Dissemination material from first Future Sky Safety External Workshop

Marcello Amato (CIRA), Angela Vozella (CIRA), Sara Silvagni (DBL), Vera Ferraiuolo (DBL)

Short abstract: Future Sky Safety is a Joint Research Programme (JRP) on Safety, initiated by EREA, the association of European Research Establishments in Aeronautics. The Programme contains two streams of activities: 1) coordination of the safety research programmes of the EREA institutes and 2) collaborative research projects on European safety priorities.

This deliverable is produced by the Project 2 “Dissemination Exploitation and Communication”.

The main objective is to present the main outcomes of the first Future Sky Safety External Workshop.

Programme Manager	M.A. Piers , NLR
Operations Manager	L.J.P. Speijker, NLR
Project Manager (P2)	M. Amato, CIRA
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Contributing partners

Company	Name
DBL	Sara Silvagni
CIRA	Angela Vozella
DBL	Vera Ferraiuolo

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Prepared by: *(name)*	**Company**	**Role**	**Date**
Marcello Amato	CIRA	Main Author	18-12-2017
Sara Silvagni	DBL	Co-Author	18-12-2017
Angela Vozella	CIRA	Co-Author	18-12-2017
Vera Ferraiuolo	DBL	Co-Author	18-12-2017
Checked by: *(name)*	**Company**	**Role**	**Date**
Angela Vozella	CIRA	WP2.1 leader	24-12-2017
Approved by: *(name)*	**Company**	**Role**	**Date**
Marcello Amato	CIRA	Project Manager (P2)	24-12-2017
Lennaert Speijker	NLR	Operations Manager	29-12-2017

Acronyms

Acronym	Definition
ACARE	Advisory Council for Aviation Research in Europe
ANSP	Air National Service Provider
ASRP	Aviation Safety Research Plan
ATM	Air Traffic Management
CEO	Chief Executive Officer
COO	Chief Operating Officer
EACCC	European Aviation Crisis Coordination Cell
EASA	European Aviation Safety Agency
EC	European Commission
EMAS	Engineered Materials Arresting System
ENAC	École Nationale de l'Aviation Civile
EREA	European Research Establishments in Aeronautics
FSS	Future Sky Safety
HMI	Human Machine Interface
HPE	Human Performance Envelope
IATA	International Air Transport Association
NASA	National Aeronautics and Space Administration
R&TD	Research and Technology Development
RO	Risk Observatory
ROPS	Runway Overrun Prevention System
SMS	Safety Management System
SPS	Safe Performance System
SRIA	Strategic Research and Innovation Agenda
WP	Work Package

EXECUTIVE SUMMARY

Problem Area

Dissemination and exploitation of knowledge is a key ingredient for any successful research Programme. In Future Sky Safety (FSS), Dissemination is made through a set of specific, coordinated actions. Several dissemination and communication actions are undertaken for raising wider public participation and awareness, to engage with actors beyond the research community (also non-specialised people) and with the public as a whole. Two External Workshops are organised within the scope of FSS.

In addition to these Programme external dissemination activities, it is important to also timely disseminate results internally within the Programme and with the European Commission and EU-related services. Besides the distribution of reports, deliverables and scientific publications, for this purpose Future Sky Safety organizes two internal workshops on the complete Programme for the whole consortium and EC.

Description of Work

The objective of this document is to present the main outcomes of the first Future Sky Safety External Workshop, together with the material produced for external dissemination of information.

Results & Conclusions

The first FSS External Workshop was held in Brussels, at EUROCONTROL Headquarters, on the 8th and 9th of March, 2017. Aviation safety stakeholders – Regulators, Industry, Research Centres, Universities and members of EC and Nationally funded RTD projects – were invited to attend.

The External Workshop was a unique opportunity for all participants to network and to discuss emerging safety issues, new trends, and progress of aviation safety research. It allowed to be updated on the latest research developments on key topics such as “Reduction of Runway excursion”; “Total aviation system risk prevention and mitigation”; “Reduction of the likelihood of organisational accidents”; “Improvement of pilot performance and reduction of human errors”; “Mitigation of risk of fire, smoke and fumes in modern cabins”.

A poster session was also organised around these five topics, open to students, researchers, projects and all interested participants.

The event was attended by representatives of all FSS projects, as well as by distinct representatives of NASA, the European Commission, EASA, ENAC, and various aviation stakeholders like Easyjet, Airbus, Safe Runway GmbH, etc.

Interesting and fruitful discussions were generated by each presentation, with several interventions from the participants to discuss both the technical aspects of the projects and the more general topics.

A Handout with a summary of the results of the first year of FSS was produced and was appreciated by the participants, with extra copies left for the European Commission.

Lessons learnt from the previous INTERNAL event, such as saving more time for open discussion and facilitating networking, were taken into consideration and implemented.

Overall, the EXTERNAL workshop fully reached its objectives, in terms of participation, awareness of the FSS programme goals and technical progress up to date, and latest research developments on key safety topics.

Applicability

This document supports the dissemination of FSS results, both externally and internally.

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1 INTRODUCTION

1.1. The Programme

FUTURE SKY SAFETY is an EU-funded transport research programme in the field of European aviation safety, with an estimated initial budget of about € 30 million, which brings together 33 European partners to develop new tools and new approaches to aviation safety, initially over a four-year period starting in January 2015. The two main objectives of Future Sky Safety Programme are:

- **Coordination of institutional safety research programmes**, funded by the EREA institutes;
- **Collaborative safety research** on safety risk priority areas (co-funded by the EC).

The research Programme focuses on four main topics:

- Building ultra-resilient vehicles and improving the cabin safety;
- Reducing risk of accidents;
- Improving processes and technologies to achieve near-total control over the safety risks;
- Improving safety performance under unexpected circumstances.

EU is funding specific **Collaborative Safety Research** projects:

- Perform breakthrough safety research to enable a significant reduction of runway excursion risk in the medium term.
- Develop a prototype risk observatory to assess and monitor safety risks throughout the Total Aviation System and allow frequent update of the assessment of risks.
- Reduce the likelihood of organisational accidents in aviation via development and implementation of a Safe Performance System (SPS).
- Define and apply the Human Performance Envelope for cockpit operations and design, and determine methods to recover crew's performance to the centre of the envelope, and consequently to augment this envelope, through HMI principles, procedures or training.
- Develop solutions to mitigate the risk of fire, smoke and fumes-related (fatal) accidents.

Coordination/cooperation of institutional safety research programmes connects and drives the complementary in-house Safety R&TD in the European aeronautical research establishments.

This achieves significant leverage of the invested EU funding through a more efficient and effective use of resources.

The Programme will also help to coordinate the research and innovation agendas of several countries and institutions, as well as to create synergies with other EU initiatives in the field (e.g. SESAR, Clean Sky 2).

Future Sky Safety contributes to the EC Work Programme Topic MG.1.4-2014 Coordinated research and innovation actions targeting the highest levels of safety for European aviation in Call/Area Mobility for Growth – Aviation of Horizon 2020 Societal Challenge Smart, Green and Integrated Transport. Future Sky Safety addresses Safety challenges of the ACARE Strategic Research and Innovation Agenda (SRIA).

1.2. Project context

Dissemination, exploitation and communication of knowledge are key ingredients for any successful research project. Future Sky Safety Project P2 is specifically dedicated to Dissemination, Exploitation and Communication; its goals are to:

- Develop a dissemination plan and communication strategies;
- Disseminate safety research findings to relevant target audience;
- Develop a plan for exploitation of results;
- Develop a knowledge and data management policy and approach;
- Assess dissemination activities.

Project P2 ensures that all aspects of dissemination are efficiently and effectively managed over the entire duration of the project, aiming at communicating in a consistent and distinctive way, while engaging and involving different categories of audiences. In this context, an appropriate strategy for the dissemination assessment, with specific quantifiable targets needs to be developed and implemented.

1.3. Research objectives

The objective of this document is to present the main outcomes of the first Future Sky Safety EXTERNAL Workshop, together with the material produced to improve the internal dissemination of information. This Workshop was held in Brussels, at EUROCONTROL Headquarters, on the 8th and 9th of March, 2017. Aviation safety stakeholders – Regulators, Industry, Research Centres, Universities and members of EC and National funded RTD projects – were invited to attend.

The document also reports the dissemination actions undertaken to promote the event, and the dissemination material produced for the workshop participants.

1.4. Approach

A summary of the event and dissemination material is included in this report. The presentations are available on the specific section of the Future Sky Safety web site, specific links to download each presentation and poster is provided).

1.5. Structure of the document

Section 2 presents an overview of the first EXTERNAL Workshop. Section 2.1 reports the detailed minutes of the Consortium Workshop, including the dissemination material produced for the event.

Section 3 reports the main conclusions and lessons learnt from the event, together with recommendations for future FSS Workshops.

Appendices include the list of participants to the Consortium Workshop (Appendix A).

2 FIRST FUTURE SKY SAFETY EXTERNAL WORKSHOP

The First Future Sky Safety EXTERNAL Workshop was held on the 8th and 9th of March 2017, kindly hosted by EUROCONTROL at the Headquarters in Brussels.

The event was promoted via email (see in Figure 1 the save the date) and through the project website, with a page specifically dedicated to the workshop: https://www.futuresky-safety.eu/1st-future-sky-safety-public-workshop

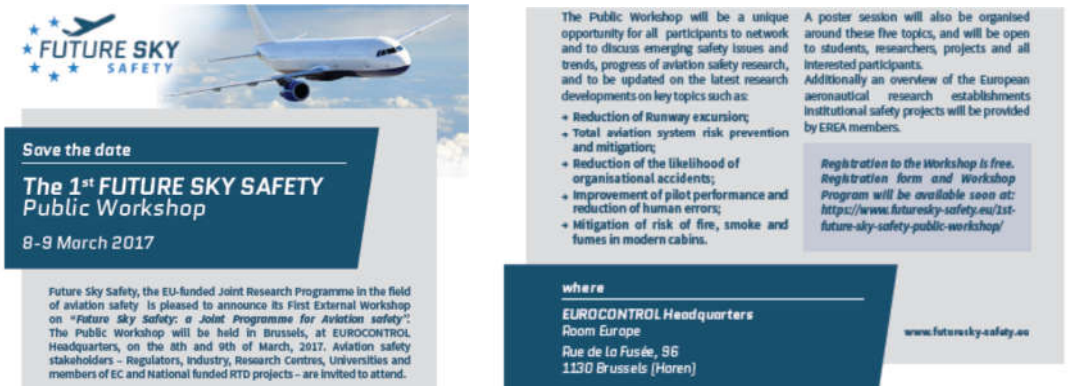

Figure 1: Invitation to the 1st Future Sky Safety EXTERNAL Workshop

2.1. The Overall Agenda

The External Workshop was a unique opportunity for all participants to network and to discuss emerging safety issues and trends, progress of aviation safety research, and to be updated on the latest research developments on topics related to the five EC funded collaborative projects initiated within Future Sky Safety (P3, P4, P5, P6, P7):

- Reduction of Runway excursions (P3);
- Total aviation system risk prevention and mitigation (P4);
- Reduction of the likelihood of organisational accidents (P5);
- Improvement of pilot performance and reduction of human errors (P6);
- Mitigation of risk of fire, smoke and fumes in modern cabins (P7).

The workshop was split into two days to properly cover the five technical areas. A poster session was organised around these five topics, open to students, researchers, projects and all interested participants. The following posters were presented during dedicated networking sessions along the two days of the workshop:

- *P4 poster* – Physical models for the prediction of incident probabilities
- *P5 poster* – The Safety Dashboard user group
- *P5 poster* – Organisational capability of agile response to crises
- *P7 poster* – Geopolymer composites

- *RETINA poster* – Augmented and virtual reality in the airport control tower: the RETINA concept

The event was attended by representatives of all FSS projects, as well as by distinct representatives of NASA, the European Commission, EASA, ENAC, and various aviation stakeholders like Easyjet, Airbus, Safe Runway GmbH, etc. More specifically:

- 109 people subscribed to the workshop;
- 72 people attended the workshop;
- most of the people attended both days;
- only 8 out of 72 people attended the workshop during only one day.

The Agenda was organised in the following sessions:

- opening session;
- five technical sessions around the FSS funded projects;
- two dedicated poster sessions;
- closing session.

The opening session included three presentations:

- Welcome & Introduction given by INEA;
- Safety research overview by EASA;
- Future Sky Safety Programme by the FSS Programme coordinator.

The technical sessions were meant to provide highlights on scientific and technical developments in the five FSS areas, including lectures from experts of the field and presentations illustrating progress achieved in the specific FSS Projects. Each session had a dedicated 25 minutes slot for round-the-table discussions; this approach gave the opportunity to have an effective exchange of opinions amongst participants, and opened up to networking opportunities.

The poster sessions were dedicated to both networking and discussing the technical content of the posters. These sessions were held during the workshop to ensure an appropriate attendance and a real and effective opportunity to network both within the FSS consortium and towards the external stakeholders.

The closing session had a lecture dedicated to “how European research contributes to aviation safety” by Prof. Frederik Abbink. Finally, the FSS Programme coordinator gave a wrap-up of the workshop with main conclusions.

Figure 2: Agenda of the 1st EXTERNAL Workshop – 8-9 March 2017

Day 1		
Time	**Title**	**Speaker**
9:00-9:30	Registration and coffee	
9:30-9:50	Welcome & Introduction	Daniele Violato – **INEA EC**
9:50-10:10	Safety research overview	Emmanuel Isambert **EASA**
10:10-10:45	Future Sky Safety Programme (including FS)	Michel Piers – **NLR**
10:45-11:15	Poster session and Coffee break	
11:15-13:00	***1st Technical session "Runway Excursion"***	
	2016 World wide runway occurrences costs (20')	Capt. Rob van Eekeren – **Safe-Runway GmbH**
	Aerodynamic analysis for two A/C generic configuration at high side slip crosswind gust & Basic CFD simulation for a wheel in hydroplaning effects (20')	Gabriel Cojocaru – **INCAS**
	"Big data Analytics" of braking distance at Paris-CDG airport (20')	Frédéric Barbaresco – **Thales**
	How Can We Reduce Runway Excursion Risk? (20')	Gerard van Es – **NLR**
	Roundtable questions & answers	**Chairman:** Gerard van Es – **NLR**
13:00-14:00	Lunch	
14:00-15:45	***2nd Technical session "Total aviation system risk prevention and mitigation"***	
	EASA Data4Safety (20')	TBC
	The Risk Observatory: strengthening the ability to monitor safety performance (20')	Joram Verstraeten – **NLR**
	Risk modelling: from safety data to a risk picture (20')	Marta Llobet Lopez – **EUROCONTROL**
	Big data for aviation safety (20')	Gerben van Baren – **NLR**
	Roundtable questions & answers	**Chairman:** Joram Verstraeten – **NLR**
15:45-16:15	Poster session and Coffee break	
16:15-17:30	***3rd Technical session "Resolving the organisational accidents"***	
	'EasyJet's experience of its first safety culture survey' (20')	Sian Blanchard and Jim Pegram – **easyJet**

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	Expanding safety culture across the aviation spectrum (20')	Tom Reader – **London School of Economics**
	Safety intelligence and middle managers – the undiscovered country? (20')	Corinne Bieder – **Airbus**/**ENAC**
	Roundtable questions & answers	**Chairman:** Barry Kirwan – **(EUROCONTROL)**
17:30-17:45	Day 1 closure and wrap-up	**NLR**

Day 2		
Time	**Title**	**Speaker**
8:45-9:00	Registration and coffee	
9:00-9:15	Introduction to Day 2	**NLR**
9:15-10:30	***4th Technical session "Human Performance Envelope"***	
	Charting the Human Performance Envelope – a US-ATM perspective (20')	Dr. Tamsyn Edwards – **NASA Ames**
	Charting the Human Performance Envelope: Results from simulator experiments (20')	Alia Lemkaddem – **CSEM**
	Designing the future pilot for the future sky (20')	Frederik Mohrmann – **NLR**
	Roundtable questions & answers	**Chairman:** Marcus Biella – **DLR**
10:30:-11:00	Poster session and Coffee break	
11:00-12:45	***5th Technical session "Mitigating the Risk Of Fire Smoke & Fumes"***	
	How to protect aircraft against fire with an intumescent cake? (20')	Pr. Serge Bourbigot – **University of Lille**
	Fire properties and behaviour of primary structure composite materials (20')	Julien Berthe and Gilian Leplat – **ONERA**
	Fibre metal laminates for improved structural behaviour under fire exposure – progress on material development and testing within WP7.2. (20')	Martin Liebisch – **DLR**
	Fire behaviour of composite materials: ONERA contributions to the development of experimental and numerical methods (20')	Cédric Huchette and Gilian Leplat – **ONERA**
	Roundtable questions & answers	**Chairman:** Eric Deletombe –

		ONERA
12:45-14:00	Lunch	
14:00-14:30	Workshop wrap-up and future of Aviation research	**NLR**

Figure 3: 1st Future Sky Safety EXTERNAL Workshop – Dissemination Material

Figure 4: Photos from the 1st EXTERNAL Future Sky Safety Workshop

2.2. Workshop Material

Links to each presentation and poster are provided in the table below. All the material from the workshop can also be downloaded from the Future Sky Safety web site: https://www.futuresky-safety.eu/1st-future-sky-safety-public-workshop.

PRESENTATIONS – DAY 1

- Developing Safety Research: Views from a Regulator, by Emmanuel Isambert, EASA.
- Program Overview, by Michel Piers, NLR.
- Cost-benefit Analysis of runway occurrences, by Rob van Eekeren, Safe-Runway GmbH.
- Aerodynamic analysis of aircraft at high sideslip crosswind gust & simulation of hydroplaning effects, by Gabriel Cojocaru, INCAS.
- "Big data Analytics" of braking distance at Paris-CDG airport, by Gilles Beauquet, Thales
- How can we reduce runway excursion risk? by Gerard van Es, NLR
- Data4Safety. The European Big Data Programme for Aviation Safety, by Emmanuel Isambert, EASA
- The Risk Observatory. Strengthening the ability to monitor safety performance, by Joram Verstraeten, NLR.
- Risk modelling: from safety data to a risk picture, by Marta Llobet Lopez, EUROCONTROL
- Big data for improving aerospace safety, by Gerben van Baren, NLR.
- EasyJet's experience of our first safety culture survey, by Siân Blanchard and David Cross, EasyJet.
- Airline safety culture: A pan-European survey study of pilots, by Dr Tom Reader, London School of Economics.
- Safety intelligence and middle managers – the undiscovered country? by Corinne Bieder, Airbus/ENAC.

PRESENTATIONS – DAY 2

- Using the Human Performance Envelope to inform Future Trajectory Based Operations, by Dr Tamsyn Edwards, NASA Ames
- Charting the Human Performance Envelope: Results from simulator experiments, by Alia Lemkaddem, CSEM
- Designing the future pilot for the future sky, by Frederik Mohrmann, NLR
- How to protect aircraft against fire with an intumescent cake? by Serge Bourbigot, University of Lille
- Fire properties and behaviour of composite materials, by Gillian Leplat and Julien Berthe, ONERA
- Fibre metal laminates for improved structural behaviour under fire exposure, by Martin Liebisch, DLR
- How European Research contributes to Aviation Safety, by Frederik Abbink, Abbink Aviation Consultancy

HANDOUT

Future Sky Safety Handout

POSTERS

- P4 poster – Physical models for the prediction of incident probabilities
- P5 poster – The Safety Dashboard user group
- P5 poster – Organisational capability of agile response to crises
- P7 poster – Geopolymer composites
- RETINA poster – Augmented and virtual reality in the airport control tower: the RETINA concept

Figure 5: Download section from the Future Sky Safety website

In order to raise participants' awareness on the achievements of the FSS programme, the projects' handout was updated and a second issue distributed; the first issue of the handout was distributed during the 1st Internal FSS Workshop.

2.3. Highlights from presentations and discussion

Here some highlights from the presentations and resulting discussion are reported.

For a complete review, please check the available slides on the FSS website as referred above.

2.3.1. Opening Session

2.3.1.1. Welcome & Introduction (Daniele Violato - INEA)

The role of INEA and EC Directorates was highlighted:

- single point access point for programmes;
- positioning with respect to Aviation R&I family.

INEA is getting the monitoring of more and more projects in aviation and also specifically in Safety:

- FSS, as the largest effort in H2020 dedicated to Safety.
- EUNADICS-AV European Natural Airborne Disaster Information and coordination system for aviation.
- SafeClouds.eu: Sharing data to make aviation safer: data mining combined with smart representation of data.
- SARAH: increased safety and robust certification for ditching of aircraft and helicopters
- PHOBIC2ICE: super ice-Phobic surfaces to prevent ice formation on aircraft (EU Aviation Workshop at the end of March).
- Vision: validation of integrated safety enhanced intelligent flight control.

INEA needs experts for proposal evaluation.

D. Violato made very positive comments on the FSS Workshop: "impressive quality of speakers and relevant topics will be treated in the workshop".

2.3.1.2. Safety research overview by EASA (Emmanuel Isambert - EASA)

EASA provided a perspective on Safety Research from the point of view of Safety Regulators

- THE PAST - Research initiated in reaction to safety events: unexpected failures
- Key issues to tackle
  - Involvement of stakeholders
  - getting pro-active
  - balancing short-term vs. long-term
  - follow-up actions until deployment
- Challenging EU Context
  - limited funding

- fragmented initiatives
- low visibility of achievement

- Have a long term vision
  - FP2050 – SRIA: Challenges and Goals
  - Future Vision of Safety: Human Organization factors
    - safety intelligence
    - safe operation
    - safe design manufacturing
    - safe governance

- Building on identified safety risks
  - identification of safety issues
  - assessment of safety issues
  - definition and programming of safety actions
  - implementation and follow up
  - safety performance measurements

- The analysis is resulting in two important documents:
  - EASA - Annual Safety Review
  - EASA - European Plan for Aviation Safety

- The European Safety risk management Cycle
  - Collaboration work with experts from industry and MSs
  - Identify safety priorities
  - Connect safety intelligence with actions

- The European Plan for Aviation Safety
  - includes rulemaking, safety promotion, focused oversight and research actions

- EASA involvement in Safety Research
  - Main ambition
    - strengthen the coordination of safety research with aviation stakeholders
    - prepare evolution of aviation standards
    - support innovation
    - address urgent research areas
  - Building on existing initiatives and research programming processes
  - Involving EASA teams of domain experts

- EASA current actions
  - Identify research need from EU level safety risk a management
    - operational issues
    - systematic issues
    - emerging issues
    - assist innovation programs H2020 national programs
    - assess safety challenges, research themes proposed
    - advise projects

2.3.1.3. Future Sky Safety Programme by the FSS Programme coordinator (Michel Piers - NLR)

An overview of the FSS Programme was provided.

- FSS in a nutshell
  - H2020 –Coordinated research & innovation for aviation safety
  - EREA Future Sky Initiative - Two main activities:

        - Research into specific safety topics
        - Research coordination
    - A strong consortium: 33 partners – research, industry & academia
    - Duration: 48 months
    - Budget: 25M€ budget (15 M€ EU)
- Overview of the projects
    - P1 coordination of institutional programs
    - P2 Dissemination and Communication
    - Technical Projects summary
- Will FSS improve safety?
    - FSS addressing key safety risks
    - Focusing formidable R&TD resources
    - Connecting science to impact
    - Amplifying the European safety strategies
    - Striking the right risk – reward balance

2.3.2. Session on Runway Excursions (P3)

2.3.2.1. Cost-benefit Analysis of runway occurrences (Rob van Eekeren- Safe-Runway GmbH)

- Three runway issues every month.
- Despite all prevention measures runway excursions occur!
- The Return Of Investment (ROI) of additional prevention solutions can become negative: we have to find a way to overcome the problem.
- Runway grooving is not a standard RESA (Runway End Safety Area): why NOT?
- Balance between costs and benefits: we need a model to show what can be done
- 643 identified runway accidents
    - 52% GA
    - 18% commercial A/C
    - 6.5 billion dollars total cost.
- Aircraft operators have the main responsibility to reduce the probability of events but also the severity
- Was it cost effective to bring a non ICAO RESA to the right standard by EMAS?
    - Analysis is showing a large advantage on all the analysed cases
    - Large reduction of severity was achieved
- Incursion is not the right problem to address: EXCURSION IS
- Special attention to regional aerodromes
- Reduction of injuries for General Aviation (GA)
- Include severity reduction in runway risk reduction policies

2.3.2.2. *"Aerodynamic analysis of aircraft at high sideslip crosswind gust & simulation of hydroplaning effects (Gabriel Cojocaru, INCAS)*

- This work is performed within P4 FSS project.
- A CFD analysis of an A/C in Crosswind Aerodynamics is presented.
- CFD methodology, grid independence and Results are discussed in detail.
- Furthermore a specific analysis of Hydroplaning Effects of an A/C is presented.
- Tyre models, CFD methodology and progress of work is illustrated.

2.3.2.3. *"Big data Analytics" of braking distance at Paris-CDG airport (Gilles Beauquet- Thales)*

- Dry stop vs wet stop distances analysis
- Are the models accurate?
- Collect a large set of data
- Establish statistics on landing and sort cases to be more explicated
- input; ADSB data, Lidar data, Meteo France data: local sensors and radars (scanning up to 250 km)
- Output: ROT, deceleration, etc.

2.3.2.4. *How can we reduce runway excursion risk? (Gerard van Es - NLR)*

- Two runway excursion per week; 30% of the accidents imply damages to the aircraft
- Excursion by Flight Phases: Landing 79% Take-off 21%
- Causal factors: wet contaminated runway, long landing, speed too high, incorrect decision to land, aquaplaning, tail wind, etc.
- Landing veer-offs causal factors: wet/contaminated runways, crosswind, aircraft directional control not maintained, hard landing, etc.
- To Reduce the excursion risk: Reduce Probability and reduce consequences
- Reduce probability:
  - improve procedures:
  - better training
  - conservative/realistic aircraft performance assessment
  - technology
  - better information
- Assessment of runway condition is not an easy task: what is what on the runway?
- Procedure on how to deal with strong gusts or slippery runways is not easy
- Runway technology: grooved, porous friction course, antiskid concrete
- Reduce consequences: use of runway and runway end safety areas.
  - Use of Area around the runways
  - arresting systems:
    - cables and barricades
    - water ponds

- gravel beds
- foamed plastic
- soft ground arresting systems (EMAS)
- EMAS seems to work properly: 11 successful cases since 1999 (for overrun)

- Involved actors: Operators, Airports, Air Traffic Control, aircraft manufacturers, regulators

2.3.2.5. Session on Runway Excursions - Questions & Answers

- Business model by **Rob van Eekeren**: is it practical? Is it being adopted by somebody?
  - In airports complying with ICAO standard there is a 300m area; the airport could anyhow reduce the official landing area. In previous Military Airports, the RESA are often not there.
- Quality of information available to pilots
  - information is there but sometimes the procedures are missing; the meteorological conditions are also very variable and may not be so accurate (runway condition, gusts strength and direction)
- DG-MOVE :
  - The trade-off between safety and cost is an essential element.
  - The use of real aircraft data would be beneficial: few data on extreme side sleep conditions
- Rob van Eekeren
  - Use 10% of the funds for safety currently used for security and all the problems are solved

2.3.3. Session on Total system risk assessment (P4)

2.3.3.1. Data4Safety. The European Big Data Programme for Aviation Safety (Emmanuel Isambert - EASA)

- The European Big Data Program for Aviation Safety
  - Why
  - What
  - How
- Identification, Assessment and performance -> Data4Safety
- Exchange of data: there is a big interest. From the feasibility study with industry: 53 fully supportive, 39 supportive, 8 with reservation; nobody not supportive.
- The initial Feasibility Study concluded on the need to have a proof of concept phase before going to the potential full deployment
- Proof of concept with a limited number of stakeholders: to confirm expected benefits while testing the technical governance models
- Proof of concept phase is planned over 3 years
- Partnering with research
  - identify relevant projects and check for possible synergies
  - networking with projects; technical exchanges, early lessons
  - assess opportunities for testing solutions
- Proof of concept 2016-2019
- Operational Phase 2019-2020

2.3.3.2. *The Risk Observatory. Strengthening the ability to monitor safety performance, by Joram Verstraeten, NLR.*

- An overview of the P4 objectives, technical activities and progress is provided
- P4 did specify software and hardware requirements
- P4 will deliver a prototype Risk Observatory (RO) for end-users validation and future exploitation
- P4 will deliver a RO organisation business model

2.3.3.3. *Risk Modelling: from safety data to a risk picture (Marta Llobet Lopez - Eurocontrol)*

- Prioritize the risk hazards
- Which are the factors of the hazards
- Model the events
- Fault tree: initiating events, pivotal event 1, pivotal event 2, …
- Safety models for design, aircraft functions and systems, pilot abnormal procedures
  - Event sequence diagrams,
  - physical models,
  - safety models
  - barrier models
- Risk Observatory to get them work together
- Plug in the different models in the risk observatory
  - RO Interface
  - Backbone models
  - domain/specific Models
  - providing a full risk picture
  - showing the contribution to risk from several domains
  - supporting the assessment of risk improvements in the different domains

2.3.3.4. *BIG DATA for improving aerospace safety (Gerben van Baren - NLR)*

- Motivation ICAO and Aviation Safety Plan
- Data driven performance monitoring
- Flight Path Data
  - radar data
  - flight data: ADS-B weather data, airport Infr. data
  - fusion data sources, focus on exposure data
  - convert data into performance information
  - prediction of indicators using historical and actual data, SoA SW and tool-sets
  - analysis visualization of data from occurrence reports
  - text and data mining of occurrence reports
- Use of Data
  - Flight path
  - Flight data monitoring
  - Occurrence
  - Weather

by Information Technologies
- IT infrastructure
- Data mining
- Machine learning
- Text processing
- Visualisation

to get Applications/Information
- Monitoring of performance
- Prediction of indicators
- Learning from occurrence reports

2.3.3.5. Session on Total system risk assessment - Questions & Answers

- Intellectual Property Rights (IPR) of Data?
  - it is a challenge to be overcome
  - there is the will to share data on an equal playground and to get a good feedback
- Use cases?
  - in P4 we adopted use cases tailored to specific end users
- Human Machine Interface (HMI) tailored to the end user?
  - a good HMI tailoring procedure has to be identified
  - EASA: data provider is sitting with the analyst sharing data and results
- Airbus - Intelligence on the data: what about the consistency of the data that are collected in order to have the right benchmarking?
  - P4 is not focusing on proposing a standard but we are accepting the available data as they are currently used.
- Airbus - It is difficult to have a standard for the data in order to have a real benchmarking of the data and results we obtain. For example, we do not know exactly where the aircraft are landing (this could be possible using Global Positioning System (GPS)).
- External Participant - About Open data and big data for security there is an article in the Guardian.
  - In P4 we are looking at Safety not at Security. Interfaces are existing between the different domains: ground operators, etc.
- DG Move - From the presentations on P4, the feeling is that the core element of the Observatory is the analytical core; I would expect some focus on Standards. We are looking at quantitative heterogeneous data.
  - Now P4 is focusing on how to use Safety Data and how to use Risk models and SW architecture
  - P4 will look at how to deal with large amounts of data
  - The focus is on how to use the big data for the modelling
- About getting information and experience from other transport domains or domains in general?
  - CEIAA is working also in other transport modes (scooter sharing modelling)
- D. Violato (EC): A lot of effort on exploiting big data for aviation is being spent; a dialogue with the SafeClouds project is recommended.

2.3.4. Session on Resolving the organisational accident (P5)

2.3.4.1. EasyJet's experience of our first safety culture survey (Siân Blanchard and David Cross - Easy Jet)

- A total system Approach is adopted by the Luton Stack
- FSS P5 Methodology has been adopted
  - Safety Culture Survey
  - Internal workshop
  - Stack workshop
- What we are doing at EasyJet? - Some initiatives include:
  - Pilot Peer Support Programme
  - Independent review of fatigue
  - Schedule and roster – more stability
  - More collaboration on new procedures in the flight deck
  - Human Factors training for safety managers
  - OHS training for base and line maintenance

2.3.4.2. Airline safety culture: A pan-European survey study of pilots (Tom Reader - London School of Economics)

- Safety Culture
- Safety values
- Beliefs (do pilots think managers are committed to safety?
- Behaviours (are pilots reporting incidents)
- Study aims:
  - Identify pilot perceptions on organisational safety culture within the European aviation industry
  - Identify areas were the industry is strong, and areas for improvement
  - Compare the experiences of pilots in different organisations and individual contexts.
- Study Method
  - Data collection
    - Online survey via ECA & Social media
    - Commercial pilots based in Europe
  - Data Analysis
    - Descriptive analysis of survey items
    - Group correlations & comparisons by dimensions (e.g. ANOVAs)
  - findings in 7239 answers (14% response rate – robust sample)
- Conclusions
  - Overall, the average safety culture is good (m=3.49)
    - Positive results for colleague commitment & speaking up
  - Potential improvement/concern areas:
    - Fatigue management
    - Pilots on unsecure contracts
    - Cargo & Low Cost airlines
  - Regulators, airlines and pilot associations need to consider results & ways forward.

2.3.4.3. *Safety Intelligence and middle management - the undiscovered country? (Corinne Bieder - Airbus, ENAC)*

- Middle management: very little study has taken place on this layer, yet they are key for implementing safety culture.
- mindset - What do they think about safety
  - managing information
  - making decisions
  - influencing others
- practices - what do they actually do in their job with respect to safety
- working environment
- overall environment
- mindset
  - safety-related experience (activity or event)
  - no safety no business
- Immediate working environment
  - culture
  - supported by their managers to maintain decisions with safety impact
  - safety first means something vs "delivering on time and within budget is the main target" (1 ps)
- Resources
  - safety experts either within the division or in dedicated groups
  - standard processes
  - data information
- Challenges
  - keep developing experience on the job area and safety expertise build up versus HR policy on mobility
  - developing people safety mindset versus short term cost reduction
  - connecting separate teams e.g. safety and other teams
  - complexity of systems, processes
- Middle Manager safety wisdom consideration are heavily influenced by organisational elements

2.3.4.4. *Session on Resolving the organisational accident Questions & Answers*

- What kind of companies did you look at for the middle manager survey?
  - ENAV, Eurocontrol, Boeing RTE, Airbus

2.3.5. Session on Human Performance Envelope (P6)

2.3.5.1. *Using the Human Performance Envelope to inform Future Trajectory Based Operations (Tamsyn Edwards – NASA Ames)*

- The Future is Trajectory Based Operations
  - ATM remains human centric real time operations
  - 9 key factors in ATC
  - exploration of factors interactions and performance

- What happens at the edge of the performance envelope curve
  - falling behind uncomfortable
  - no plan reliant on colleagues support, blanking others
  - purely reactive unsafe clearance, silence, blacked out, shaken
- Markers are used to indicate edges of performance
  - internal, subjective to the controller
  - external-overt, observable indicators
    - compensation strategy
    - physical change
    - change strategy
    - performance decline
- Summary of Human Performance Envelope findings
  - Factors that influence controller performance (e.g. workload, fatigue) co-vary and appear to interact to create cumulative effect on performance
  - Markers can indicate when controllers are reaching performance limits
  - Findings support a shift towards research investigating multi-factor co-occurrences and performance associations
- Trajectory based operations
  - fundamental shift in Air Traffic Management
  - system resilience is critical
  - knowledge of the causes and mitigations of degradation in TBO must be understood
- brittle systems versus graceful degradation
- framework of graceful degradation
  - identification
  - degradation cause
  - pre-degradation; system design (Fault tolerance, redundancy, automation), environment (airspace design, traffic flows, CONOPS, procedures), Operator (training, HCI, Decision, Support tools)
  - post degradation recovery
- application of the HPE: planning research
  - how do causes of degradation interact ?
  - what are the associations of interactions on controller performance?
  - when can controllers no longer recover the system?
  - the operational envelope?
- Work Programme
  - identify causes of degradation in TBO
  - identify the limits of recovery of the human operator
- Conclusions and implications
  - The Human Performance Envelope uniquely takes into account the multifactorial nature of operational environments
  - The specification of the edges of the envelope can be utilized to predict and prevent performance decline and associated performance related incidents
  - In relation to graceful degradation in TBO, the HPE allows us to understand the problematic nature of only focusing on solving one element of degradation
  - Need to understand limits of system performance AND human performance
  - The HPE can be applied to complex, multifactorial problems to guide areas of research
  - Applying the HPE also enables hypotheses to be made regarding likely human performance outcomes

2.3.5.2. *Charting the Human Performance Envelope: results from simulator experiments (Alia Lemkaddem – CSEM)*

- Physiological data
  - eye tracking glasses
  - two electrocardiograms leads
  - a transthoracic bio-impedance
  - skin temperature
  - accelerometer
  - multichannel PPG sensor
- correlation between physiological parameters and reactions/behaviour: performance
- they are sensitive to the work load and stress

2.3.5.3. *Designing the future pilot for the future sky (Frederick Mohrmann – NLR)*

- HPE in operations
  - what does the HPE concept do in the operational scenario?
  - where are the performance limits of the HPE model?
  - how can we effectively support the HPE?
- Scenario design
  - Situation Awareness
  - Stress
  - Workload
- Pilot flying and pilot monitoring tasks (automatic flying)
- Evidence based training
  - situation awareness
  - problem solving and decision making
  - application of procedure
- Experiments
  - real time analysis
  - post analysis on recorded data
- Next Steps
  - Validation of HPE equation (from indicators to HPE evaluation)
  - Validation of new HMI by evaluating the impact on HPE

2.3.6. Session on Mitigating risks of fire, smoke and fumes (P7)

2.3.6.1. *How to protect aircraft against fire with an intumescent cake? (Serge Bourbigot - Univ. of Lille)*

- Expanding char forming heat and fire barrier
- Fire retardation required to prevent spread of fire
- Fire protection of CFRP
  - full scale tests very long and expensive
  - not relevant for basic research on new materials
  - Silicone-based intumescent coating
    - expandable graphite has special properties

- Small scale test
  - T flame 1100 °C
  - protection by intumescence
- lower temperature and no flames
- very nice aging property as well
- the material expands deforming; and the heat connectivity lowers
- high cohesion thanks to chemical interactions (SiC, Ca-Si)
  - without intumescent coating: the CFRP is delaminated and T after 15 minutes is 550 °C
  - with coating and a proper thickness the reached Temperature after 15 minutes decreases

2.3.6.2. *Fire properties and behaviour of primary structure composite materials (Julien Berthe – ONERA)*

- thermal properties
- chemical properties
- mechanical and thermal behaviour
- fire behaviour
- the objective is to produce experimental database on a reference material -> validation of models and numerical tools
  - independent experiments for specific parameters or combination of parameters.
  - different experiments to characterize the behaviour of material with different heat flux

2.3.6.3. *Fibre metal laminates for improved structural composite materials (Martin Liebisch – DLR)*

- metal laminates to improve behaviour of CFRP
- temperature and smoke density is reduced with the laminate layers
- to be verified
  - the mechanical behaviour under fire conditions
  - the accuracy of modelling and numerical tools
- Conclusions and next steps
  - FST behaviour of cfrp can be improved through integration of metal layers
  - Compression under Fire exposure test to investigate the mechanical behaviour
  - Round-Robin tests
    - Geopolymers @ DLR facility
    - Burn-through tests of FML @ VZLU
- Temperature dependent material models to be verified by static material tests @ different temperatures
- Test simulation by numerical methods

2.3.6.4. *Fire behaviours of composite materials: development of experimental and numerical methods (Cedric Huchette - ONERA)*

- experimental testing
- numerical tools
- multi physics SW for energetics and propulsion evaluation
- a post processing toolbox for kinetics and energetics analysis of decomposing composite materials

2.3.7. Closing Session

2.3.7.1. *How European research contributes to aviation safety (Fred Abbink – Abbink Aviation Consultancy)*

- An interesting overview of safety research funded by EC is provided

3 CONCLUSIONS

The First External Workshop was held in Brussels, at EUROCONTROL Headquarters, on the 8th and 9th of March, 2017. Aviation safety stakeholders – Regulators, Industry, Research Centres, Universities and members of EC and National funded RTD projects – were invited to attend.

The event was attended by representatives of all FSS projects, as well as by distinct representatives of NASA, the European Commission, EASA, ENAC, and various aviation stakeholders like Easyjet, Airbus, Safe Runway GmbH, etc. More specifically:

- 109 people subscribed to the workshop;
- 72 people attended the workshop;
- most of the people attended both days;
- only 8 out of 72 people attended the workshop during one day.

The technical sessions were meant to provide highlights on scientific and technical developments in the five FSS areas including lectures from experts of the field and presentations illustrating progress achieved in the specific FSS Projects. Each session had a dedicated slot for round-the-table discussions; this approach gave the opportunity to have an effective exchange of opinions amongst participants, and opened up to networking opportunities.

A poster session was also organised around these five topics, open to students, researchers, projects and all interested participants. The poster sessions were dedicated to both networking and discussing the technical content of the posters. These sessions were held during the workshop to ensure an appropriate attendance and a real and effective opportunity to network both within the FSS consortium and towards the external stakeholders.
The closing session had a lecture dedicated to “how European research contributes to aviation safety” by Prof. Frederik Abbink. Finally, the FSS Programme coordinator gave a wrap-up of the workshop with main conclusions.
The External Workshop was a unique opportunity for all participants to network and to discuss emerging safety issues, new trends, and progress of aviation safety research. It allowed the participants to be updated on the latest research developments on key topics such as “Reduction of Runway excursions”; “Total aviation system risk prevention and mitigation”; “Reduction of the likelihood of organisational accidents”; “Improvement of pilot performance and reduction of human errors”; and “Mitigation of risk of fire, smoke and fumes in modern cabins”.
Interesting and fruitful discussions were generated by each presentation, with several interventions from the participants to discuss both the technical aspects of the projects and the more general topics.
A Handout with a summary of the results of the first year of FSS was produced and was appreciated by the participants, with extra copies left for the European Commission.

APPENDIX A LIST OF PARTICIPANTS

FUTURE SKY SAFETY PUBLIC WORKSHOP – List of Participants

8-9 March, Brussels

N	SURNAME	NAME	AFFILIATION	SIGNATURE – 8 March	SIGNATURE – 9 March
1	Abbink	Frederik	Abbink Aviation Consultancy		
2	Amato	Marcello	CIRA		
3	Andreev	Evgeny	TsAGI		
4	Atares	Julio	Airbus Defence and Space		
5	Barba	Gustavo	BACUBA, Solutions and Services		
6	Barbaresco	Frederic	Thales Air Systems		
7	Beauquet	Gilles	Thales Air Systems		
8	Berberian	Bruno	ONERA		
9	Bertho	Julien	ONERA		
10	Bettignies-Thiebaux	Beatrice	EUROCONTROL		
11	Biasi	Valentin	ONERA		
12	Bieder	Corinne	Airbus/ENAC		
13	Blanchard	Sian	easyJet		
14	Bos	Drs Ing JGH	TNO		
15	Bourbigot	Serge	University of Lille		
16	Buiting	Tim	NLR		
17	Charlaftis	Angelos	ePAPHOS ADVISORS TEAMWORK		
18	Chintamani	Keshav	imec-IDLab		
19	Cioponea	Radu	EUROCONTROL		
20	Cojocaru	Marius Gabriel	INCAS		
21	Colaço	António	European Commission DGMOVE		
22	Cross	David	easyJet		
23	Cruz Bardera	Daniel	ALG		

24	De Haan	Johannes	EUROCONTROL
25	De Ruytter	Joeri	Honeywell Aerospace
26	Dubois	Paul	Airbus
27	Dziugiel	Bartosz	Institute of Aviation
28	Edwards	Tamsyn	SJSU / NASA
29	Ferraiuolo	Vera	Deep Blue srl
30	Feuvrier	Matthieu	APSYS
31	Fiore	Michelo	Leonardo aircraft
32	Frederix	Florent	European Commission
33	Froment	Pierre	SAFRAN
34	Fumagalli	Andrea	Moverim
35	Goodchild	Clive	BAE Systems
36	Greene	Graham	CAA UK
37	Hiemaux	Olivier	Thales Avionics
38	Hoffmann	Dieter	Airbus
39	Hraška	Matěj	VZLU
40	Huchette	Cédric	ONERA
41	Insúa Ortega	Elena	Airbus Defence and Space
42	Isambert	Emmanuel	EASA
43	Kilner	Andrew	EUROCONTROL
44	Kirwan	Barry	EUROCONTROL
45	Kos	Johan	NLR
46	Kourousis	Kyriakos	University of Limerick
47	Krajenski	Volker	DLR
48	Kunze	Marcus	Cologne Bonn Airport
49	Kyriakopoulos	Michael	European Commission
50	Lee	Yoon Been	KIC-Europe

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51	Lemkaddem	Alia	CSEM		
52	Leplat	Gillian	ONERA		
53	Lieblsch	Martin	DLR		
54	Llobet Lopez	Marta	EUROCONTROL		
55	Lopez	Paula	INNAXIS		
56	Lottl	Simona	SESAR Deployment Management		
57	March	Marta	INTA		
58	Martaus	František	VZLU		
59	Martinez	Ruben	Advanced Logistics Group		
60	Martinotti	Giacomo	Adelfi Consulting		
61	Mašek	Zdeněk	VZLU		
62	Mingels	Ronny	ARTTIC International		
63	Mirra	Gaetano	Leonardo Spa		
64	Mohrmann	Frederik	NLR		
65	Moitas	Mónica	CEliA		
66	Mojsoski	Dejan	EUROCONTROL		
67	Mortágua	João Pedro	CEliA		
68	Niculescu	Mihai	INCAS		
69	Nikanorov	Andrey	State Research Institute of Aviation Systems		
70	Nuotatore	Pietro	Bode		
71	Occhiato	Daniele	Aeroporti di Roma		
72	Oliveira	Manuel	CEliA		
~~73~~	~~Pegram~~	~~Jim~~	~~easyJet~~		
74	Pejovic	Tamara	EUROCONTROL		
75	Perez-Illana	Pablo	European Commission		
76	Perini	Andrea	Toscana Aeroporti S.P.A.		

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77	Piastra	Sergio	University of Bologna		
78	Piers	Michel	NLR		
79	Porter	Russell	NATS		
80	Reader	Tom	London School of Economics		
81	Reis	Ricardo	Embraer Portugal		
82	Reuzeau	Florence	Airbus		
83	Ribeiro	Bernardo	CEiiA		
84	Rodrigues	Mario	Embraer Portugal		
85	Rooseleer	Frederic	EUROCONTROL		
86	Rutten	Alex	NLR		
87	Samyn	Fabienne	University of Lille / UMET		
88	Sickert	Ansgar	ACI Europe		
89	Silvagni	Sara	Deep Blue srl		
90	Slobben	Kaisli Anna	Belgian CAA		
91	Speijker	Lennaert	NLR		
92	Spiliotis	Panos	ACI Europe		
93	Stuhlsatz	Volker	Maastricht-UAC/Eurocontrol		
94	Tranchard	Pauline	UMET-R2Fire Team		
95	Valbonesi	Carlo	Deep Blue srl		
96	van Baren	Gerben	NLR		
97	Van Eekeren	Rob J.N.M.	Safe-Runway GmbH		
98	Van Es	Gerard	NLR		
99	Verstraeten	Joram	NLR		
100	Vieira Junior	Francisco	Embraer Portugal		
101	Violato	Daniele	European Commission INEA		
102	Vozella	Angela	CIRA		
103	Wang	Chong	Technical University of Munich		

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104	Wang	Xiaosong			
105	Wies	Matthias	DLR		
106	Witter	Ian	Heathrow Airport		
107	Woltjer	Rogier	FOI		
108	JOSEFSSON	BILLY	LFV		
109	VU DUC	HOANG	European Commission		