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FUTURE SKY
SAFETY

The title "FUTURE SKY SAFETY" is displayed in a bold, blue, sans-serif font. The words "FUTURE SKY" are on the top line, and "SAFETY" is on the bottom line. The text is surrounded by several blue stars of varying sizes, and a stylized blue airplane icon is positioned above the word "SKY".

Project background

What is FUTURE SKY SAFETY?

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 35 European partners to develop new tools and new approaches to aeronautics safety, initially over four and a half year, starting in January 2015. The first phase of the Programme research 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

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

Who initiated FUTURE SKY SAFETY?

EREA, the association of European Research Establishments in Aeronautics, launched FUTURE SKY: Joint Research Initiatives to prepare the future of aviation beyond the next generation vehicle and air traffic management. FUTURE SKY's overall goal is "Twenty-four-Seven". This concept describes the full airside mobility, 24 hours a day, 7 days a week, resilient against any impacts e.g. from disruptive events like extreme weather, in line with the goals laid down by FlightPath 2050. The first Joint Research Initiative: FUTURE SKY SAFETY, initiated by EREA, builds on the European safety priorities and safety challenges.

What Societal Challenge?

FUTURE SKY SAFETY is an innovative research programme, dealing with Aviation Safety. 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 the Safety challenges of the ACARE Strategic Research and Innovation Agenda (SRIA).





Programme summary

The EC Flight Path 2050 vision aims to achieve the highest levels of safety to ensure that passengers and freight as well as the air transport system and its infrastructure are protected. However, trends in safety performance over the last decade indicate that the ACARE Vision 2020 safety goal of an 80% reduction of the accident rate is not being achieved. A stronger focus on safety is required. FUTURE SKY SAFETY, established under coordination of EREA, is built on European safety priorities, around four main themes with each theme consisting of a small set of Projects.

- Theme 1 (New solutions for today's accidents) aims for breakthrough research with the purpose of enabling a direct, specific, significant risk reduction in the medium term.
- Theme 2 (Strengthening the capability to manage risk) conducts research on processes and technologies to enable the aviation system actors to achieve near-total control over the safety risk in the air transport system.
- Theme 3 (Building ultra resilient systems and operators) conducts research on the improvement of Systems and the Human Operator with the specific aim to improve safety performance under unanticipated circumstances.
- Theme 4 (Building ultra-resilient vehicles), aims at reducing the effect of external hazards on the aerial vehicle integrity, as well as improving the safety of the cabin environment.

To really connect and drive institutionally funded Safety R&D (by EREA) to safety priorities as put forward in FlightPath 2050, the EC ACARE SRIA Safety challenges, and EASA's European Aviation Safety plan (EASp) and, EREA's Safety Research Coordination activities are planned. Focus on key priorities that impact the safety level most will significantly increase the leverage effect of the institutionally funded Safety Research and Innovation actions planned and performed by EREA Institutes.

Projects

The FUTURE SKY SAFETY Programme includes the following Projects:

- P0 Programme Management (lead NLR)
- P1 Coordination of institutionally funded safety research (lead DLR)
- P2 Dissemination, exploitation and communication (lead CIRA)
- P3 Solutions for runway excursions (lead NLR)
- P4 Total system risk assessment (lead NLR)
- P5 Resolving the organizational accident (lead EUROCONTROL)
- P6 Human Performance Envelope (lead DLR)
- P7 Mitigating risk of fire, smoke and fumes (lead ONERA)



The Concept

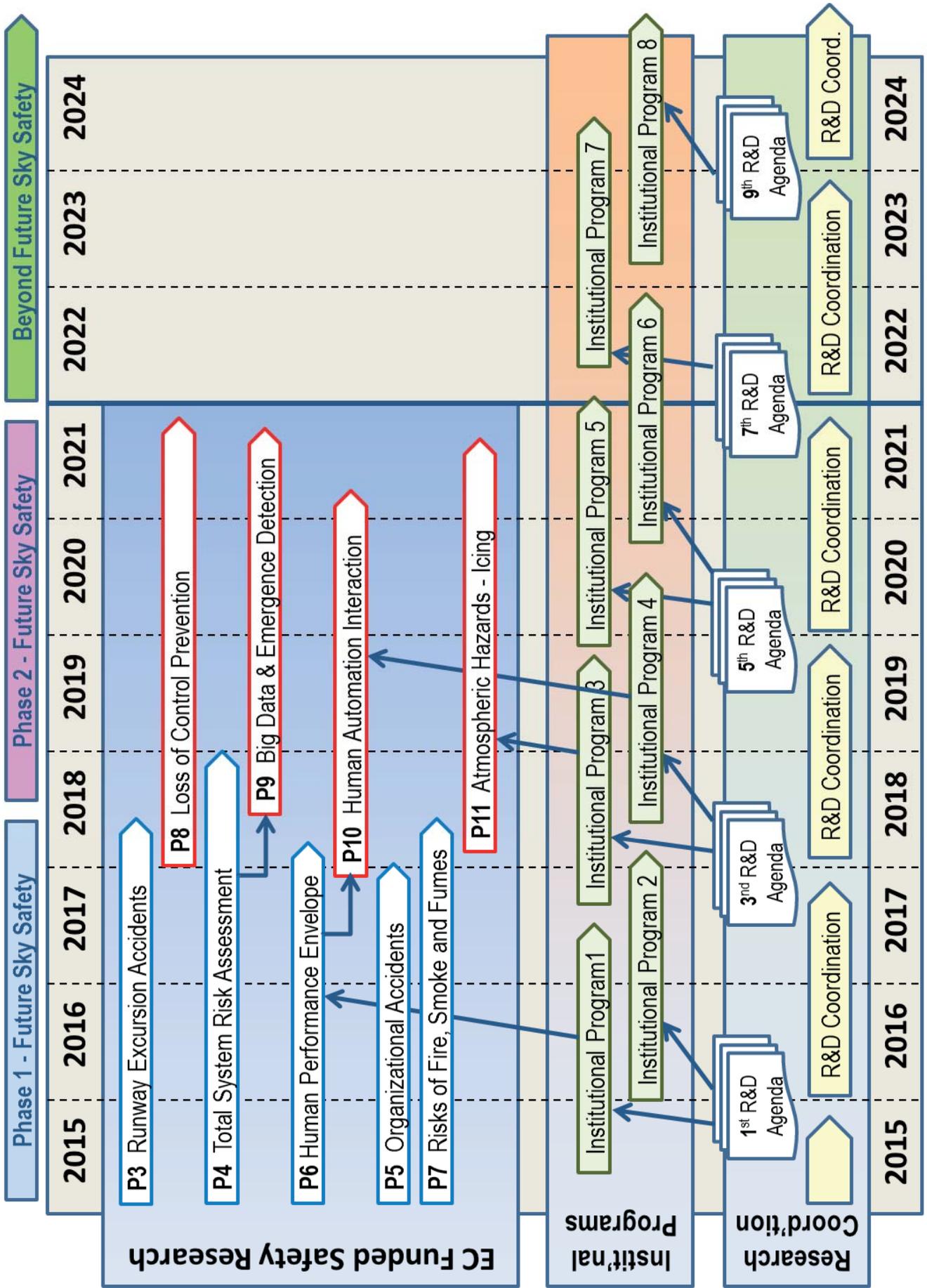
The collaborative safety research Projects in FUTURE SKY SAFETY are built on relevant safety priorities in Europe. Main European safety pillars are defined by ACARE SRIA Safety challenges, EU's Safety Management Policy, and the European Aviation Safety Plan (EASp). The long term aviation vision, issued by the EC as Flight Path 2050, includes safety as one of the most important European priorities: to achieve the highest levels of safety and security to ensure that passengers and freight as well as the air transport system and its infrastructure are protected. The FUTURE SKY SAFETY Programme links the EASp main pillars (operational issues, systemic issues, human performance and emerging issues) to the Flight Path 2050 Safety challenges.

Flight Path 2050 - Challenge 4: Safety Goals



Overall concept of Future Sky Safety

The Roadmap



The Objectives and Projects

The seven specific objectives, each addressed in one Project, are:

- **To coordinate institutional safety research programmes**, and connect and drive institutionally funded Safety R&TD by EREA to safety priorities established by the EC in the ACARE SRIA on Safety and Security.
- **To perform dissemination, exploitation & communication actions**, and maximize impact and use of Results
- **To perform collaborative safety research** on safety risk priority areas. The priorities and objectives are:
 - **Solutions for runway excursions**. Perform breakthrough safety research, in accordance with European Action Plan for the Prevention of Runway Excursions (EAPPRE) priorities, to enable a significant reduction of runway excursion risk.
 - **Total system risk assessment**. 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.
 - **Resolving the organizational accident**. Reduce the likelihood of organisational accidents in aviation via development and implementation of a Safe Performance System.
 - **Human Performance Envelope**. 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 Human Machine Interface principles, procedures or training.
 - **Mitigating risk of fire, smoke and fumes**. Develop solutions to mitigate fire, smoke and fumes related (fatal) accidents.



Theme 1 New solutions for today's accidents

Over half of the fatalities in worldwide commercial air transport occur in only two accident categories: Loss of Control in flight and Runway Excursions. Therefore, the two Projects proposed here focus on these accidents as it may be expected that progress here will have a major impact on the fatality rate.

- For Runway Excursions (P3), the research challenges are already well understood and the expected impact of improvements is in the short and medium term. For this reason, this Project is included in the first phase.
- For the Project on Loss of Control (P8), it is noted that a large program (SUPRA) has already been conducted on the recovery of Loss of Control. Therefore, the Project proposed here is focusing on the prevention element. This Project is proposed for the second phase.



Project P3 - Specific solutions for runway excursion accidents

The objective is to perform breakthrough safety research, in accordance with the EAPPRE priorities, to enable a significant reduction of runway excursion risk in the medium term. The European Action Plan for the Prevention of Runway Excursions (EAPPRE) has identified areas where non-ATM research is needed to further reduce runway excursion risk:

- Flight mechanics of ground operations on slippery runways under crosswind conditions
- Impact of fluid contaminants of varying depth on aircraft stopping performance
- Advanced methods for analysis of flight data to monitor runway excursion risk factors.

A fourth work package will look into new technologies, other than the Runway Overrun Prevention System (ROPS) (e.g. gear technologies, pavement technologies, on-board guidance,) to prevent excursions or the consequences of excursions.



Theme 2 Strengthening the capability to manage risks

There is a need for a holistic, total system approach to aviation safety integrated across all components and stakeholders, supported by new safety management, safety assurance and certification techniques that account for all system developments (FlightPath 2050). Being able to monitor existing and new risks (e.g. emerging from external hazards) is a prerequisite for defining and implementing appropriate mitigation measures to proactively manage risks. To strengthen the capability for pro-active management of safety risks, two Projects are proposed.

- The first one, P4 on Total System Risk Assessment, builds on the progress made in five major programs (CATS in the Netherlands, AIM in SESAR and EUROCONTROL, ISAM and ASIAs in the FAA, and the EC FP7 Project ASCOS) and brings the results of these programs together to develop a permanent risk observatory for Europe. This Project is included in the first phase.
- To also ensure sufficient innovative development and to further strengthen the pro-active capabilities, P9 focuses on Big Data and the detection of Emergence of new risks. This Project is proposed for the second phase.



Project P4 - Total system risk assessment

The objective is to 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. Adequate means for safety risk assessment and safety performance monitoring of large, complex and dynamic systems of sufficient accuracy and depth are not yet available. Explicit representation of latent factors in risk assessment and data, processes and techniques for continuous updating of risk pictures must be developed. The Project builds on existing means for safety risk assessment and continuous safety performance monitoring, and will develop a next generation of safety assessment techniques.

Theme 3 Building ultra-resilient systems and operators

Strengthening the resilience to deal with current and new risks of the humans and the organizations operating the air transport system is a key component of the Project supported by three Projects. Two Projects are aimed at the Human Operator, both on the cockpit.

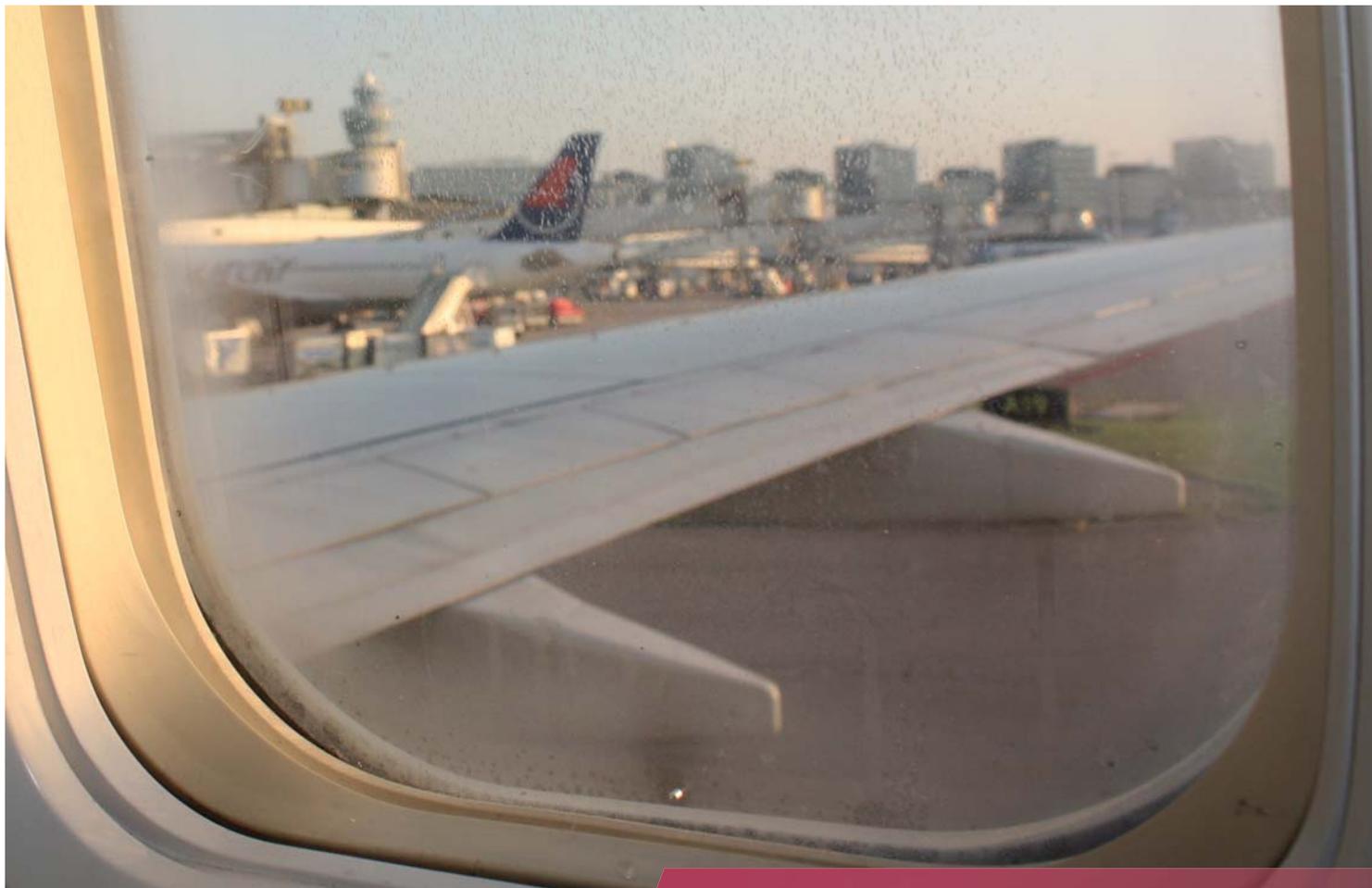
- First Project in this Theme is focusing on what is most probably the most important contributing factor in today's accidents; the organizational factors (P5). While the proposed work is breakthrough research in aviation safety, expected outcomes can be applied almost immediately in air transport organizations. Because of the widespread and short term expected impact, this Project is included in the first phase.
- Project P6 on the Human Performance Envelope builds on a concept previously proposed in the ATM domain. The Impact will primarily be through improved training and operational practices and is thus expected in the short to medium term. This Project is therefore included in the first phase.
- Project P10 is designed to strengthen the cooperation between the human operator and the automated aircraft systems under unanticipated circumstances. This Project is proposed for the second phase.

Project P5 - Resolving the organisational accident

The objective is to reduce the likelihood of organisational accidents in aviation via development and implementation of a Safe Performance System. Safety focus has traditionally been on technical failures and human error as they occur in operations. New and promising approaches consider the overall socio-technical system in the full operational and organizational context. The research addresses effects of organizational structures, processes & cultural phenomena on safety performance in aviation organizations.

Project P6 - Human Performance Envelope

The objective is to define and apply the Human Performance Envelope for cockpit operations and design, and determine methods to recover crew's performance to the center of the envelope, and consequently to augment this envelope, through HMI principles, procedures or training. The Human Performance Envelope is to some extent a new paradigm in Human Factors. Rather than focusing on one or two individual factors (e.g. fatigue, situation awareness,), it considers a range of factors and how they collectively influence performance.



Theme 4 Building the ultra-resilient vehicle

Two Projects under this Theme focus on the safety resilience of the vehicle.

- The first Project P7 is about the risks associated with fire, smoke and fumes in modern technology composite and more-electrical aircraft. This Project will be looking at design aspects which will have an impact in the longer term, but also at more operational aspects of dealing with on-board fires. The results are thus expected to also have significant short term benefits in in the operation for the survivability of fires. As new technology aircraft are currently entering service in greater numbers, this research is needed in the short term and is therefore included in the first phase.
- Project P11 is about Icing, which is still considered the most important environmental threat that could possibly be amplified by global climate change. Because this Project builds on the results of other Projects that are ongoing (such as HAIC) this Project is proposed for the second phase.

Project P7 – Mitigating the risk of fire, smoke & fumes

The objective is to develop solutions to mitigate the risk of fire, smoke and fumes related (fatal) accidents. Important knowledge gaps exist around fire behaviour of CFRP materials for primary structures, and the risks related to fire, smoke & fumes in the modern cabin environment, despite EC FP7 projects such as AircraftFire. The P7 project will improve understanding of fire behaviour of composite materials and explore new generations of mitigating solutions. Possible risks associated with on-board (including cabin) air quality will also be studied by addressing knowledge about the thermo-chemical and thermo-physical decomposition (be it natural or accidental) of materials (incl. materials, fuel, oil, ...) in new generations of aircraft systems, and its measurement when for instance low contamination level or very fast changing ones are considered. Mainly:

- Develop better methods to measure and assess material properties,
- Analyse composite behaviours under various temperature, flame, and load conditions,
- Evaluate numerical models and methods.





Consortium

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Netherlands Aerospace Centre NLR
NLR - Nederlands Lucht- en Ruimtevaartcentrum

Consortium Partners:

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Leonardo
Cranfield University
Trinity College Dublin
Zodiac Aerosafety Systems
Institut Polytechnique de Bordeaux
Koninklijke Luchtvaart Maatschappij
NavBlue



Project details

EU Programme:	Horizon 2020 – Smart, Green and Integrated Transport
EU Topic:	MG1.4-2014 Coordinated research and innovation actions targeting the highest levels of safety for European aviation
EU Call/Area:	Mobility for Growth – Aviation
Type of Action:	Coordinated Research and Innovation Action (RIA)
Estimated Total cost:	30.000.000 EURO
EU contribution:	14.882.894 EURO
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