (PF) if there is only one HUD (should have the same information for both).

A: (Wim Huson): Even large FOV HUDs are limited in scope – if you talk about what is ahead, you also need to see what is around.

Q: (Christoph Vernaleken): Wilfred – what is the initial pilot reaction to traffic displays (ground, air)?

A: (Wilfred Rouwhorst): From the MTE, we need more clutter suppression to filter out traffic. On ground be smart and do not show all aircraft.

Comment (Wim Huson): Please do not brief MTE pilots in advance (*some Air Malta pilots were in the Forum, but not those due to perform MTEs in the next few weeks*).

Q: (Peter Cox): Most pilots fly different aircraft during their career. What steps are being taken to harmonise displays across all types so transfers are easier?

A: (Laurence Mutuel): We are working on standardisation – an SAE group is issuing a draft display recommendation for Weather, etc. which is now stalled because all inputs are American! The FLYSAFE approach is different – it uses polygons to describe hazard areas. The SAE group is waiting for further trials, FLYSAFE results and more implementation in SESAR. Once more mature in EU (data exchange, WIMS,

etc.), SAE will re-issue the current draft. Currently defines mixing of terrain/radar, NOTAM.

Q: (Wilfred Rouwhorst): This has been an overview of FLYSAFE safety aspects. Could you comment on aims for future projects - More depth, new directions?

A: (Bengt Nilsson): Interaction between ATC and cockpit. See more workload to download data to ATC so that they see the same information as crew.

Comment: (Wilfred Rouwhorst): Follow on projects (SESAR, CLEAN SKY) to look at this.

A: (John Rankin, EEAG): In the US, more liaison with dispatchers is common – share same info with them too to allow better slot management.

Comment: (Wilfred Rouwhorst): In FLYSAFE concept, it is foreseen that weather data would be shared with ATC and AOC's Airline Ops Centres.

Comment from EC: Another step in integration for SESAR etc.

Q: (Christoph Vernaleken): Mix of voice/CPDLC in demos. In ICAO, you should have one or the other, not both. What was the rationale for this mix?

A: (Wilfred Rouwhorst): Limitations in MTE equipment. NARSIM is not yet able to handle all CPDLC messages (it was not foreseen earlier in the project). Procedures are not ready yet.

A: (Marc Fabreguettes): EMMA2 is looking at this – integrating air and ground. Choice / handover / phraseology are major topics. Eurocontrol is involved.

A: (Wilfred Rouwhorst): Bear in mind that FLYSAFE not an ATM project – limited to datalink in specific situations.

Q: (Nico de Gelder): More and better info on the flight deck. Must remember that more complex scenarios are needed with more targets, hazards, etc. You must reconsider whether to show everything - this needs more sorting out. Also, separation of CPDLC / radio – pilots can be overloaded and miss vital alerts. Graphics are nice to see in simulator, but in real life it can be difficult to see colours in bright sunlight.

A: (Wim Huson): Some issues were seen in the MTEs. More is not always better – must be smarter. Makes solution more complicated. Software may not be optimum for normal, may need manual adjustment.

Q: (Victor Nesterov) In the presentation, WIMS datalinks use SATCOM. Acceptable for civil aircraft in 10 years time. For Russia, the SATCOM cost is same as the aircraft cost. What about "radio mode" VDL 4 in FLYSAFE?

A: (Wilfred Rouwhorst): There were discussions about datalink format. "Radio mode" VDL 4 not used for a variety of reasons. In the future, we should look at multiple channels.

Q: (Victor Nesterov): Wake vortex showed only used "radio mode" VDL mode 4.

A: (Wilfred Rouwhorst): The choice is not final; it was only for the FLYSAFE Flight Tests. We wanted to show that a full WIMS chain is possible. Datalink protocols are for future projects. Airlines only interested in cost over whole phase of flight.

Comment: (Stephanie Stoltz, EC) SESAR program pressures to force a decision about datalink standards to be made soon for Europe.

Q: Comment to Nikolas. New crew procedures for crew coordination to be needed? Not in FLYSAFE?

A: (Wilfred Rouwhorst): Partly. Every new system needs new procedures, but FLYSAFE ones do fit in. ATC procedures need more attention.

Q: (Bernd Korn, DLR): Safety objectives, looking at strategic. What about TCAS in denser environment? Do we need to look at lateral avoidance in TCAS/ACAS?

A: (Derek Jordan): ACAS was included in the Traffic Specification. During FLYSAFE, SKYSOFT looked at Traffic Data Fusion and ACAS. During function development, work was focused on Traffic Data Fusion because it was on the critical path. Development of ACAS was stopped after the specification phase because of limits on what work could be achieved in the time available.

3.13. EC REVIEWERS COMMENTS

Peter Hecker commented:

This is not the final EC response to the project – more work to be done before the final review in June 2009. Very pleased with event and with results presented. Over last 4 years, we have seen how different functions have been developed. All have very good potential in their domains. It has been an achievement to integrate these functions into the NG ISS. This brings additional quality of support to the Operational users (crews, ATC & AOC). This is the real achievement.

The FLYSAFE Team managed to set up functions and the validation strategy successfully. It was challenging (especially for Flight Trials). FLYSAFE has been successful, but it was only achievable because it was set up as an integrated project.

Technically, the integration of so many different functions into GRACE was highly challenging, but was successful. We are happy about this.

Operationally, involving users (EEAG, etc.) is a good opportunity to get early inputs. Happy to hear EC will fund this in future.

Overall, FLYSAFE has been a big success. Must find ways to transfer concepts, products and recommendations to subsequent programs (e.g. ALICIA)

There are some areas of program improvement. Need further research / work done on very specific areas:

- Interoperability with the European ATM strategy (SESAR)
- Individual technical issues (e.g. fusing data onto display without crew overload)
- Findings translated into products – standardization, certification.
- Involve certification bodies early in product design cycle.

Congratulations to the team for all the work done. Without good team spirit and cooperation, this would not have been possible (FLYSAFE family).

Congratulations to project management – achieving results, supporting tools and team, efficient.

Congratulations to the Forum Hosts (NLR).

3.14. FLYSAFE WRAP UP

Marc Fabreguettes concluded the final FLYSAFE forum with a wrap up of the event. He thanked all professionals who have been working for the common goal:

- All NLR - Crews / Engineers / Supporting services
- Wilfred Rouwhorst (MTE leader and now a TV star!)
- Contributing partners
- Wim Huson, for his tremendous work (he even had to be locked out of the simulator)
- Laurent Meunier (Technical Manager)
- EEAG members for their personal involvements. Sorry for problems (e.g. lack of funding for expenses).
- EC Reviewers & EC (seen as part of consortium)
- All consortium members. Not everything was presented here.
- Post grads.
- Everybody for attending.

Marc Fabreguettes then summarised the FLYSAFE achievements and what will come after FLYSAFE:

- We developed various topics at different Technology Readiness Levels.
- Different Examples of WIMS are now running and available. Further work to be done on implementation and use of WIMS.
- Great enhancements of Terrain warning functions

- Weather displays – all will find a way to the cockpit.
- Runway Collision Avoidance Function, Airport Moving Map should be in next generation. (There is already an AMM on A380).
- FLYSAFE was an aircraft project. The relationship with ATC has to be looked at.
- SESAR – can criticize FLYSAFE for our current approach to the use of secondary flight plan
- FLYSAFE II is not foreseen. (Next call is Level 1 only).
- FLYSAFE concepts may be in SESAR and CLEANSKY.
- Want to make results available for future projects, e.g. ALICIA.
- Material benefits – our concepts have been moving toward mainstream acceptance (dissemination). These concepts will be included in demos by many partners.
- Partners learned how to work together.
- Russian partners invaluable– different approaches – learning experience.
- Lessons were learned.

Recommendations:

Level 2 projects are a good mechanism to integrate concepts in complex systems. Level 2 projects are big enough to create new paradigms for concepts and technology, and to evaluate, flight test, be resilient to cover problems, extend research, etc. They have a shorter lifecycle than SESAR, CLEANSKY.

What about life after SESAR? A different instrument is needed for what comes next...

Thanks to the NLR team – Letitia, Wilfred, Adri, ATC team, etc.

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
FME	Meteo France
ICAO	International Civil Aviation Organization
MET	Meteorology
MSAW	Minimum Safe Altitude Warning
NG ISS	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
TA	Traffic Advisory
TAWS	Terrain Awareness and Warning System
TIS-B	Traffic Information Services Broadcast
WIMS	Weather Information Management Systems
WXR	Weather Radar (onboard)

APPENDIX B : LIST OF ATTENDEES

Agusta Westland	Sim Wincott
Air Malta (KM)	Karl Falzon
Air Malta (KM)	Alan Muscat
Air Malta (KM)	Joseph Markham
Air Malta (KM)	Mark Soler
Air Malta (KM)	Mark Attard
Airbus France	Benoit Morizet
Alenia Aeronautica	Molfetta Luciano
Alenia	Stefano Martorana
Amsterdam Air Lines	Ruud Bakker
Atlantis IT Services	Jos Meijer
ATLAS	John Rankin
Austro Control	Markus Kerschbaum
AVITRONICS RESEARCH	Christos KONSTANTINIDIS
AVTECH	Bengt Nilsson
BAE SYSTEMS Avionics Limited	Derek Jordan
BAE SYSTEMS Avionics Limited	Alex Halstead
European Service Network	Neil Maclean
BALPA	Peter Cox
CAA	Gerard Temme
Cranfield University	Jason Gauci
Dassault Aviation	Laurent Francoise
Dassault Aviation	Florence Susset
Deutscher Wetterdiens	Sonja Jirsch
Deutscher Wetterdiens	Thomas Wetter
DGAC	Jean-Claude Albert

Diehl Aerospace GmbH	Michael Jirsch
Diehl Aerospace GmbH	Ronny Knepple
Diehl Aerospace GmbH	Boris Langer
Diehl Aerospace GmbH	Ursula Hoffmann
DLR Oberpfaffenhofen	Thomas Gerz
DLR Oberpfaffenhofen	Arnold Tafferner
DLR Oberpfaffenhofen	Caroline Forster
DLR Oberpfaffenhofen	Vilmar Mollwitz
DLR Braunschweig	Tobias Bauer
DLR Braunschweig	Bernd Korn
DLR Köln	Brigitte Brunner
EADS Deutschland GmbH	Christoph Vernaleken
EC Reviewer	Andreas Eckel
EC Reviewer	Peter Hecker
Eurocontrol	Sven Fraenkel
Eurocopter Deutschland	Wolfgang Kreitmair-Steck
Funkwerk Avionics GmbH	Mika Semann
Galileo Avionica SpA	Claudia Savarino
German pilot's association/IFALPA	Nikolaus Braun
GosNIIAS	Mikhail Kanevsky
GosNIIAS	Ekaterina Lemishchenko
GosNIIAS	Eduard Falkov
Greek ATC	Ourania Chatzialekou
GTD SISTEMAS DE INFORMACIÓN	Florent Birling
GTD SISTEMAS DE INFORMACIÓN	Isidro Bas
Hellenic Aerospace Industry	Nikolaos Priggouris
IVW	Peter Broos
Jeppesen GmbH	Patrick Wipplinger
Jeppesen GmbH	Marco Gartner

LVNL	Dick van Eck
Meteo France	Patrick Josse
ONERA	Muriel Brunet
RNLAF	Bernard Buijs
Rockwell Collins France	Frédérique Azum
Skysoft Portugal	Paulo Fernandes
Technische Universität Braunschweig	Thomas Feuerle
Technische Universität Braunschweig	Shana Schönhals
Technische Universität Darmstadt	Uwe Klingauf
Technische Universität Darmstadt	Nima Barraci
Technische Universität Darmstadt	Carole Urvoy
Thales Air Defense	Frédéric Barbaresco
Thales Air Systems	Daniel Muller
THALES AVIONICS	Marc Fabreguettes
THALES AVIONICS	Laurent Meunier
THALES AVIONICS	Laurence Mutuel
THALES AVIONICS	Hervé Barny
THALES AVIONICS	Thierry Ganille
THALES AVIONICS	Eric Laurent
THALES AVIONICS	Bernard Dubourg
THALES AVIONICS	Eric Hurel
THALES AVIONICS	Alain Verbeke
THALES AVIONICS	Eric Lussiez
THALES AVIONICS	Sébastien Dubois
The University of Malta	Brian Zammit
The University of Malta	Andrew Sammut
UK Met Office	Bob Lunnon
University of Hannover	Thomas Hauf
Universität Trie	Clemens Drüe

Use2Aces	Wim Huson
EC DG XII	Stephanie Stolz
Galileo Avionica SpA	Flavio Fusco
Galileo Avionica SpA	Roberto Bojeri
NLR	Wilfred Rouwhorst
NLR	Adri Marsman
NLR	Rob Ruigrok
NLR	Nico de Gelder
NLR	Jaap Groeneweg
NLR	Bart Heesbeen
NLR	Hafid Smail
NLR	Martijn Stuij
NLR	Con Kranenburg
NLR	Michiel Valens
NLR	Theo Verhoogt
NLR	Marcel Verbeek
NLR	Michiel de Leeuw
NLR	Margriet Klompstra
NLR	Robert Tump
NLR	Joris Field

APPENDIX C : FLYSAFE CONTACTS

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

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Wim Huson (Use2Aces): whuson@use2aces.com

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

APPENDIX D : FLYSAFE CONSORTIUM

THE 36 PARTNERS OF FLYSAFE:

Airframers:

AIRBUS France
AIRBUS Deutschland
Eurocopter Deutschland
Dassault Aviation

System providers:

Thales, 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
Rockwell Collins France
Thales Air Defence

Specialised SMEs:

Avionics Research
AVTECH
Deep Blue
Skysoft Portugal
Hovemere
USE2ACES