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Aeronautics and Air Transport Research

7th Framework Programme 2007-2013

Project Synopses - Volume 1

Calls 2007 & 2008

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EUROPEAN COMMISSION

Aeronautics and Air Transport Research

7th Framework Programme 2007-2013

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2010

Directorate-General for Research
Cooperation/Transport (including Aeronautics)

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Greetings from the Commissioner for Science and Research (2004-2009)

'Making the European Union the world's most competitive and dynamic knowledge-based economy': these goals, set by European leaders in the Lisbon Strategy in March 2000, were certainly visionary. They are still fully relevant today. Much has changed in 10 years; the European Union has gained 12 more Member States, we have been hit by a global economic crisis, and our impact on the globe is reaching unsustainable proportions. But as we reflect on our vision from here to 2020, it is clear that the knowledge-based economy must underpin it.

The creation of a seamless **European Research Area**, in which knowledge, ideas and creativity can circulate freely, is therefore becoming ever-more pertinent. ERA will continue to be the overarching aim of European research policy and of our Framework Programme for Research and Technological Development which currently covers 38 countries.

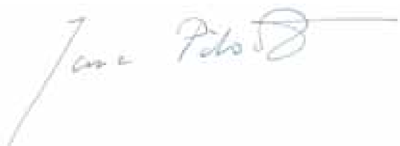
Launched in 2007 to span seven years, the **Seventh Framework Programme** (FP7, 2007-2013) has given a €50 billion boost to the Lisbon Strategy. On a yearly basis, the FP7 budget has almost doubled compared to the FP6 budget. But if we are serious about reaching the target of 3% of GDP invested in research, it will require a similar commitment from all stakeholders, in particular from Member States and industry.

The largest part of the FP7 budget is dedicated to the **'Cooperation'** specific programme (more than €32 billion over the seven years). In FP7, **Aeronautics and Air Transport** (AAT) is part of the 'Transport' theme and the budget for **Collaborative Research** over seven years is close to €1 billion.

To make sure that this money is invested in the most relevant and promising research, we have oriented our work programmes in AAT on the recommendations of the **Advisory Council for Aeronautics Research** (ACARE) Strategic Research Agenda[1]. Our work programme is now focused around: Greening of Air Transport, Increasing Time Efficiency, Ensuring Customer Satisfaction and Safety, Improving Cost Efficiency, Protection of Aircraft and Passengers, and Pioneering the Air Transport of the Future. But we also support cross-cutting activities including, for example, support to SMEs and stimulation of international cooperation.

This book provides you with a concise overview of the projects selected for funding in the first two FP7 Calls for Proposals, with a cumulative indicative budget of €430 million. In addition to these projects, new major initiatives have been introduced on the landscape of EU-funded research. In 2008, the Directorate-General for Research also launched the **Clean Sky Joint Technology Initiative**[2], a public private partnership with a total indicative budget of €1.6 billion (€800 million coming from the European Commission). Clean Sky focuses on the demonstration of green technologies capable of reducing the impact of aviation on the environment. The **SESAR Joint Undertaking**[3] is working towards harmonisation of air traffic management in Europe and supporting the associated research. This is now in its development phase (2008-2014) under the guidance of the Commission's Directorate-General for Transport and Energy.

These are serious responses to serious challenges, and we must maintain our efforts as the challenges grow. Continuously **increasing air traffic** and the associated **pressure exerted on the environment**, strong dependence on oil, the emergence of new strong economic regions and **worldwide competition** are the challenges we must engage with in developing Europe's Air Transport System of the future.



Janez Potočnik
European Commissioner for Science and Research

[1] Strategic Research Agenda 2, www.acare4Europe.com
[2] www.cleansky.eu
[3] www.sesarju.eu

Aeronautics and Air Transport Research in the Seventh Framework Programme

The Aeronautics Unit of the Directorate-General for Research is pleased to provide you with a short description of more than 80 projects funded in the first two Calls for Proposals of the Seventh Framework Programme in the field of Aeronautics and Air Transport.

The book starts with an introduction which gives an overview of the Aeronautics and Air Transport sector plus useful information on the drafting process of the Call for Proposal Work Programmes, the FP7 instruments, the proposal evaluation and selection procedure as well as statistics on the two first Calls for Proposals. A short note on the Clean Sky and SESAR joint undertakings is also provided.

For each project you will then find a short description of the state of the art, the objectives, the work planned during the project and the expected results. The contact details of the project coordinator and the partnership are also provided. We hope that this information will be helpful to research policy-makers, project proposers who are looking to achieve an exhaustive state of the art, and stakeholders in the research community who want to identify ongoing research projects of interest to them or to identify potential partners for future collaboration.

The research projects are grouped by the activities of the Work Programme:

- The Greening of Air Transport;
- Increasing Time Efficiency;
- Ensuring Customer Satisfaction and Safety;
- Improving Cost Efficiency;
- Protection of Aircraft and Passengers;
- Pioneering the Air Transport of the Future.

The last section is a collection of policy-related actions to support, for example, the participation of SMEs, international cooperation in research, etc.

To help with your research, an index is also provided based on the following technical disciplines:

- Flight Physics;
- Aero-structures;
- Propulsion;
- Systems and Equipment;
- Avionics;
- Design Systems and Tools;
- Production;
- Maintenance;
- Flight Management;
- Airports;
- Human Factors.

At the end of the book, indexes by acronyms, partners and instruments are also provided. Contact details of the National Contact Points, whose role is to relay the information on the Seventh Framework Programme in the European Union Member States, are also given. Finally, contact details of the people involved in the following up the projects in the European Commission are also provided.

As the editor of this publication, and on behalf of all my colleagues in the Aeronautics Unit, I wish you a fruitful co-operation in the Seventh Framework Programme.

The Editor

R. D

Rémy Dénos

European Research Area

SEVENTH FRAMEWORK PROGRAMME

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European Aeronautics and Air Transport System

Importance of Air Transport System in Europe

The Air Transport System (ATS), which includes the aeronautics manufacturing industry, airports, airlines and air navigation service providers, is an important economic player all over Europe. Not only does it ensure that people and goods move around but it also generates wealth and jobs.

European aeronautics manufacturing exports ~60% of its total production and is a research intensive sector investing ~12% of its turnover in research and development. Air Transport provides 407 000 direct jobs (2006, [1]) and also plays an important role in other sectors like tourism. In addition to the direct jobs, about 2.6 million indirect jobs can be attributed to air-transport-related activities (2005 , [2]) with a contribution to the European gross domestic product amounting to €241 billion (2006, [3]).

The European Air Transport System (EU-27)

- 407 000 direct jobs in air transport (2006[1], [1])
- 2.6 million indirect jobs (2005[2], [2])
- 4 200 passenger aircraft in service (12/2008, [4])
- 793 million passengers transported (2007, [2])

Society's growing and changing air transport needs

The number of intra-EU air passengers increased about 5% annually between 1995 and 2004 (EU-25, [5]). A growing proportion of the traffic is going to the low-cost air carriers which have increased their share of flights from 3% to 16% in five years (2001-2006, [6]). Therefore, the importance of leisure travel compared to business travel is also growing.

To answer these needs, in the period 2007-2016, an average of 1 213 aircraft deliveries (>100 seats, excluding freighters) has been predicted, 31% of which would be delivered in the Asia-Pacific region (Europe: 24%, North America: 27%, [7]).

This general trend of a continuously growing ATS should not hide the fact that events such as, for example, the terrorist attack of 11/09/2001, fluctuating oil prices and the more recent financial crisis may change the situation suddenly, and a lot of flexibility is required to adapt to these unpredictable events.

Aircraft-related emissions and environmental concerns

Aircraft propulsion relies almost exclusively on the use of hydrocarbon fuels. While emissions like CO_2 are directly coupled to fuel consumption, combustion technology can minimise NO_x emissions and soot production. The impact of other aircraft emissions such as contrails (water vapour) are not yet fully understood and quantified.

The share of direct emissions from aviation was estimated to be 3% of the EU's total greenhouse gas (GHG) emissions in 2006, while the road transport sector's share is of the order of 18%. In contrast to other energy-intensive sectors that have succeeded in stabilising or even decreasing their emissions, the transport sector, and in particular aviation, have not succeeded in offsetting the increase in traffic (see Figure 1), in spite of constant technological progress and high R&D investment (~12% of a company's turnover).

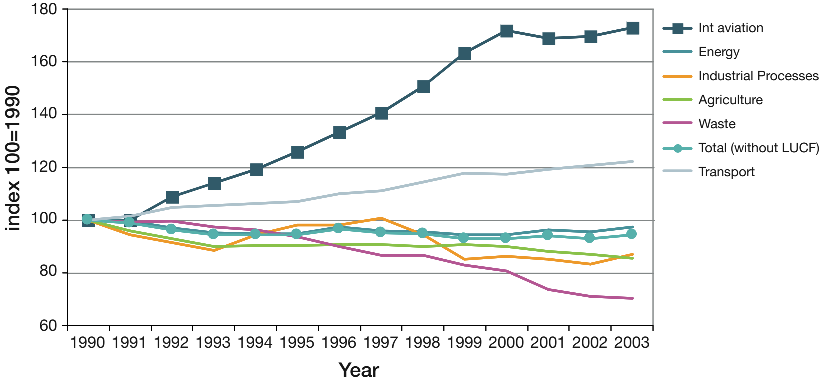
Noise from aircraft is also a concern for populations living in the vicinity of airports. Here also, in spite of quieter aircraft, the increase in traffic results in an overall increase in noise disturbances around EU airports. From 2006 to 2010, it is projected that the number of exposed people in the Lden 55 dB(A) (Level day evening night) contour will grow by about 10% [10].

In response to this, FP7 has put the 'Greening of Air Transport' as the first priority in its Aeronautics and Air Transport theme. The European Commission has also published a Directive to include aviation in the existing EU Emissions Trading Scheme (ETS) [8].

[1] Code NACE 62: Air Transport

[2] Code NACE 63: Supporting and auxiliary transport activities; activities of travel agencies

Figure 1:
EU greenhouse gas emissions by sector referred to year 1990 levels



Time efficiency

Based on the Eurocontrol Performance Review Report 2007 [9], air transport punctuality (on-time performance with respect to schedule) remained at a low level in 2007 (22% of arrival delays >15 min). After a continual deterioration between 2003 and 2006, air transport punctuality stayed nearly constant in 2007, which is an encouraging result in view of the high increase in traffic. This is definitely an area for improvement where the SESAR Joint Undertaking will play an important role.

Safety and security

With increasing traffic and the opening up and interconnecting of national transport networks in an enlarged Europe, it is important to maintain a high level of safety. In 2004, the EU adopted a package of legislation as the first step in creating the so-called 'Single European Sky'. This initiative seeks to promote a more rational organisation of European airspace, increasing capacity while ensuring uniformly high safety standards throughout Europe. It aims to put in place a framework for decision-making and operational improvement that will enhance the efficiency, safety and cost-effectiveness of the system. In 2006, a Regulation was adopted which allows the European Commission to keep European airspace free from airlines and aircraft considered to be unsafe. Since then, the Commission has compiled a list of airlines considered to be unsafe and therefore not permitted to fly passengers or cargo in the EU or to operate within European airspace.

The repeated threats of terrorist attacks in the last few years have also emphasised the need for a high level of security.

Aeronautics and Air Transport Research under the Seventh Framework Programme

Aeronautics and Air Transport Research in the Framework Programmes

Specific aeronautics research at European level was first introduced in 1989, under the Second Framework Programme (FP2), in the form of a pilot programme. The Seventh Framework Programme (2007-20103) was prepared and proposed by the European Commission and adopted via a Co-decision procedure involving the Council and the European Parliament. In FP7, the Aeronautics and

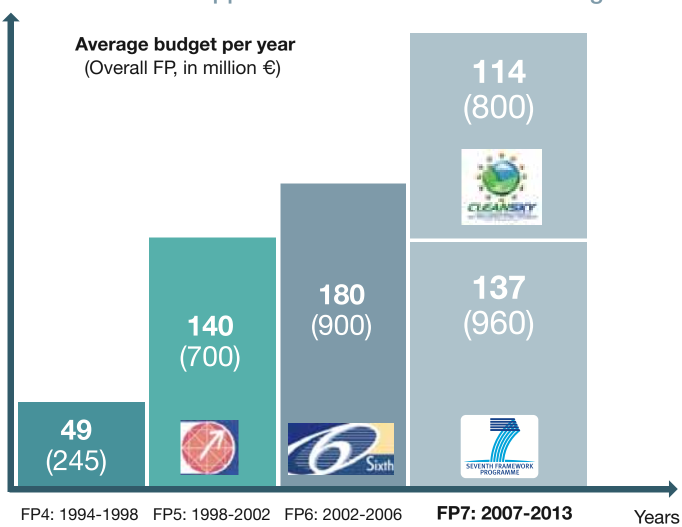
Air Transport theme (AAT) is part of the 'Transport' thematic priority.

As can be seen from the following indicative budget figures, aeronautics research started with modest beginnings to reach today's significant values:

- FP2 (1987-1991): €35 million for a pilot phase aimed at stimulating European collaboration;
- FP3 (1991-1994): €71 million dedicated to a consolidation phase with emphasis on key technical areas;
- FP4 (1994-1998): €245 million focused on industrial competitiveness with increasing emphasis on subjects of wide public interest;
- FP5 (1998-2002): €700 million dedicated to a specific key action aimed at industrial competitiveness and sustainable growth of air transport;
- FP6 (2002-2006), €900 million as a part of the 'Aeronautics and Space' thematic priority (this included budgets from both Directorates-General for Research (DG RTD) and Energy and Transport, DG TREN), with equal focus on issues of public interest and industrial competitiveness; and
- FP7 (2007-2013), €960 million for Collaborative Research focused on reducing the environmental impact of aviation, as well as on the efficiency, competitiveness and safety of the air transport system. Another €800 million is dedicated to the Joint Technology Initiative Clean Sky, also focusing on environmental aspects. Overall, this results in a considerable increase in funding compared to FP6 (see Figure 2). Note that from this same DG RTD Transport budget, another €350 million has been contributed towards financing the SESAR Joint Undertaking.

Since FP2, the EU has funded some 450 projects representing RTD work for a total cost of about €4 billion (i.e. at least €2 billion in EC funding). The total cost of most of the research projects varies typically between €2 and €8 million. However, there are some 30 projects with larger total costs, up to €100 million (Integrated Projects).

Figure 2: Budget evolution of specific aeronautics research in the Framework Programmes. In FP7, an additional €350 million support the SESAR Joint Undertaking



Vision 2020 and the ACARE Strategic Research Agenda

In 2000, a 'Group of Personalities' led by the then Commissioner for Research, Philippe Busquin, issued a report entitled 'European Aeronautics, a Vision for 2020' [11]. The report presents a thoughtful analysis of how a reorganisation of the research in aeronautics could better serve society's needs, and it calls for the setting up of an Advisory Council for Aeronautics Research in Europe (ACARE).

Since then, ACARE has defined and maintains a Strategic Research Agenda (SRA) i.e. a roadmap for research into new technologies which were identified as critical to fulfil the objectives of Vision 2020. ACARE includes a wide range of stakeholders such as Member States, manufacturing industry, airlines, airports, regulators, research establishments, academia, Eurocontrol and the European Commission.

In 2002, ACARE set some of the ambitious goals for the period 2000-2020, in its first Strategic Research Agenda (SRA-1, [12]):

- 50% cut in CO_2 emissions per passenger kilometre;
- 80% reduction in NO_x emissions;
- Halving perceived aircraft noise;
- Five-fold reduction in accident rates;
- An air traffic system capable of handling 16 million flights per year; and
- 99% of flights departing and arriving within 15 minutes of scheduled times.

In 2004, the second issue of the Strategic Research Agenda (SRA-2, [13]) set the following High Level Target Concepts for the future European Air Transport System:

- Highly customer oriented;
- Highly time efficient;
- Highly cost efficient;
- Ultra green; and
- Ultra secure.

In 2008, an Addendum [14] to SRA-2 was published to take into account recent evolutions. In this document, the importance of environmental impact is emphasised yet again with a specific focus on the possibility of using alternative fuels. The importance of a mechanism that can speed up technological progress is underlined, including international co-operation and calls for the development of a longer-term perspective.

Elaboration and scope of the Work Programme

The research actions funded by the European Commission are implemented via Calls for Proposals. The Work Programme is a key document that sets out the objectives and technical content of each Call. It is the result of a broad consultation process that involves many of the stakeholders in the field of Aeronautics and Air Transport (AAT).

The structure of the FP7 Work Programme is in line with the recommendations of ACARE's Strategic Research Agenda 2. The content of the Work Programme also takes into account the observations provided by research centres, universities and industry. It is discussed within the various European Commission's Directorates-General via an inter-service consultation. The Commission also consults an external independent Advisory Group. Finally, the Work Programme integrates the comments and receives the approval of the Programme Committee which represents the Member States and States Associated to FP7.

The AAT Work Programme follows an all-encompassing, global approach to commercial aviation, focusing not only on the improvement of aircraft technologies but also on the infrastructure of the operational environment. The programme covers commercial transport aircraft, ranging from large civil aircraft to regional and business aircraft and rotorcraft, including their systems and components. It also encompasses airborne and ground-based elements of air traffic management and airport operations and a number of general issues, such as international co-operation, knowledge transfer and SME participation. FP7 does not fund military aeronautics research.

The content of the Work Programme is adapted Call after Call to the changing Research and Technological Development scene. Advantage is taken of possible synergies between the Clean Sky and SESAR Joint Undertakings.

Main research areas

Under FP7, the AAT Work Programme proposes six activity lines:

1. The Greening of Air Transport
2. Increasing Time Efficiency
3. Ensuring Customer Satisfaction and Safety
4. Improving Cost Efficiency
5. Protection of Aircraft and Passengers
6. Pioneering the Air Transport of the Future

Within these six Activities, the Work Programme calls for proposals for research projects or coordination actions which answer one or several topics mainly in the following non-exhaustive list of technical domains where research 'Topics' are proposed:

- Flight Physics
- Aero-structures
- Propulsion
- Systems and Equipment
- Avionics
- Design Systems and Tools
- Production
- Maintenance
- Flight Management
- Airports
- Human Factors.

The Call also includes Topics that do not deal with research by themselves but support the programme's implementation in the field of, for example, support to small and medium-sized enterprises (SMEs), improved international co-operation, support for the organisation of conferences, etc.

Seventh Framework Programme: Instruments and Implementation

Research, technological development and demonstration

The path from an idea to a product made available on the market requires many successive phases. Figure 3 illustrates a possible procedure whereby an idea is first investigated at the level of fundamental research. Basic principles are observed and reported then followed by a proposal of a possible application which requires a technological development. This development will lead to a proof of concept, usually tested in a simplified environment and in isolation from the complete system in which the technology is to be used. This enables advancing to the next step: validating the technology in an environment that is more representative of the complete system. In the field of aeronautics, an ensemble of technologies is often tested simultaneously in an experimental ensemble called a demonstrator.

Since the next phase usually sees the start of product development, public funds are normally confined to the support activities of research and technological development up to demonstration but not beyond. As indicated in Figure 3, this evolution usually takes several years. Another measure of this evolution commonly used in industry is the Technology Readiness Level, as described in [15].

FP7 Collaborative research Instruments

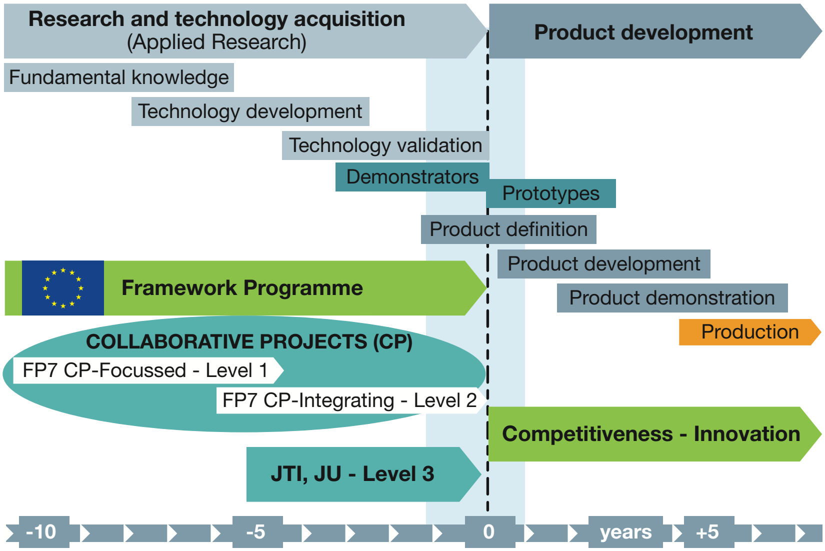
The Aeronautics and Air Transport Work Programme proposes the use of the following range of instruments.

Collaborative Projects (CP-FP or CP-IP)

Focused Projects (CP-FP or Level 1)

This comprises research and technology development activities that range from basic research to the validation of concepts at component or sub-system level in the appropriate environment through analytical and/or experimental means. The objective of these upstream research activities is to improve the technology base with proven concepts and technologies which could eventually be integrated and validated at a higher system level. The number of partners in such a project is typically below 20 and the total cost below €10 million. This instrument is similar to Specific Targeted Research Projects (STREPs) in FP6.

Figure 3:
Research and technological development and product development



Integrated Projects (CP-IP or Level 2)

This comprises research and technology development activities up to higher technology readiness, centred on the multidisciplinary integration and validation of technologies and operations at a system level in the appropriate environment (large-scale flight and/or ground test beds and/or simulators). The objective of these focused downstream research activities is to produce proven multidisciplinary solutions that work reliably in integration at the scale of a system. A typical partnership of such projects involves possibly 20 to 60 partners with a total cost ranging between €10 and €100 million. This instrument can be seen as similar to Integrated Projects (IP) in FP6.

Joint Undertakings or Level 3

This comprises the research and technology development activities up to the highest technology readiness, focusing on the combination of systems and the final proof in the appropriate operational environment of the comprised technologies in a fully integrated system of systems. These activities of full-system technologies demonstration are undertaken in large-scale public-private partnerships especially established for this purpose in specific areas: the 'Clean Sky' Joint Technology Initiative relevant mainly to the Work Programme activity 'The Greening of Air Transport', and to SESAR, Single European Sky Air Traffic Management Research. 'Clean Sky' and SESAR also cover research activities of lower technology readiness levels (i.e. Level 1 and Level 2), where appropriate. The Calls for Proposals for these activities are directly published by Clean Sky and SESAR and are not described in the AAT Work Programme.

In Figure 3, these instruments are positioned along the development line.

Network of Excellence (NoE)

A Network of Excellence is an instrument that was introduced in FP6. In the field of aeronautics, two were selected: ECATS (Environmental Compatible Air Transport System) and EWA (European Wind Tunnel Association). These FP6 projects are described in [16]. This instrument seeks for a sustainable integration of research activities and capacities with the view of creating a European virtual centre of research in a dedicated field. The recommended number of partners is three to seven, with of the project lasting 48-60 months. The Joint Programme of Activities should combine the participants' complementary resources.

Coordination and Support Actions (CSA-CA or CSA-SA)

Coordination and Support Actions do not involve research actions.

Coordination Actions (CSA- CA)

The aim of the CSA-CA is to coordinate research activities and research policies. In many cases, the consortium maintains an updated state of the art of the research landscape and recommends a research strategy in order to fill the research gaps (for example, see further in this book Wakenet3-Europe, in the field of aircraft wake turbulence). This instrument can be used for most of the topics for CP-FP (Level 1). This instrument can be seen as similar to Coordination Actions (CA) in FP6 (see, for example, ELECT-AE, in the field of combustion or X3 Noise in [16]).

Support Actions (CSA-SA)

The CSA-SA can cover a broad spectrum of activities. These can be studies (e.g. FUSETRA, on the potential of seaplanes to increase the possibilities offered by air transport), actions to support the participation of SMEs in the Framework Programme (e.g. Aeroportal), to improve the co-operation with International Cooperation Partner Countries (ICPC, e.g. Aerochina2), and to support the organisation of conferences at European level (Euroturbo 8), etc.

FP7 implementation

Call for Proposals

Within the duration of the Seventh Framework Programme (2007-2013), six Calls for Proposals are planned.

The indicative budgets for the two first Calls in Aeronautics and Air Transport (AAT) were:
- FP7-AAT-2007-RTD-1: €220 million (Directorate-General for Research);
- FP7-AAT-2007-TREN-1: €4 million, (Directorate-General for Energy and Transport);
- FP7-AAT-2008-RTD-1: €210 million (Directorate-General for Research)
- FP7-ERA-NET–2008-RTD: €2 million (Directorate-General for Research)

Detailed documentation for these Calls is available from the CORDIS website (http://cordis.europa.eu). There was no Call in 2009.

For each of these two first Calls, the budget available for CSA-SA was about €3 million. The remaining main part of the budget was shared almost equally between CP-FP (Level 1) and CP-IP (Level 2) projects. In the 2008 Call, there was also a topic for an ERA-NET project in an effort to coordinate some of the national funding proposed by the Member States in the field of Aeronautics and Air Transport.

The next Calls will run on a yearly basis with funding ranging between about €100 and €160 million for DG RTD.

The evaluation and selection process

Following the deadline of a Call for Proposals, a first eligibility check is performed. Eligibility conditions are spelt out in the Call text – for example, a maximum EC funding that cannot be exceeded. The eligible proposals are evaluated by independent evaluators who are recognised experts in the relevant fields.

The eligible CP-FP (Level 1) and CSA-CA proposals are assigned to technical panels (e.g. Flight Physics, Propulsion, Avionics-Human Factors and Airports, Noise, Systems and Equipments, Design Tools and Production, Aero-structures and Materials, Maintenance and disposal, Breakthrough and Novel Concepts) including evaluators with the relevant competences. The CSA-SA proposals are treated in a separate panel dealing with the cross-cutting issues.

Within each panel, every proposal is initially evaluated independently by at least three evaluators, against three predetermined evaluation criteria, which have been published:

- Scientific and technological excellence;
- Quality and efficiency of the implementation and management;
- Potential impact through the development, dissemination and use of the project results.

The marks range from 0 and 5 with a threshold of 3 below which the project will not be considered for funding. Proposals with overall total marks below 10/15 are also rejected for funding. Each evaluator registers his marks in an Individual Evaluation Report (IER).

Once the individual evaluations have been completed, the evaluators hold a consensus meeting where they share their views and agree on the common marks and comments to be noted in the Consensus Report (CR). This meeting is moderated by a Commission representative who ensures that the different views can be expressed freely and a consensus is found in a fair way.

Representatives of each panel are then invited to participate in a Final Panel where all the proposals from all the panels are itemised to give a ranked list. All projects that have passed individual thresholds and have an overall grade of at least 10 are eligible for funding. However, the budget available is often not enough to fund all the projects, so only the top ones will, in effect, be funded. Following the outcome of the final panel meeting, minor adjustments can be made to the CRs which then become the Evaluation Summary Reports (ESR), to be sent later to the proposal co-ordinator.

For the CP-IP projects (Level 2), panels of five to seven evaluators assess each proposal, first individually drafting their IER. Afterwards, the panel agrees on a preliminary CR. If the marks for the proposal are above the threshold, questions can be formulated for clarification and sent to the consortium. The co-ordinators are invited to a hearing on those questions, after which the panel agrees on the final CR. Representatives of each panel come together for the final meeting during which the ranked list is established and the final ESRs are formulated.

Call results

Table 1 gives an overview of the results off the two first AAT Calls. For CP-FP (Level1), the success rate in the two first Calls was of the order of one proposal funded out of seven submitted. As the proposal text is the only link between the proposers and the evaluators, it must be comprehensive, of very good quality and address each of the three evaluation criteria properly. The CP-FP (Level 1) projects are the most numerous and represent about 52% of the EC funding recommended after the evaluation. While the maximum EC contribution allowed was €8 million in the first Call and €6 million in the second Call, the average EC contribution for this type of project is €3.9 million.

The eight CP-IP projects have an average EC contribution of €25 million and represent 46% of the overall EC contribution.

The CSA-SA projects represent a small percentage of the EC funding (1.3%) but usually provide a significant contribution to the research policy and can act as a catalyser or as stimulation measures.

Table 1: Some statistics on the results of the first two AAT Calls

	Projects	Share %	Recommended EC Funding (M€)	Share	Average Funding (M€)
CP-FP (Level 1)	58	71%	224.7	52%	3.9
CP-IP (Level 2)	8	10%	200.3	46%	25.0
CSA-SA	15	18%	5.8	1.3%	0.389
CSA-CA	1	1%	2.2	0.5%	2.2
TOTAL	**82**		**433.0**		

Small and medium-sized enterprises

SME participation in FP7 research projects is strongly encouraged in the Work Programme. The Specific Support Action Aeroportal (see project description or www.aeroportal.eu) has provided support to SMEs to help them find their way in FP7.

Successive Work Programmes have seen an increasingly successful response from SMEs (see Figure 4). Note that between FP6 and FP7, the funding rate for SMEs for research activities (excluding demonstration) was raised from 50% to 75% (similarly for non-profit public bodies, secondary and higher education establishments, and research organisations).

International co-operation

The Guide for Applicants of the second Call (see CORDIS FP7-AAT-2008-RTD-1) lists the 27 Member States and the 11 Associated Member States which, at that time, constituted the FP7 Members. This does not exclude the possibility to co-operate with the so-called International Cooperation Partner Countries (ICPC). A list is published within each Work Programme that identifies which countries can participate and which countries are entitled to receive funding from FP7 ('developed' countries can participate but without FP7 funding).

The Work Programme encourages international co-operation in areas of mutual benefit. A number of stimulation actions have taken place recently with Russia, other countries from Eastern Europe, Central Asian states and China, which have resulted in the identification of fields of mutual interest for research actions with EU partners in the Work Programme.

As far as ICPC participation in the second Call is concerned, ~1.6% of the requested EC contribution in successful proposals came from ICPC countries.

Other initiatives relevant to Aeronautics Air Transport

'Clean Sky' Joint Undertaking

In order to answer increasing concerns about the impact of aviation on the environment, a public-private partnership was launched in 2008 between the Commission and the aeronautics industry in the Joint Technology Initiative 'Clean Sky' with the aim of accelerating the integration of 'green' technologies in the European Air Transport System.

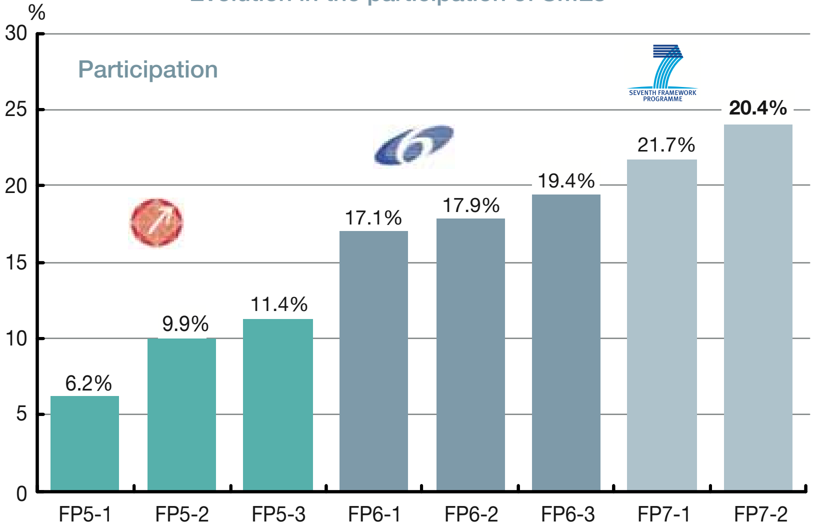
With EC funding of €800 million and an equal contribution from industry (mostly in kind), €1 600 million will be invested in RTD work during 2008 - 2017 [17].

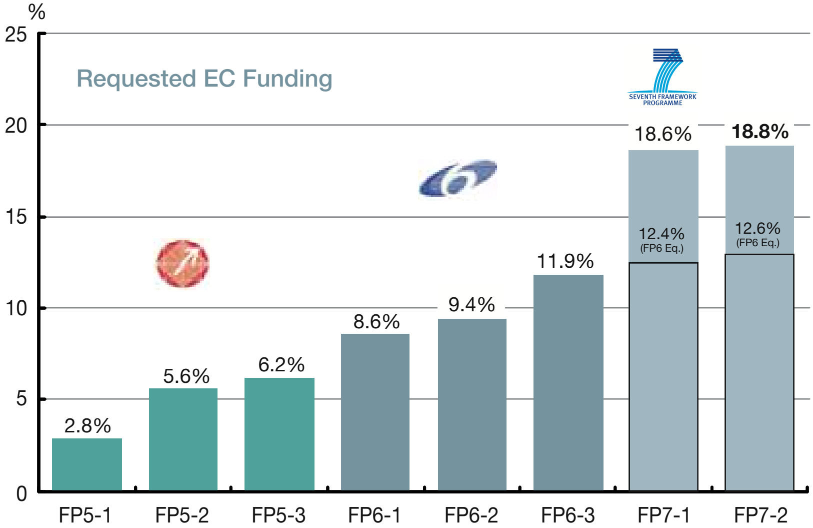
Clean Sky is structured into six Integrated Technology Demonstrators (ITD):
- Smart Fixed Wing Aircraft;
- Green Regional Aircraft;
- Green Rotorcraft;
- Sustainable and Green Engines;
- Systems for Green Operations; and
- Eco-Design.

The achievements of the platforms, in particular with respect to reducing environmental impact, will be assessed by the so-called technology evaluator.

The ITDs are mainly coordinated by large industry partners with a work share of €800 million, of which 50%, i.e. €400 million comes from Clean Sky Joint Undertaking (CSJU) contributions. Numerous Associate Members were also selected to help implement the Clean Sky Work Programme. Their contribution is about €400 million, 50% of this i.e. €200 million coming from the CSJU contribution. Finally, RTD activities for €200 million CSJU funding will be made available for additional partners from industry and research institutions through open Calls for Proposals. More information and announcement of the Calls can be found at www.cleansky.eu.

Figure 4:
Evolution in the participation of SMEs





SESAR – Single European Sky Air Traffic Management (ATM) Research

The SESAR (Single European Sky ATM Research) programme has been launched as an integrated part of the Single European Sky initiative (SES). This programme represents the technological pillar of the SES and aims to develop a modernised and highly efficient air traffic management infrastructure which will enable the safe, cost-efficient and environmentally friendly development of Europe's air transport.

In order to rationalise and organise ATM research so that it leads to actual operational and industrial implementation, all Air Traffic Management (ATM)-related research in the Seventh Framework Programme will be undertaken and implemented by the SESAR Joint Undertaking (SESAR JU), established by a Council Regulation under Article 171 of the Treaty. This Joint Undertaking coordinates the SESAR programme with other aeronautical research activities in order to maintain a consistent system-wide approach for the entire air transport system, and manages all ATM research so as to avoid possible duplications between different programmes.

The SESAR programme comprises three phases:

1. Definition phase (2005-2008), which delivered an ATM Master Plan for 2020 and beyond, defining the content of the next generation of ATM systems and identifying the necessary elements for its realisation.
2. Development phase (2008-2013), which develops the necessary elements on the basis of the definition phase findings.
3. Deployment phase (2013-2020), through which there will be large-scale production and implementation of the new air traffic management infrastructure, composed of fully harmonised and interoperable components which guarantee high-performance air transport activities in Europe.

The EC will provide a maximum total contribution of €700 million to SESAR JU for the programme's development phase over the period 2007-2013 (€350 million from the Transport Thematic Priority (including Aeronautics) and €350 million from the Trans-European Networks programme). More information can be found at www.sesarju.eu.

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Index by Activities

The Greening of Air Transport

Pioneering the Air Transport of the Future

Cross Cutting Activities

Index by Technical Fields

Flight Physics

Aerostructures and Materials

Systems and Equipment

Avionics, Human Factors and Airports

Propulsion

Noise and Vibration

Design Tools and Production

Maintenance and Disposal

Breakthrough and Novel Concepts

ATAAC

Advanced Turbulence Simulation for Aerodynamic Application Challenges

State of the Art - Background

Substantial resources have been invested over the years into Computational Fluid Dynamics (CFD). These investments (many of them made in the framework of European programmes) have resulted in a remarkable progress in the use of Computational Fluid Dynamics (CFD) for the design of new aircraft by the European airframe industry, significantly reducing the reliance on wind-tunnel and flight tests. This trend has resulted in the progressive shift of CFD priorities from numerics to flow physics and, ultimately, to turbulence modelling, which has become the weakest link in the CFD-based design chain. This is highlighted by the fact that, on the one hand, the theoretical capabilities for simulating full aircraft configurations with deployed flaps and landing gear are available, while, on the other hand, maximum-lift prediction of much simpler configurations or flow and noise predictions for an isolated landing gear fail due to turbulence modelling defects. It is clear that strengthening this link is crucial to satisfying the urgent needs of the European aerospace industries. CFD-aided design procedures for the analysis of turbulent aerodynamic flows must be improved to a level that is sufficient to resolve numerous problems directly related to the 'Green Aircraft Challenge', e.g. reliable evaluation of innovative drag and noise reducing concepts, and high lift systems allowing steeper take-off and landing.

Objectives

ATAAC aims at improving the current turbulence modelling/simulation approaches available in CFD methods for aerodynamic flows. As Large Eddy Simulation (LES) will not be affordable for the high Reynolds numbers typical of real-life flows in the next decades, ATAAC focuses on approaches below the LES level, namely Differential Reynolds Stress Models (DRSM), advanced Unsteady Reynolds Average Navier-Stokes (RANS) models, including Scale-Adaptive Simulation (SAS), Wall-Modelled LES, and different hybrid RANS-LES coupling schemes. The project resources will concentrate exclusively on flows for which current models fail to provide sufficient accuracy, e.g. stalled flows, high lift applications, swirling flows (delta wings, trailing vortices) or buffet. The assessment and improvement process will follow thoroughly conceived roadmaps linking practical goals with corresponding industrial application challenges and with modelling issues through 'stepping stones' represented by appropriate generic test cases.

The final goals are:
- to recommend one or at most two 'best' DRSM for conventional RANS and Unsteady RANS;
- to provide a small set of hybrid RANS-LES and SAS methods that can be used as 'reference' turbulence-resolving approaches in future CFD design tools;
- to formulate best practice guidelines for the recommended models with clear indications of areas of applicability and uncertainty for aerodynamic applications in industrial CFD.

Description of Work

The project consists of four work packages (WP).

WP1 is dedicated to managing the project and dissemination and exploitation activities. This WP also includes the management of the website, which hosts the database and is also used for the management, communication and dissemination processes. The remaining three work packages deal with scientific and technical work.

WP2 is dedicated to the work on the different types of models under consideration and their improvement in terms of both physics and numerical efficiency.

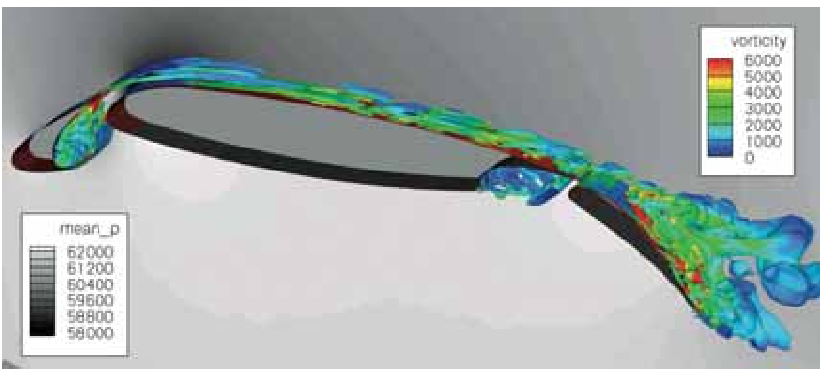
WP3 serves the assessment of the chosen models and their improvement based on the roadmaps by employing small sets of basic and challenging applications from the fields of both aerodynamics and aero-acoustics.

WP4 is dedicated to the gathering and preservation of the knowledge gained in the project and the appraisal of the models based on the results of WP2 and WP3. This work package will run over the complete time of the project ensuring also the critical supervision of the assessment process in WP3, the adherence to quality guidelines, as well as the identification and minimisation of uncertainties. Thus it will guarantee a sound final assessment of all project results leading to the recommendation of 'standard' or 'reference' approaches from the different model strands and to a concise set of best practice guidelines.

Expected Results

Besides a set of critically assessed and improved turbulence models and approaches with the main results of ATAAC are one (or at most two) 'best' Reynolds-Stress models for conventional RANS and Unsteady RANS, as well as a small set of hybrid RANS-LES and SAS methods that can be used as 'reference' turbulence-resolving approaches in future CFD design tools. These will be supplemented by recommendations for their usage and their range of applicability and uncertainty, which will be documented in the best practice guidelines.

Contributing to reliable industrial CFD tools, ATAAC will thus have a direct impact on the predictive capabilities in design and optimisation. This is of utmost importance due to the clear tendency of the airframe industry to base their design cycles much more upon numerical simulation and to perform experiments with a significantly reduced frequency at a later point in the cycle. Increasing the trust in reliable prediction, ATAAC will thus directly contribute to the development of greener aircraft (Greening of Air Transport) as well as to improving cost efficiency.



Detached Eddy Simulation of Three-Element Airfoil showing turbulent structures

Acronym:	ATAAC
Name of proposal:	Advanced Turbulence Simulation for Aerodynamic Application Challenges
Grant Agreement:	233710
Instrument:	CP – FP
Total cost:	5 653 950 €
EU contribution:	3 791 012 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.04.2009
Ending date:	31.03.2012
Duration:	36 months
Technical domain:	Flight Physics
Website:	http://www.ataac.cfdtm.org

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Tsinghua University	CN
CFS Engineering SA	CH
Chalmers Tekniska Högskola AB	SE
Dassault Aviation SA	FR
EADS Deutschland GmbH	DE
Eurocopter Deutschland GmbH	DE
Totalförsvarets Forskningsinstitut	SE
Imperial College of Science, Technology and Medicine	UK
Institut National Polytechnique de Toulouse	FR
LFK-Lenkflugkoerpersysteme GmbH	DE
Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
New Technologies and Services LLC	RU
Numerical Mechanics Applications International SA	BE
Office National d'Études et de Recherche Aérospatiales	FR
Rolls-Royce Deutschland Ltd & Co KG	DE
Technische Universität Berlin	DE
Technische Universität Darmstadt	DE
University of Manchester	UK

DESIREH

Design, Simulation and Flight Reynolds-Number Testing for Advanced High-Lift Solutions

State of the Art - Background

Laminar wings offer a significant potential for advancing aerodynamic performance and thus improving the environmental acceptance of future aircraft. While offering a large fuel saving potential, laminar wings for large transport aircraft still suffer from incompatible high-lift leading edge systems. Natural laminar flow (NLF) technology poses new design constraints and adds further design parameters to the design space. Hence, the design space of a NLF high-lift system must be wider compared to the design space of a high-lift system for a transport aircraft with turbulent wings. Exploring a wider design space calls for automated optimisation algorithms for which, however, code developers often lack the specific knowledge.

In the industrial design process of high-lift systems, the wind tunnels play a very important role as they allow a reliable analysis of the design variations with respect to aircraft performance. Pressurised cryogenic wind tunnels are able to simulate almost any flight condition so these tunnels are very important in minimising the uncertainties. An improvement in the testing efficiency, by applying simultaneously different state-of-the-art measurement techniques under cryogenic conditions, provides the potential to decrease the development costs within the industrial design process.

Objectives

DeSiReH supports the realisation of Vision 2020 by improving the aerodynamics of the high-lift system. This will be achieved by considering the numerical design methodology and the measurement techniques for cryogenic conditions for an advanced laminar high-lift wing design to be performed in DeSiReH. This will facilitate an improved industrial design process in terms of product quality, efficiency and reduced development costs with respect to the high-lift systems.

DeSiReH addresses the following quantified objectives:

- reducing the industrial aircraft development costs by 5% through less and more efficient wind tunnel testing;
- decreasing the time-to-market by 4% by improving the aerodynamic design turnaround time;
- improving the industrial high-lift design process efficiency by 15%;
- designing a compatible high-lift system enabling the NLF-potential of reducing aircraft drag by 5%.

Description of Work

Existing and validated high-fidelity numerical tools will be developed for an efficient high-lift design and optimisation process chain, which is able to explore the design space of a typical multi-objective optimisation problem.

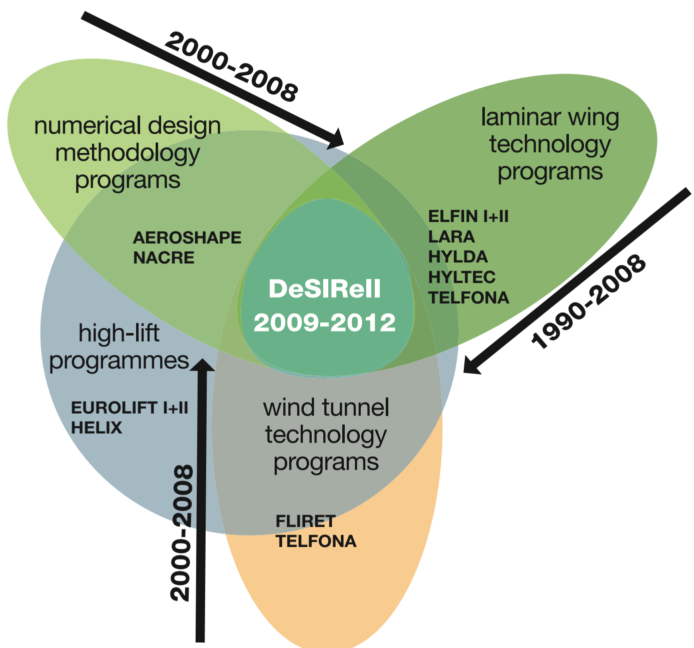
These strategies and tools are applied to the aerodynamic design of a high-lift system for the NLF wing. The key objective of the design activity is to achieve the required high-lift performance in take-off and landing whilst facing the constraint to maintain NLF at cruise to the best possible extent. The matured methods are benchmarked against the aerodynamic high-lift design by applying today's industrial design approach. This benchmark is an important activity for the targeted qualification of the high-fidelity optimisation process and strategies for industrial implementation.

A further important work package focuses on the improvement of the experimental measurement technique for cryogenic testing. The objectives here are to enhance the measurement accuracy of the results and to generate the capability to apply different important techniques (e.g. transition measurement and deformation measurement) in parallel, and to analyse the influence of the model surface quality on the high-lift performance. These techniques are finally applied in the ETW at high Reynolds numbers on the HARLS model equipped with the high-lift system.

Expected Results

DeSiReH intends to provide an efficient, high-fidelity numerical design process which will be applied for designing and testing a high-lift design system for a laminar-flow wing. The design will be tested in the ETW in a close joint action between the numerical and experimental specialists. The latter will use the enhanced testing strategies and technologies also prepared in DeSiReH. The results will be ready and available for being integrated into the Smart Fixed-wing Aircraft part of the Joint Technology Initiative 'Clean Sky'. The results will also be promoted by an intensive dissemination within respective papers and workshops, for instance in the KATnet II Coordinating Action.

The results include, but are not limited to:
- an optimised laminar wing high-lift system;
- an improved high-lift design methodology in an industrial context and evaluation of the aerodynamic high-lift system solutions;
- advanced experimental measurement techniques at cryogenic conditions;
- quantification of the environmental and economical benefit in relation to the ACARE targets.



Acronym:	DESIREH	
Name of proposal:	Design, Simulation and Flight Reynolds-Number Testing for Advanced High-Lift Solutions	
Grant Agreement:	233607	
Instrument:	CP – FP	
Total cost:	7 078 821 €	
EU contribution:	4 992 335 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.03.2009	
Ending date:	28.02.2013	
Duration:	48 months	
Technical domain:	Flight Physics	
Coordinator:	Dr.-Ing. Jochen Wild DLR - Deutsches Zentrum für Luft- und Raumfahrt e.V. Lilienthalplatz, 7 DE 38108 Braunschweig	
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	Dassault Aviation SA	FR
	Piaggio Aero Industries S.p.A.	IT
	ASCO Industries N.V.	BE
	Aircraft Development and Systems Engineering B.V.	NL
	European Transonic Windtunnel GmbH	DE
	IBK Ingenieurbüro Hauptsitz	DE
	Centro Italiano Ricerche Aerospaziali S.C.p.A.	IT
	Totalförsvarets Forskningsinstitut	SE
	Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	Instituto Nacional de Técnica Aeroespacial	ES
	Office National d'Études et de Recherche Aérospatiales	FR
	Federal State Unitary Enterprise - The Central Aerohydrodynamic Institute named after Prof. N.E. Zhukovsky	RU
	Technische Universität Braunschweig	DE
	Università degli Studi di Napoli 'Federico II'	IT
	Università degli Studi di Padova	IT
	Dziomba Aeronautical Consulting	DE

REACT4C
Reducing Emissions from Aviation by Changing Trajectories for the Benefit of Climate

State of the Art - Background

Despite the significant progress that has been made in reducing the specific emissions of aircraft, in particular CO_2, the absolute emissions have been increasing rapidly during the recent decades and are projected to continue to grow. Furthermore, aviation substantially impacts upon the climate through non-CO_2 effects such as ozone formation and methane destruction from aviation's NO_x emissions, the formation of contrails and contrail cirrus, the emission of H_2O at high altitudes, emission of aerosols (e.g. soot) and aerosol precursors (e.g. SOx), which are directly radiatively active and which modify cloudiness and cloud micro-physical and radiative properties.

Current flight planning is performed with the objectives of achieving maximum punctuality or minimizing the operational costs, whereas the target of minimal fuel consumption, minimal CO_2 emissions or minimal climate impact has a lower priority.

Impact of aircraft non-CO_2 emissions on the atmospheric composition and on the climate depends on the altitude and location of the emissions. Therefore climate impact via NO_x, contrails and contrails cirrus can be reduced, for example, by flying lower and avoiding contrail regions. On the other hand this results in a higher fuel burn and hence in higher CO_2 emissions.

The project REACT4C will perform an optimisation approach for alternative or environmental flight planning in order to assess the potential for reducing fuel consumption, CO_2 emissions and climate impact from aviation.

Objectives

In order to reduce aviation's emissions and improve its environmental compatibility, the project REACT4C will address those inefficiencies which exist in the aviation system with respect to fuel consumption and emissions by investigating the potential of alternative flight routing for lessening the atmospheric impact of aviation.

Hence, the main objectives of REACT4C are:
- to explore the feasibility of adopting flight altitudes and flight routes that lead to reduced fuel consumption and emissions, and lessen the environmental impact, and
- to estimate the overall global effect of such ATM measures in terms of climate change.

The objective of REACT4C is to demonstrate that environmentally-friendly flight routing is feasible, but does not address the operational implementation of such advanced Air Traffic Management (ATM) procedures. The latter would require much more time than is available during the present project. However, REACT4C will deliver substantial scientific foundation and operational specification for novel ATM procedures, which might be explored in a later phase of the SESAR JU. Analogously, REACT4C will deliver fundamental concepts of aircraft that are better suited for environmental flight routing, which will have the potential to enter the Clean Sky JTI in a later phase.

Description of Work

We plan to achieve the objectives of REACT4C mainly by a numerical approach, which combines atmospheric models of different complexity, ATM tools of planning flight trajectories, including models to calculate aircraft emissions, and tools for aircraft pre-design.

The work plan of REACT4C is structured into nine Work Packages (WPs) such that each individual work package is as compact as possible and that interfaces among different work packages can be kept as simple and efficient as possible (see also figure).

We begin with the selection of weather situations (WP1). Climate cost functions are determined for these weather situations (WP2) and then fed into a flight planning tool to calculate environmentally-friendly flight trajectories and emissions and climate impact along these trajectories (WP3). Finally, the results are evaluated and uncertainties are estimated (WP4).

The potential for mitigating the atmospheric effect of aviation are further explored (WP5) and how aircraft design can be optimized with respect to environmentally friendly flight routing is studied (WP6).

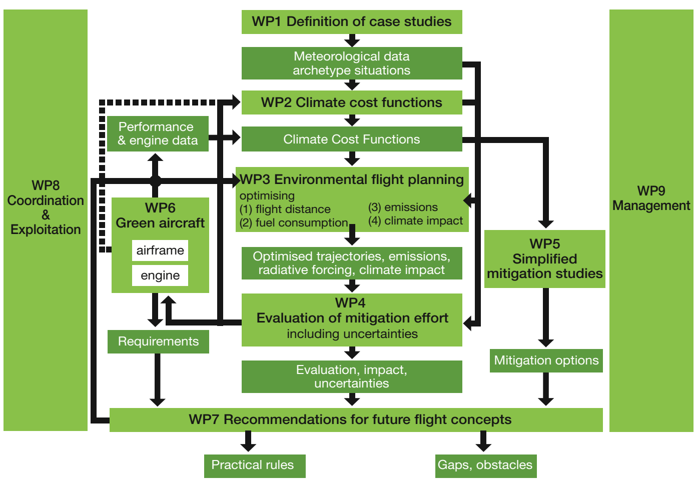
The findings of the project will be aggregated to recommendations for future ATM, aircraft design and research (WP7). Specific WPs on coordination and exploitation (WP8) and management of the project (WP9) complement the above structure.

Expected Results

The expected results are:

- An initial scoping study of expanding an operational flight planning tool by optimisation against criteria of fuel consumption and emissions will be performed; the inclusion of climate cost functions will enable environmentally friendly flight planning with respect to climate impact;
- The project will, for the first time, quantify the potential for improvements of inefficiencies in the air transport system with respect to fuel consumption, emissions and climate impact due to non-conventional flight trajectories under realistic atmospheric conditions on a regional and global scale.
- For the first time, 4D climate cost functions (as functions of latitude, longitude, altitude and time) will be calculated for realistic weather situations. These cost functions will rely on different emission metrics of climate change, targets being time integrated marginal Radiative Forcing RF (in analogy to the Kyoto metric Global Warming Potential) and temperature change after a given time horizon (the Global Temperature Potential);
- The project will allow the formulation of specific recommendations for stakeholders on flight planning, aircraft and engine design for future green aircraft;
- Cooperation will be instigated between complementary experts required for environmental flight planning, which has the potential to initiate follow-up joint work in Clean Sky JTI and SESAR JU.

Graphical presentation of project structure, showing work packages and interaction



Acronym:	REACT4C
Name of proposal:	Reducing Emissions from Aviation by Changing Trajectories for the Benefit of Climate
Grant Agreement:	233772
Instrument:	CP – FP
Total cost:	4 165 587 €
EU contribution:	3 195 555 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.01.2010
Ending date:	31.12.2012
Duration:	36 months
Technical domain:	Flight Physics
Website:	http://www.react4c-project.eu
Coordinator:	Prof. Robert Sausen
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Partners:	Airbus Operations S.A.S	FR
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	EUROCONTROL Experimental Centre	BE
	The Manchester Metropolitan University	UK
	MET OFFICE	UK
	Universita degli Studi de L'Aquila	IT
	University of Reading	UK

SADE
Smart High Lift Devices for Next-Generation Wings

State of the Art - Background

All aerodynamic concepts for significant reduction of drag such as laminarisation require slim high-aspect-ratio wings. However, state-of-the-art high lift systems will suffer from the reduced construction space and do not cope with the required surface quality. Thus, SADE will develop suitable 'morphing' high lift devices. The seamless 'smart leading-edge device' is an indispensable enabler for laminar wings and offers great benefit for reducing acoustic emissions; the 'smart single-slotted flap' with active camber capability permits a further increased lift. Thanks to their ability to adapt the wing's shape, both devices also offer aerodynamic benefits for cruise flight.

Morphing devices imply the integration of drive systems into tailored lightweight structures and therefore reduce complexity and mass. Furthermore, focusing on electric actuators can diminish the energy consumption, which directly reduces the aircraft operational costs as well as the environmental impact.

However, the high elasticity required for efficient adaptability of the morphing structure is diametrically opposed to the structural targets of conventional wing design like stiffness and strength. To find the optimum compromise, precise knowledge on target shapes for maximum high lift performance and sizing loads is mandatory.

Objectives

SADE aims at a major step forward in the development and evaluation of the potential of morphing airframe technologies and contributes to the research work on the reduction of carbon dioxide and nitrogen oxide emissions through new intelligent low-weight structures.

The project objectives are:
- Develop and investigate the morphing high lift devices 'smart leading edge' and 'smart single-slotted flap';
- Enhance morphing structure concepts and develop solutions which cope with the requirements of real aircraft and industrialisation;
- Increase technological readiness of morphing structures and verify experimentally;
- Perform multidisciplinary design and assess benefits for the overall system and for all individual disciplines;
- Reduce system complexity and mass;
- Enable seamless high lift devices and therefore enable laminar wings;
- Increase lift-over-drag in take-off thus enabling steeper climb and reducing noise footprint;
- Increase maximum lift in approach referring to conventional droop-nose devices;
- Reduce noise emissions in approach compared to high lift systems containing slats;
- Reduce power consumption following the more-electric-aircraft concept;
- Concentrate European experts on morphing. Create a roadmap itemising further research until the first experimental flight can take place with full-scale morphing wing devices.

Description of Work

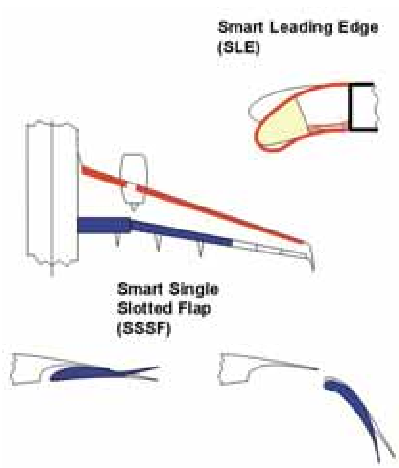
The most essential challenge for morphing today is the technological realisation and optimisation of available promising concepts for smart structures towards the special requirements of full-scale systems. Another challenge results from the aero-elastic condition the structural system is optimised for. SADE comprises all relevant disciplines for the investigation of morphing wings, operates a state-of-the-art virtual development platform, but focuses on the structural challenge of realising morphing high lift devices.

The work includes:
- Initialise a common database with a reference geometry related to previous projects and establish a central data management infrastructure.
- Calculate the aerodynamic target shapes for the morphing structures and structural design studies for the smart leading edge and the smart single-slotted flap.
- Component development, manufacturing and testing (skins, actuation, frame structure).
- Detailed structural design of both targeted smart high lift devices and the development of actuators and control concepts.
- Design a modular wind-tunnel test bed based on a fixed wing-box concept.
- Multidisciplinary analysis of both selected and designed smart high lift devices.
- Manufacture and assembly of test bed and morphing devices.
- Static and dynamic tests with the wind-tunnel functional model.
- Wind tunnel tests at TsAGI 101.

Expected Results

In order to compare the effect of the different morphing high lift systems on real aircraft a baseline reference from a previous project will be selected. This reference will be used to compare the performance impact of a change in the high lift system's design. The performance potential will be measured on a combined basis of the weight impact and the direct operating cost (DOC) impact. The interrelation between added weight as compared to the baseline and added lift is to be considered for the weight impact. Direct operating costs are considered as a measure for the economic feasibility of a candidate concept. The cumulative effects of the total weight impact, and the impact on fuel efficiency, maintenance complexity, purchase price, etc. are all taken into account in the DOC. Thus, for the first time, DOCs relative to morphing high lift systems will be available.

SADE encompasses the development of morphing technologies, the realisation of morphing components and assesses the benefit at aircraft level. The project will open a roadmap itemising the further research required until full-scale flight tests take place with morphing wings.



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SADE smart high lift configurations

Acronym:	SADE
Name of proposal:	Smart High Lift Devices for Next-Generation Wings
Grant Agreement:	213442
Instrument:	CP – FP
Total cost:	7 087 841 €
EU contribution:	4 969 975 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.05.2008
Ending date:	30.04.2012
Duration:	48 months
Technical domain:	Flight Physics
Website:	http://www.smr.ch/sade/
Coordinator:	Mr. Hans Peter Monner Deutsches Zentrum für Luft- und Raumfahrt e.V. Institut für Faserverbundleichtbau un Adaptronik Lilienthalplatz 7 DE 38108 Braunschweig
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Partners:	Airbus Deutschland GmbH	DE
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	Centro Italiano Ricerche Aerospaziali S.C.p.A.	IT
	Cranfield University	GB
	EADS Deutschland GmbH	DE
	Swedish Defence Research Agency	SE
	Piaggio Aero Industries S.p.A.	IT
	RWTH Aachen	DE
	SMR Engineering & Development SA	CH
	Central Aerohydrodynamic Institute	RU
	Delft University of Technology	NL
	Aeronautical Research and Test Institute Ltd	CZ

GreenAir

Generation of Hydrogen by Kerosene Reforming via Efficient and Low-Emission New Alternative, Innovative, Refined Technologies for Aircraft Application

State of the Art - Background

Europe is an important player as far as climate change is concerned. Following this line, the aeronautic industry aim at 'greener' aircraft and a 'greener' air transport' system.

Another topic thoroughly investigated is the improvement in new aircraft architectures, in particular simplifying the secondary onboard energy systems. In the future, the three systems presently on aircraft, i.e. hydraulic, pneumatic and electric, shall be ultimately reduced to just an electric one.

One option of these advanced aircraft architectures is that the engines are primarily used to produce thrust, and additional onboard electric power is generated by a separate autonomous unit, for which fuel cells are a promising candidate.

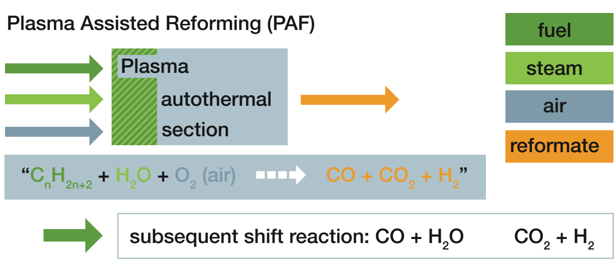
Despite the widespread discussion about a hydrogen economy, kerosene will remain the one and only aviation fuel for the coming decades. However, the key problem of applying fuel cells on board an aircraft will be to generate hydrogen from the onboard kerosene fuel.

For this purpose various processes, e.g. autothermal or catalytic partial oxidation, have already been investigated. GreenAir deals with two alternatives, which promise to be better suited to aircraft application.

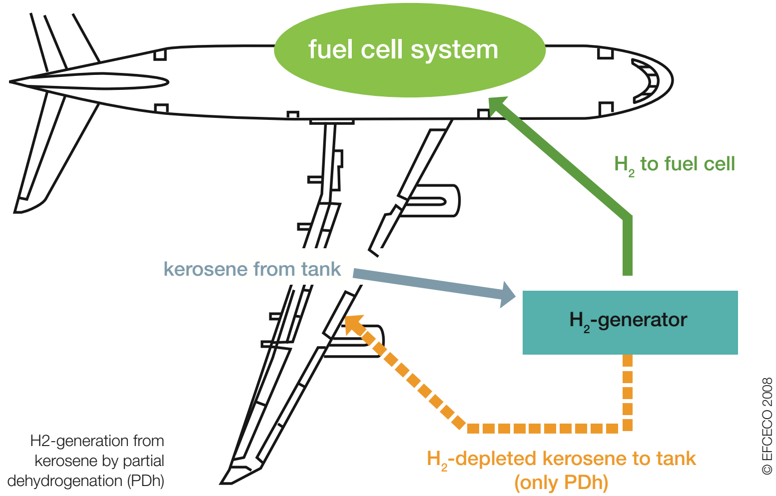
Objectives

GreenAir will elaborate the fundamentals of two unconventional methods to generate hydrogen from kerosene for continuous operation of a fuel-cell system on board an aircraft: partial dehydrogenation (PDh) and plasma-assisted reforming (PAF).

The main objectives include the definition of requirements and the elaboration of concepts for their implementation into aircraft. The proof of concept will be carried out with breadboard systems in the power range of 1 kW (PDh) to 5 kW (PAF) – big enough to allow a judgement of the technology with respect to its viability and scaling-up and small enough to be cost effective.



H2-generation from kerosene by plasma-assisted reforming (PAF)



Description of Work

The project is divided into three technical sub-projects (SP).

SP1 will investigate the issue of aircraft integration, specifically with respect to fuel processing technology.

SP2 is the main sub-project and deals with the 'technical hardware' based on the following main activities:

- development of partial dehydrogenation by lab-scale catalyst performance tests, followed by an up-scaling to about the 1 kW level;
- adaptation of plasma-assisted reforming by development and performance tests at about the 5 kW level;
- experimental determination of methods for the fractionation of kerosene;
- modelling of processes in order to assist and facilitate hardware development.

SP3 consists of the construction and testing of breadboard systems at simulated flight conditions.

Expected Results

The major deliverables of the project are:

- aircraft requirements, interfaces, safety and integration concepts;
- basic proof of concept for partial dehydrogenation (PDh);
- proof of concept for plasma-assisted reforming (PAF);
- simulated flight tests for both breadboard systems;
- evaluation of aircraft applicability for both PDh and PAF.

Acronym:	GreenAir
Name of proposal:	Generation of Hydrogen by Kerosene Reforming via Efficient and Low-Emission New Alternative, Innovative, Refined Technologies for Aircraft Application
Grant Agreement:	233862
Instrument:	CP – FP
Total cost:	7 795 134 €
EU contribution:	5 057 658 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.09.2009
Ending date:	31.08.2012
Duration:	36 months
Technical domain:	Systems and Equipment
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	Dr. Erich Erdle	DE
	HyGear B.V.	NL
	Instytut Maszyn Przepływowych - Polskiej Akademii Nauk	PL
	Instytut Niskich Temperatur i Badań Strukturalnych im. Włodzimierza Trzebiatowskiego Polskiej Akademii Nauk	PL
	Johnson Matthey plc	UK
	Commission of the European Communities - Directorate General Joint Research Centre (Petten)	NL
	QinetiQ Ltd	UK
	Alma Mater Studiorum - Università di Bologna	IT

WakeNet3-Europe

European Coordination Action for Aircraft Wake Turbulence

State of the Art - Background

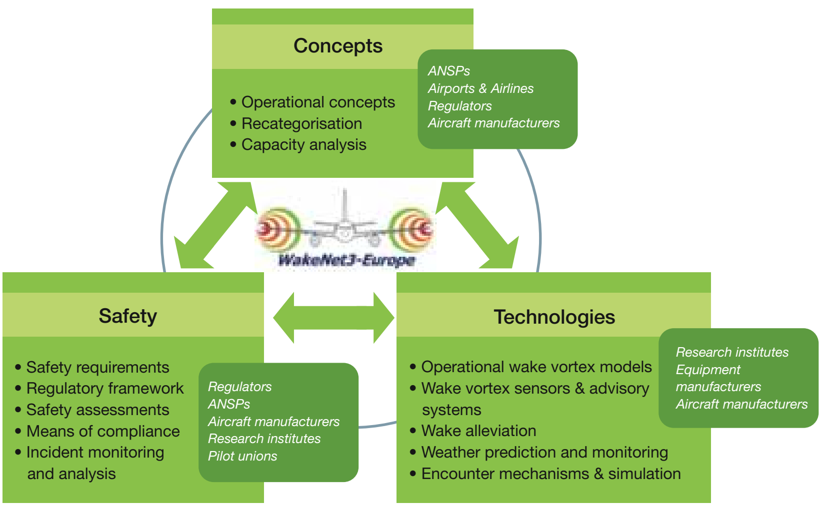
A flying aircraft generates a turbulent wake as a direct consequence of its aerodynamic lift generation. This wake consists of a high amplitude of swirling air flow velocities concentrated in a region of relatively small spatial extent trailing behind the generator aircraft. Another aircraft entering into this wake may be significantly impacted by the vortex flow.

In order to prevent hazardous wake encounters, minimum separations behind medium and heavy aircraft are maintained by air traffic control and pilots. This allows wakes to decay to non-hazardous levels as they age and are moving out of the flight path of following aircraft.

The International Civil Aviation Organization (ICAO) has defined 'Minimum Wake Turbulence Separations' for worldwide application. These separations are based on three dedicated aircraft classes (Light, Medium and Heavy) depending on aircraft maximum take-off weight. Some regulating national authorities have introduced modified regulations to reflect their specific experience obtained over the years.

Today's wake turbulence separations have basically been established in the 1970s. They are generally regarded as safe since the number of wake encounter incidents by commercial aircraft is very small as long as they are applied. But they are also regarded as overly conservative under many circumstances, for example in conditions of high atmospheric turbulence or strong crosswinds.

Aircraft wake turbulence in general and the associated separations have received increased interest again during the last decade for a number of reasons:



WN3-E Coordination Areas

- More and more airports are operating at their capacity limit during peak hours, leading to delays and increased fuel burn. Wake turbulence separations are often the limiting factor for runway throughput.
- New aircraft types are entering into service. This includes new and larger aircraft like the Boeing 747-8 and the Airbus A380, but also new aircraft classes like very light jets (VLJ). Furthermore, the fleet mixes themselves are changing with some airports experiencing increased variety in aircraft sizes.
- Traffic density is increasing in general, leading to more and more aircraft operating in close vicinity to each other and thus potentially increasing the risk from wake encounters.
- New technologies are emerging and entering into operation. Increased information sharing, new and more capable sensors, new decision making tools and higher automation allow for new solutions to address wake encounter risk.

Many different research and development activities have been launched in response to these needs and opportunities and in order to safely reduce wake turbulence separations. They address a wide and complex range of related topics, including the following:
- New operational concepts;
- Regulatory framework and means of compliance;
- Improved understanding and characterisation of aircraft wake vortices;
- Probabilistic prediction of wake vortex behaviour;
- Safety assessments of wake encounters by flight tests and simulation;
- Probabilistic modelling of wake encounters;
- Weather prediction, monitoring and statistics;
- Wake encounter incident reporting;
- Automated analysis of flight data recordings for wake encounters;
- Real-time detection, monitoring and characterisation of aircraft wakes by ground-based and airborne sensors;
- Wake vortex advisory systems;
- Wake vortex alleviation at the source;
- Airborne wake encounter avoidance & alleviation systems;

In line with the large number of related topics, many stakeholders are concerned.

Objectives

The main objectives of WakeNet3-Europe are:
- To be a forum promoting multidisciplinary exchange between specialists active in the field of aircraft wake turbulence and to disseminate relevant information;
- to develop a shared view on how to address safety and capacity related issues caused by wake turbulence;
- to give recommendations, which are agreed between all relevant stakeholders from R&T and operations, on how to support new operational concepts, procedures and new regulations relative to wake vortex;
- to help making new technologies usable for operational purposes;
- and to give recommendations for future research, in order to support operational users' needs.

Description of Work

WakeNet3-Europe is composed of 12 beneficiaries plus third party, Eurocontrol. They represent all major related disciplines.

The project is structured according to three coordination areas (Technologies, Safety and Concepts) with second level task groups addressing specific topics plus dedicated links to existing local stakeholder groups, professional groups and other projects as well as to US and other non-EU activities (e.g. WakeNet USA and WakeNet Russia).

WakeNet3-Europe provides annual workshops open to the whole wake vortex community, promoting global information exchange and networking.

In addition, specific workshops addressing key topics with experts and stakeholders are organised.

Based on these activities the members of WakeNet3-Europe establish recommendations for future wake vortex research in Europe and for the implementation of the solutions developed for operational schemes, as well as of adapted regulations.

Results are communicated to the public via the project's internet site accessible at www.WN3E.eu.

Expected Results

WakeNet3-Europe will contribute to achieving the ACARE goals and FP7 objectives by fostering multi-disciplinary information exchange and harmonized approaches on topics related to aircraft wake turbulence through dedicated means like public and specialists workshops, research needs reports, and position papers.

It is directly contributing to establishing new solutions allowing to safely reduce separation distances between aircraft, which in turn enables a reduction of delays as well as an increase in capacity together with the associated societal benefits.

Acronym:	WakeNet3-Europe	
Name of proposal:	European Coordination Action for Aircraft Wake Turbulence	
Grant Agreement:	213462	
Instrument:	CSA – CA	
Total cost:	1 069 866 €	
EU contribution:	900 000 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.04.2008	
Ending date:	31.03.2011	
Duration:	36 months	
Technical domain:	Systems and Equipment	
Website:	http://www.WN3E.eu	
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	Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	DFS Deutsche Flugsicherung	DE
	Office National d'Études et Recherches Aérospatiales	FR
	NATS En-Route Plc.	UK
	Université catholique de Louvain	BE
	Technische Universität Berlin	DE
	European Cockpit Association	DE
	Technische Universität Braunschweig	DE

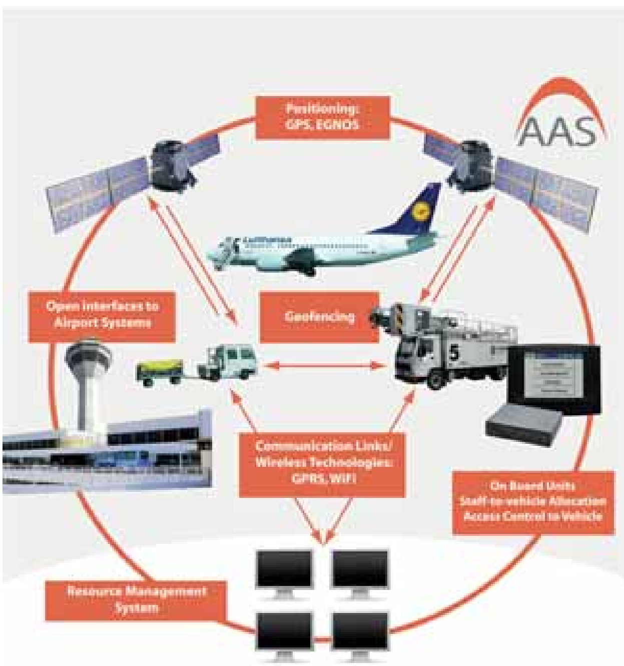
AAS
Integrated Airport Apron Safety Fleet Management

State of the Art - Background

One of the main challenges in the apron area is that due to many different companies operating on an airport apron, each business brings in the vehicles and equipment it requires to sustain operations. This causes high levels of congestion in ramp areas, which increases the accident rate, and the chances of vehicles and equipment being misused.

By gaining telematic data on the running times of the various vehicle categories, detailed real-time statistics can be created. This would allow advanced fleet management and effective maintenance planning in off-peak periods, thus helping to reduce the number of vehicles and equipment which is considered necessary to maintain a high level of service. Actual reports on these running times would allow a good long-term budget plan, by showing how many vehicles or pieces of equipment are actually needed to support daily operations. By monitoring the vehicles, unnecessary running times can be avoided, thus reducing costs and the environmental impact. This type of information can lead to considerable savings in investment and daily operational costs, and a reduction in vehicles and equipment required, thus reducing congestion and enhancing safety in these areas.

AAS system layout



Objectives

AAS will develop, implement and investigate the implications of a cost and safety-beneficial high-tech system for comprehensive monitoring and controlling of all Ground Support Equipment (GSE) vehicle movements in the apron area.

The main objectives are:
- to deliver an advanced fleet management concept by maximising the utilisation of GSE vehicles;
- to enhance the techniques for cost-efficient passenger and luggage flow, and efficiency by automatically passing the information from GSE vehicles into the Resource Management System (RMS);
- to improve airport operations by reducing the number of accidents and GSE/aircraft damage repair costs;
- to deliver integrated knowledge for maintenance and investment planning to the companies operating on the apron;
- the implementation of a GPS/EGNOS-based (European Geostationary Navigation Overlay System) location device;
- the system will be embedded into a mapping and positioning system, based on geo-fencing;
- the communication system will be based on different modes: Wi-Fi, GPRS.

Description of Work

The project will integrate GSE-based onboard units in the different vehicles, which can detect, by using navigation and telematics as well as a digital airport map (geo-referencing via GPS/EGNOS), the actual situation of other apron-based equipment in real time. Different technologies, like Wi-Fi (IEEE 802.11a) and GPRS, will be investigated for wireless communication between GSE vehicles and the operations centre.

The described approach will identify which vehicles are to be used for which tasks, and under which status the vehicles are operating (availability, downtime, etc.). The onboard units will be connected to the RMS of the airport database in order to synchronise the flight schedules and positions of the aircraft and apron vehicles.

The system will be tested during operations at the airports in Berlin (TXL) and in Porto (OPO). Both airports are appropriate sites for demonstrating new technologies like the AAS system under realistic conditions. The underlying categories are the following:
- Porto: a new, not overcrowded, small-sized airport;
- Berlin: a medium-sized, overcrowded airport and predecessor to the new Berlin Brandenburg International Airport (scheduled for completion in 2011).

Expected Results

The main results of AAS are:
- maximising the utilisation of GSE vehicles at airports, e.g. baggage tugs, passenger buses, Ground Power Units (GPU), follow-me cars, stairs, towing vehicles;
- reducing costs by efficient passenger and luggage flow;
- enhancing safety, reducing the number of accidents and GSE/aircraft damage repair costs;
- return on investment in less than five years.

This will be a system with open interfaces towards existing airport operational systems and R&D activities like Advanced Surface Movement Guidance and Control System (A-SMGCS) and Collaborative Decision Making (CDM). The project is framed by the SESAR Joint Undertaking and the Clean Sky JTI.

Acronym:	AAS	
Name of proposal:	Integrated Airport Apron Safety Fleet Management	
Grant Agreement:	213061	
Instrument:	CP – FP	
Total cost:	3 543 313 €	
EU contribution:	2 363 004 €	
Call:	FP7-AAT-2007-TREN-1	
Starting date:	01.05.2008	
Ending date:	30.04.2011	
Duration:	36 months	
Technical domain:	Avionics, Human Factors and Airports	
Website:	http://www.aas-project.eu	
Coordinator:	Mr. Thomas Meißner	
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	Euro Telematik AG	DE
	ANA, SA Aeroportos de Portugal	PT
	HiTec – Vereinigung High Tech Marketing	AT
	University of Salzburg	AT
	Siemens AG	DE
	Ingeniería y Economía del Transporte, S.A.	ES
	Consorzio Ferrara Ricerche	IT
	Lappeenranta University of Technology	FI
	INESC Inovação, Instituto de Novas Tecnologias	PT
	BRIMATECH Services GmbH	AT

DREAM
valiDation of Radical Engine Architecture systeMs

State of the Art - Background

The DREAM project is the response of the aero-engine community to commercial and environmental pressures that have come about mainly as a result of two main factors:

- The political pressure to reduce CO_2 emissions has increased considerably since the publication of the ACARE goals (ACARE: Advisory Council for Aeronautics Research in Europe).
- Hydrocarbon fuel ressources are finite; recent fuel prices suffered from large oscillations with an overall trend upwards.

Consequently DREAM is studying a range of completely novel designs for both contra-rotating open rotors and turbofans developing novel engine systems on top of the technologies issued from the EU funded EEFAE, NEWAC and VITAL projects and validating the use of alternative fuels in these aero engines to demonstrate green house gas emission reduction.

Objectives

The objectives are to reduce:

- CO_2 by 9 % over and above the FP7 Integrated Project VITAL or the FP5 Technology Platform EEFAE Technology Readiness Level (TRL) 4/5 (7 % better than ACARE or 27 % better than year 2000 engine),
- Noise by 3 dB per operation point (~ –9dB cumulated on 3 certification points) versus the year 2000 engine references at TRL4 with improved methods, materials and techniques developed on past and existing noise programmes,
- NOX will be reduced accordingly with engine specific fuel burn reduction.

Description of Work

DREAM comprises of 6 sub-programmes:-

Management and dissemination
Ensures the overall programme management and dissemination

SP3 open rotor

Whole Engine Architecture

Specification and assessment of each architecture concept

- Defines the aircraft application context
- Ensures the overall consistency of DREAM results
- Assesses the benefits of the DREAM engine technologies and architectures that have the potential to go beyond the ACARE objectives for fuel consumption
- Considers both specification and assessment of each architecture concept, from the common point of view of aircraft environmental and technical objectives

Geared Open Rotor

Development of an advanced geared open rotor concept in a pusher configuration

- Specifies the engine architecture
- Test blades rig tested in both high and low speed wind tunnels to enable the acquisition of both aerodynamic and acoustic data
- Performs the parametric studies with the addition of a pylon. Comparable 'isolated' and 'installed' aerodynamic and acoustic data will be generated, with acoustic data again captured and analysed.
- Examines a range of mechanical design options for variable pitch open rotors and the integration of the control mechanism with the system.
- Develops an Optimised Power Turbine module for the geared open rotor configuration including rig testing to support performance predictions.
- Design the hot rear support structure

Direct Drive Open Rotor

Development of the advanced direct drive open rotor

- Specifies the engine architecture
- Define several advanced propfans including one reference for test rig calibration
- Acquire both acoustic and performance test data of the above propfans at low and high speed conditions in wind tunnels
- Develop the most innovative features of the stator-less counter-rotating turbine
- Define an advanced high-speed low pressure compressor dedicated to the open rotor engine
- Validate the advanced aero concepts on a one stage rig

Innovative Systems

Provides enabling technologies for low weight and low cost future engines leading to an efficiency improvement of 0.5 % by adding innovative functionality and active solutions for turbines:

- Active vibration control engine structure with piezo actuator damping systems
- Elastomer damping rings for passive vibration control and cost efficiency
- Innovative mid turbine frame configurations with optimized aerodynamics, structural mechanics and materials
- Active boundary layer control for high speed flow to improve the efficiency of low pressure turbines
- Closed-loop active clearance control to improve the low pressure turbine running clearances

Alternative Fuels Demonstration

Demonstrates that alternative fuels can be used in modern aircraft and engines

- Demonstrates the performance of an existing available fuel (XTL type or 3rd generation fuels from algae or Jatropha) matching the following requirements:
  - No significant modification of aircraft or engine is needed
  - Advantages on emissions of pollutants (NO_x, CO, HCs, soots)
  - Reduction of green house gas emissions (CO_2 emissions will be measured and compared with standard aviation fuel)
- Performs a demonstration on a turbo-shaft engine together with a paper work extension to aero-engines

Expected Results

The main result will be

- The initial development of new open rotor technologies (blades, pitch change mechanisms, high-speed turbine, contra-rotating turbine).
- Novel concepts (vibration damping, structures and active control).
- The demonstration of the operation of alternative fuels.
- Demonstrate the potential of open rotor to greatly reduce CO_2 emissions and still achieve acceptable levels of community noise

Acronym:	DREAM
Name of proposal:	valiDation of Radical Engine Architecture systeMs
Grant Agreement:	211861
Instrument:	CP – IP
Total cost:	40 200 000 €
EU contribution:	25 000 000 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.02.2008
Ending date:	28.02.2011
Duration:	36 months
Technical domain:	Propulsion
Website:	http://www.dream-project.eu/

Coordinator:	Mr. David Bone Rolls Royce plc Mailbox ML52 - PO Box 31 Derby DE24 8BJ - England
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EC Officer:	Mr. Rémy Dénos

Partners:	Avio S.p.A.	IT
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	Technische Universität Darmstadt	DE
	Rolls-Royce Deutschland Ltd & Co	DE
	Technische Universität Graz	AT
	MTU Aero Engines GmbH	DE
	Turbomeca SA	FR
	Snecma SA	FR
	ARTTIC	FR
	Airbus France SAS	FR
	Institut Supérieur de l'Aéronautique et de l'Espace	FR
	Technische Universität Berlin	DE
	Dowty	UK
	Volvo Aero Corporation AB	SE
	GE Aviation Systems Ltd	UK
	Politechnika Slaska	PL
	Techspace Aero SA	BE
	Federal State Unitary Enterprise - The Central Aerohydrodynamic Institute named after Prof. N.E. Zhuovsky	RU
	University of Southampton	UK
	Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	Chalmers Tekniska Högskola AB	SE

Office National d'Études et de Recherche Aérospatiales	FR
ISVR	UK
SCITEK Consultants Ltd	UK
Fundación Centro De Tecnologías Aeronáuticas	ES
Deutsches Zentrum für Luft- Und Raumfahrt e.V.	DE
Vibratec	FR
Politecnico Di Torino	IT
Universita Degli Studi Di Firenze	IT
Universidad Politécnica de Madrid	ES
Ecole Polytechnique Fédérale de Lausanne	CH
Progesa S.R.L.	IT
Centre de Recherche en Aéronautique asbl	BE
Von Karman Institute for Fluid Dynamics	BE
Central Institute of Aviation Motors	RU
Universität der Bundeswehr München	DE
Universität Stuttgart	DE
Magna Steyr Fahrzeugtechnik AG & Co. KG	AT
Vibro-Meter SA	CH
Politecnico di Milano	IT
Eurocopter SAS	FR
Technische Universität Dresden	DE
Pars Makina Ltd	TR
Cranfield University	UK
The Chancellor, Masters and Scholars of the University of Cambridge	UK
Technische Universität Darmstadt	DE

ELUBSYS
Engine LUBrication SYStem technologies

State of the Art - Background

In aeronautics, gas turbine engines need the assistance of systems that guarantee performance throughout the whole flight envelope of the aircraft for which they are designed. One of these systems is the lubrication system and its role is twofold: firstly to remove (via heat exchangers) the heat generated in the highly loaded rolling bearings and gears found in the power and accessory gearboxes; secondly to lubricate these parts.

The current trend of developing aircraft turbine engines that consume less fuel increases the cooling requirements from the lubrication systems due to higher speeds, loads and temperatures in engines, as well as the integration of high-power gearboxes and high-power starter-generators. Current lubrication systems in turbine engines are based on architectures and technologies that have not significantly evolved over the last 30 years. Despite improvements and advances made on the components of these systems, the technological limit is being reached. In other words, new technologies are required to face the challenge of future engine requirements (higher cooling, higher thermal efficiency, lower specific fuel consumption (SFC) impact, same high-level of reliability, improved mass).

Objectives

The overall objective of ELUBSYS is to research, develop and validate a new architectural approach towards the design of high performance aircraft lubrication systems with the aim of reducing fuel and oil consumption. There are four key goals:
- reduce engine SFC and CO_2 emissions by significantly reducing (target: 60%) the requirement for bleed air from the engine to pressurise the bearing chambers via the introduction of new high performance seals and by improving thermal management of housings (and ports) by adapting these to the presence of high performance seals;
- reduce the oil quantity rejected overboard by 60%, thus reducing both the consumption of oil, which is a non-renewable energy, and the associated atmospheric pollution by introducing high performance brush seals and improving the supply pump capability;
- optimise the architecture of lubrication systems by reducing their complexity and mass. This will be done by integrating several lubrication functions into one single component and by re-designing other external components;
- develop solutions to improve the monitoring of engine oil quality with a particular focus on the anti-coking capabilities of the lubrication system. This will allow higher oil temperatures to be sustained for longer periods of time, and contribute towards higher engine turbine inlet temperatures.

Description of Work

The proposed work is divided into five technical work packages (WP).

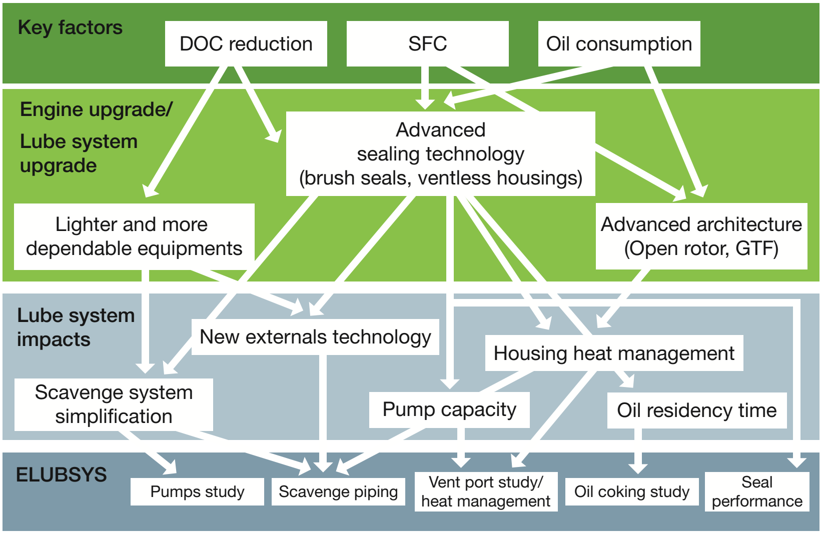
WP1 will address the sealing element of the bearing chambers by:
- investigating the performance of advanced brush seals for the bearing chamber sealing;
- studying the two-phase flow behaviour, heat transfer and pressure loss in the scavenge pipe when brush seals are used and the vent pipes removed;
- investigating the effect on the bearing chamber's thermal behaviour to the reduced air flow anticipated through the brush seals, compared to the labyrinth, and optimising the bearing chamber thermal design.

WP2 aims at a better understanding and modelling of the complex two-phase flows in bearing chambers, scavenge and vent ports, and adjacent pipes.

The objective of WP3 is to produce rules for the different parts of the oil system (supply and scavenge systems and all the related components) in order to improve or optimise their performance and adapt them to

ELUBSYS rationale

Major objectives: Ecology, Economy, Safety



the advanced bearing chamber architectures proposed in WP1 and WP2.

The objective of WP4 is to develop and validate numerical methods of characterising and predicting oil ageing and degradation in complex aero-transmission systems, develop a method and a device to monitor oil health in the engine and develop an anti-coking coating.

The overall assessment of the integration of every single improvement will be performed using a global 0D model (WP5).

Expected Results

The anticipated results are:

- the development of design rules in terms of housing architecture, heat management and associated external equipments that will lead to the implementation of advanced seals in aircraft engine lubrication systems;
- a simplified architecture for engine lubrication systems that results in fewer components and reduced mass;
- a set of design rules describing the method of developing more efficient bearing chambers, vent and scavenge pipes, seals and other external elements of the lubrication system;
- accurate methods and rules to predict heat transfer from the hot engine parts inside the lubrication system with a particular emphasis on bearing chambers;
- accurate rules for the design of the external system (pipes, pumps) compliant with advanced housing architectures incorporating tight seals;
- validated methods to predict and detect oil coking.

These results will produce significant technological advances in the area of lubrication for aircraft engines which will fully support the needs of future engine generations. These advances will increase the competitiveness of Europe's aviation industry and airlines because of the improved technologies and savings on operating costs that they will enable, thus offering more reliable and safer aircraft engines and cheaper air travel.

Acronym:	ELUBSYS	
Name of proposal:	Engine LUBrication SYStem technologies	
Grant Agreement:	233651	
Instrument:	CP – FP	
Total cost:	6 799 256 €	
EU contribution:	4 499 895 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.06.2009	
Ending date:	31.05.2012	
Duration:	36 months	
Technical domain:	Propulsion	
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	Rolls-Royce Deutschland Ltd & Co. KG	DE
	SNECMA SA	FR
	Turbomeca S.A.	FR
	Industria de Turbo Propulsores S.A.	ES
	Wytwórnia Sprzętu Komunikacyjnego PZL - Rzeszów S.A.	PL
	ARTTIC in Brussels s.p.r.l.	BE
	Université Libre de Bruxelles	BE
	Centre de Recherche en Aéronautique a.s.b.l.	BE
	Scholai Frederickou	CY
	Institut National des Sciences Appliquées de Lyon	FR
	Université de Bordeaux I	FR
	Universität Karlsruhe (Technische Hochschule)	DE
	University of Nottingham	UK
	University of Sheffield	UK
	Fundación Tekniker	ES

ERICKA
Engine Representative Internal Cooling Knowledge and Applications

State of the Art - Background

The fuel efficiency of a gas turbine used for aircraft propulsion depends on the performance of many key engine components. One of the most important is the turbine, whose efficiency has a large influence on the engine fuel consumption and, hence, its carbon dioxide emissions.

The high-pressure turbine stage must operate at high efficiency in the most hostile environment in the engine. The turbine is subject to the engine's most aggressive heat loads because the working fluid supplied to this stage is at the peak cycle temperature, and the work generation process in the turbine accelerates the flow, which results in enormous heat flows. The gas swept components are made from high temperature alloys which resist oxidation, creep and crack propagation following thermal cycling. The turbine used in civil aircraft engines are designed to operate efficiently for thousands of hours before requiring any replacement. The thermal protection systems include low conductivity coatings and tiny ducts which feed cooling air through the components. The cooling air removes heat by convection from the inner surface of the cooling passages, and this air is often then used to produce a protective layer or film of air between the hot gas and the component. As the use of external cooling mechanisms (such as film cooling) is associated with aerodynamic losses, the improvement and optimisation of internal cooling systems have been the prime focus of turbine cooling advancement over the last decade. Several technologies are used to enhance HTCs in internal passages. These devices are typically used in combination to achieve acceptable component temperatures. The most popular methods can be summarised as follows:

- Turbulence generators, such as ribs, cast into the walls of the internal passages;
- Devices, such as pin fins or pedestals, which increase both internal surface area and turbulence intensity;
- Impingement cooling;
- Application of serpentine systems that include U-bends with associated high HTCs;
- Swirling flow systems.

Objectives

The goal of ERICKA is to directly contribute to reducing aircraft specific fuel consumption (SFC) with a targeted reduction of 1% in fuel consumption relative to engines currently in service. ERICKA will provide the means of

The RHR and containment (lhs) and detail of Perspex model (rhs).

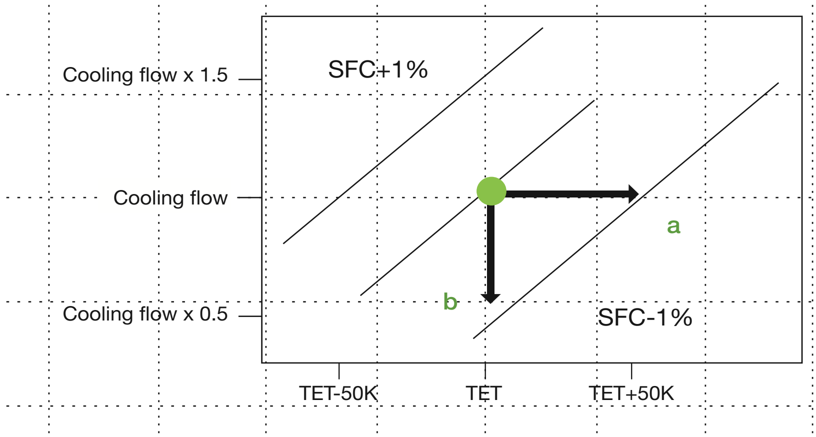

Figure 1 Schematic diagram indicating the benefits of improved cooling technology on SFC. The yellow circle is a baseline engine.

improving turbine blade cooling technology, therefore improving engine efficiency. Better cooling technology enables the cooling flow to be reduced or the turbine entry temperature (TET) to be increased. The yellow circle in Figure 1 indicates the SFC of an existing engine operating with a certain TET and turbine blade cooling flow. Line a shows a new engine with increased operating temperature and line b an engine with reduced cooling flow. Both new engines have reduced SFC through better cooling technology.

The detailed understanding of turbine cooling is a key enabler in the optimisation of the turbine operation. The technology used in turbine cooling designs includes many uncertainties because of several factors:

- The difficulty of gathering experimental data from the internal cooling passages in rotating turbine blades;
- The problems associated with predicting cooling performance using computer codes. Note that Coriolis and buoyancy forces often combine to produce complex secondary flows not modelled in existing codes.

ERICKA will research the technology to make a significant progress in understanding the internal cooling of rotating turbine blade passages by:

- Gathering high quality experimental data, and
- Developing computer codes which are calibrated with these data.

Description of Work

ERICKA is composed of the following Work Packages (WPs):

WP1 Optimisation of turbine cooling system components. This WP will first provide the industrial requirements of future numerical optimisation methods, then it will apply the methods to engine representative problems and finally test the new passage shapes.

WP2 Leading edge impingement engine geometry: This will provide an experimental database for impingement systems. WP2 will also evaluate and improve the cooling performance of impingement systems for application to High Pressure turbine cooling systems.

WP3 Radial passages engine geometry: WP3 will provide an experimental database for engine representative ribbed radial geometries. The data set will enable computer methods to be evaluated and refined, leading to more accurate flow and heat transfer predictions.

WP4 U-bend and radial passage: WP4 will provide an experimental database for CFD code validation and calibration for the U-bend cooling passages of High Pressure and Low Pressure turbines.

WP5 Computational Fluid Dynamic Studies: WP5 will provide optimal Computational Fluid Dynamics (CFD) simulation methodologies for applications encountered in WP2, 3 and 4 and will compare the different simulation strategies.

WP6 Dissemination: This will disseminate and develop exploitation plans and manage IPRs.

Expected Results

1. New simulation and optimisation software will be developed to identify optimal solutions for cooling problems. The resulting geometries will be considered for experiments in each of the experimental WPs.
2. The test conditions achieved in a rotating rig will simulate all of the important dimensionless groups that determine flow and heat transfer. The application of a test facility with this capability to the study of impingement cooling and high aspect ratio radial passages is unique.
3. Measurement in internal cooling flow channels at high and low Reynolds numbers will enable the flow and heat transfer for High Pressure and Low Pressure cooling systems to be studied.

Acronym:	ERICKA
Name of proposal:	Engine Representative Internal Cooling Knowledge and Applications
Grant Agreement:	233799
Instrument:	CP – FP
Total cost:	7 029 628 €
EU contribution:	4 702 268 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.07.2009
Ending date:	30.06.2013
Duration:	48 months
Technical domain:	Propulsion
Website:	http://www.ericka.eu
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	Industria de Turbo Propulsores SA	ES
	MTU Aero Engines GmbH	DE
	Rolls-Royce Deutschland Ltd & Co KG	DE
	Snecma SA	FR
	Centre de Recherche en Aéronautique ASBL - Cenaero	BE
	Cambridge Flow Solutions Ltd	UK
	EnginSoft SpA	IT
	Numerical Mechanics Applications International SA	BE
	Office National d'Études et de Recherches Aérospatiales	FR
	Università degli Studi di Firenze	IT
	Universidad Politécnica de Madrid	ES
	The Chancellor, Masters and Scholars of the University of Oxford	UK
	Universität Stuttgart	DE
	Instytut Maszyn Przepływowych - Polskiej Akademii Nauk	PL
	Arttic	FR

FUTURE
Flutter-Free Turbomachinery Blades

State of the Art - Background

Flutter denotes a self-excited and self-sustained vibration phenomenon of turbomachinery blades that can lead to failure unless properly damped. The present trends in turbomachinery design to increase component loading while reducing structural weight can lead to critical situations from a flutter point-of-view. Articles from literature report that although 90% of the potential high cycle fatigue (HCF) problems are covered during development testing, the remaining few problems account for nearly 30% of the total development cost and are responsible for over 25% of all engine-distress events. Problems related to flutter therefore impose large costs and programme delays since they are encountered late in development when engines are tested at full power or in flight conditions.

Today, fundamental blade design with respect to flutter is still based to a large degree on relatively simple empirical criteria. These rules are mostly over-conservative and therefore not applicable to modern, highly loaded, lightweight components. On the other hand, analysis techniques have evolved considerably and allow for a detailed breakdown of unsteady aerodynamic phenomena. The foremost reason for still having these simple criteria in use today is the lack of proper validation data addressing complex 3D flows involving non-linear viscous effects, and real engine multi-row environments.

Objectives

One of the main objectives of FUTURE is to improve and validate the current state-of-the-art prediction tools. Secondly, the underlying reasons and vital parameters for the inception of flutter are neither completely identified nor fully understood - knowledge that within FUTURE will be gained through a combined experimental and numerical effort, including extensive free-flutter experiments. With the goal to obtain a comprehensive view of the main flutter physics in both the compressor and turbine modules, the FUTURE project has been designed with structural, cascade and rotating rig experiments for these two modules.

In detail, the scientific and technical objectives of the FUTURE project are the following:
- Improve understanding of flutter based on state-of-the-art component and engine relevant experiments;
- Define design rules and criteria for aggressive lightweight bladings;
- Develop and validate state-of-the-art measurement techniques for aeromechanic experiments;
- Establish a worldwide unique database with high quality experimental aero-elastic results;
- Establish 'CFD Best Practice Guidelines' for aero-elasticity in turbines and compressors;
- Establish 'Experimental Best Practice Guidelines' for aero-elasticity in turbines and compressors.

Description of Work

The FUTURE project is organised into four different work packages that are interconnected to give a coherent and clear progress of the state-of-the-art of aero-elasticity in turbomachines. The different activities can be summarised as:
- Eight interconnected turbine and compressor experiments (using rotating and static rigs) will be performed;
- These experiments will be combined with numerical modelling of vibrating blades together with the surrounding flow interfering with the vibrating structure.

Results from all the activities in the project will lead to a more coherent view and a better physical understanding of the flutter phenomena in turbomachines.

In the process to reach this unique knowledge status, a sophisticated, not yet available, measuring technique will be being developed, and two new excitation mechanisms will be implemented as back-up to the free-flutter experiments. Furthermore, a unique database with combined structural and unsteady aerodynamic results will be established and made available for further dissemination among the partners. This database will, through the combined efforts of experimental and numerical aero-elastic experts that are gathered for the project, contain significantly more detailed data than any other existing database in the world.

Cascade flutter test facility at KTH

Expected Results

By advancing the state-of-the-art in flutter prediction capabilities and design rules, the FUTURE project will lead to short-term benefits in terms of decreased development cost in current engine programmes, reduced weight and thus fuel consumption, and an increased ability for efficiently managing flutter problems occurring in engines in service.

In the longer term, improved analysis and design aeromechanical methods for aggressive lightweight blade design are an enabling factor for high efficiency, environmentally friendly aero engines and gas turbines with maintained safety. In combination with a reduced time-to-market the project outcomes will have a strong impact on the competitiveness for the European aero-engine module and stationary gas turbines manufacturers participating in the project. The project will give the partners access to experimental data not available in any other company in the world.

Acronym:	FUTURE
Name of proposal:	Flutter-Free Turbomachinery Blades
Grant Agreement:	213414
Instrument:	CP – FP
Total cost:	10 669 089 €

EU contribution:	6 996 196 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.07.2008	
Ending date:	30.06.2012	
Duration:	48 months	
Technical domain:	Propulsion	
Website:	http://www.future-project.eu	
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	Avio S.p.A.	IT
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	Industria de Turbopropulsores S.A.	ES
	Rolls Royce plc	UK
	Snecma SA	FR
	Turbomeca SA	FR
	Alstom Power Ltd	UK
	Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique	FR
	Techspace Aero SA	BE
	PCA Engineers Ltd	UK
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	Council for Scientific and Industrial Research	ZA
	Centro de Tecnologías Aeronáuticas	ES
	Office National d'Études et de Recherche Aérospatiales	FR
	Fundación Centro de Tecnologías Aeronáuticas	ES
	École Polytechnique Fédérale de Lausanne	CH
	Stellenbosch University	ZA
	Universidad Politécnica de Madrid	ES
	Università degli studi di Firenze	IT
	Politecnico di Torino	IT
	École Centrale de Lyon	FR
	Imperial College of Science, Technology and Medicine	UK
	Technische Universität Darmstadt	DE

KIAI

Knowledge for Ignition, Acoustics and Instabilities

State of the Art - Background

The engine emissions issue is addressed by the evolution of the relevant international regulations (e.g. ICAO CAEP2 standards) and by ambitious technological objectives agreed by the European aeronautics industry described in Vision 2020 of the 2nd version of the ACARE Strategic Research Agenda (SRA2).

The availability of clean engines not only has a huge environmental impact, but it is now vital that every manufacturer tries to maintain a position within world competition for the sustainable growth of aviation transport.

For the time being, the European engine industry does not have the methodologies adapted to predict behaviour of low NO_x combustors. Consequently, and in order to be able to set up the development of low NO_x technologies, KIAI will deliver unstationary Computational Fluid Dynamics (CFD) tools which will allow a deeper comprehension of unsteady phenomena.

Results from previous European projects on conventional and lean combustion technologies are the basis of the KIAI project. They have adapted CFD methodologies to design conventional combustors and are now preparing for paths to deal with low NO_x combustors.

Objectives

The main objective of the KIAI project is to provide reliable methodologies to predict the stability of industrial low NO_x combustors, as well as their ignition process from spark to annular combustion. When used at an early stage in the conception cycle of low NO_x combustors, KIAI CFD methodologies will play a key role and accelerate the delivery process of lean combustion technology considerably with a proven capability to reach the 80% NO_x emission reduction required for introduction into service before 2020 with the necessary reliability, safety and economical viability.

As already demonstrated by past and ongoing studies and European projects, low NO_x technologies lead to crucial unsteady phenomena that are neither controlled nor predictable at the moment.

Directly linked to a better understanding and prediction of these unsteady phenomena, the scientific objectives of KIAI are:

- To predict the coupling between the acoustics and the flame;
- To determine the acoustic boundary conditions of multi-perforated plates surrounding the combustion chamber;
- To account for non-premixed spray flows in the combustion process;
- To explore aerodynamic unsteadiness in strutted pre-diffusers adapted to high mass flow injectors and develop a liquid film break-up model for an injector;
- To evaluate the sensitivity of Large Eddy Simulation (LES) predictors to small technological variations of geometry.

Description of Work

To address the weaknesses introduced by the lean low Nox combustion technology, KIAI is structured into four main technical sub-projects (SPs):

SP2: Prediction method for thermoacoustics.

The main implication of low NO_x technologies is an increased sensitivity to combustion instabilities. These instabilities come from a tight coupling between pressure fluctuations introduced by the flame and the backward influence of the acoustics of the chamber. In SP2, KIAI will integrate the impact of the flame on the thermoacoustic behaviour of combustors.

State of the art of methodologies addressing processes for low NO_x combustion

SP3: Multiperforated plates issue in industrial combustors.

The knowledge of acoustic boundary conditions is essential to determine the correct acoustic behaviour of combustors. In SP3, KIAI will determine the influence of multi-perforated plates to incident acoustic waves.

SP4: Ignition and re-ignition.

For evident operational and safety reasons, ignition and especially altitude re-ignition are essential issues for aeronautical gas turbine applications. The early propagation of the flame from spark to the combustion chamber, and then from one sector to the totality of the annular combustor is a complex, unsteady process. In SP4, KIAI will work on the flame itself by considering tabulated chemistry descriptions, re-circulated burnt gases, two phase flows and high altitude conditions.

SP5: Unsteady aero-dynamics in injection.

When dealing with low NO_x combustors, the upstream flow conditions can greatly influence the unsteady behaviour of the flame. Thus, pre-diffusers and injectors become instability sources that have to be controlled. In SP5, KIAI will shed light on spray atomisation as well as on the unsteady flows generated by pre-diffusers and injectors.

Sustaining the four aforementioned technical subprojects, the additional subproject SP1 – KIAI Coordination will focus on the project monitoring, dissemination and exploitation of project results.

Expected Results

The main expected outputs of KIAI are:
- Acoustic tools able to provide stability maps of the combustors including the influence of the flame;
- An acoustic description of multi-perforated plates widely encountered in combustion chambers;
- A tabulated chemical description of non-premixed spray combustion;
- A liquid film break up model;
- An estimation of the reliability of LES with respect to its capacity to account for small technological variations of geometry for both isothermal and reactive flows.

KIAI will secure the innovative developments emerging from technologically orientated projects like the TECC-AE FP7 project. When used at an early stage in the conception cycle of low NO_x combustors, KIAI CFD methodologies will play a key role and considerably accelerate the delivery process of lean combustion technology with a proven capability to reach the 80% NO_x emissions reduction required for introduction into service before 2020 as well as the necessary reliability, safety and economic viability needed.

Acronym:	KIAI	
Name of proposal:	Knowledge for Ignition, Acoustics and Instabilities	
Grant Agreement:	234009	
Instrument:	CP – FP	
Total cost:	8 005 293 €	
EU contribution:	5 399 005 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.05.2009	
Ending date:	30.04.2013	
Duration:	48 months	
Technical domain:	Propulsion	
Coordinator:	Mr. Sebastien Roux SNECMA SA Rond Point Rene Ravaud FR 77550 Moissy Cramayel	
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Partners:	Turbomeca SA	FR
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	Rolls Royce plc	UK
	Avio S.p.A	IT
	Institut National des Sciences Appliquées de Rouen	FR
	Centre national de la recherche scientifique (CNRS)	FR
	Université de Pau et des Pays de l'Adour	FR
	Technische Universität München	DE
	IFP-Institut français du pétrole	FR
	Office National d'Études et de Recherches Aérospatiales	FR
	Deutsches Zentrum für Luft - und Raumfahrt ev	DE
	Loughborough University	UK
	Università degli Studi di Firenze	IT
	Universität Karlsruhe (Technische Hochschule)	DE
	Centre Européen de Recherche et de Formation avancée en Calcul Scientifique	FR
	ARTTIC	FR
	Microturbo Sa	FR

TECC-AE
Technology Enhancements for Clean Combustion

State of the Art - Background

Over the next 20 years, air traffic is expected to grow annually by 3% for passengers and 9-10% for freight volume (ACARE 'average' scenario). This traffic growth will continue to affect the environment with:
- increased greenhouse effects (CO_2 emissions);
- degradation of local air quality (NO_x, but also particulates and CO emissions as well as UHCs – un-burnt hydrocarbons).

The engine emissions issue is addressed by the evolution of the corresponding international regulations (e.g. ICAO CAEP standards) and by ambitious technological objectives agreed by the European aeronautics industry, as described in Vision 2020 and the second version of the ACARE Strategic Research Agenda.

The availability of clean engines would not only have a huge environmental impact, but has also become a vital stake for every manufacturer to remain as a player within the world competition for sustainable growth of aviation transport. Developing combustion technologies for clean engines is consequently mandatory to comply with the ambitious ACARE 2020 targets and future ICAO standards, to gain new markets and to remain competitive.

Despite several ambitious R&T projects addressing engine emissions over the years, these technologies have not yet been brought to the level required for introduction into service with the necessary reliability, safety and proven economical viability.

Objectives

The scientific and technological objectives are:

1. To solve the main limitations identified during past and ongoing projects which appear when lean combustion is pushed toward its maximum potential regarding NO_x emission reductions. In particular the targets are:
   - to provide full combustor operability in terms of ignition, altitude relight and weak extinction performance;
   - to suppress the occurrence of thermo-acoustic instabilities by reducing the combustor sensitivity to unsteady features to such a level that instabilities will not happen;
   - to ensure injection system robustness with respect to coking that can appear during transient operations of the engine;
   - to develop, demonstrate and validate design rules, CFD capabilities and scaling laws;
   - to provide knowledge for global optimisation of the multiplicity of combustion parameters of lean combustion systems to achieve lower flame temperatures and thus lower thermal NO_x formation (e.g. homogeneous fuel-air mixtures, cooling and unsteady behaviour optimisation).
2. To look even further ahead and to overcome the complexity issues inherent in staged lean combustors. The TECC-AE project will also aim to design and assess an innovative, compact, lighter and simplified lean combustion combustor concept, and to develop a compact Ultra Low NO_x (ULN) injection system.

Description of Work

To achieve an 80% reduction in NO_x emissions for a commercial engine by 2020 without compromising operability and CO/UHC emissions it is also necessary to address in parallel the industrialisation of the system. This means there is a need to take into account weight, simplification and cost issues to deliver a solution that is easy to produce and then maintain.

The TECC-AE approach will be worked in parallel:

1. the development of the technology to guarantee an 80% reduction in NO_x emissions;

2. the overall design of the combustor and injection system to achieve a simpler, lighter and more economic lean combustion system.

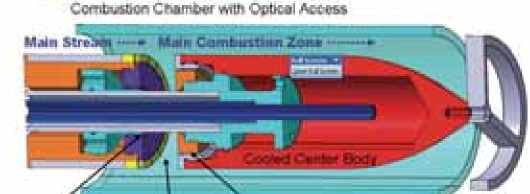
TECC-AE has been divided into four main technical work packages:
- Enhanced operability for staged injection systems;
- Thermal management;
- Sensitivity to unsteady features;
- Innovative technologies.

Three additional work packages are included: the first will be dedicated to the management of the project, and the last two to the exploitation and the dissemination. Regarding the exploitation, the complete synthesis and assessment of lean combustion regarding the ACARE 2020 objectives will be done by taking into account the results of previous projects as well as the TECC-AE outputs. The strategy and the main principles on how to design the best combustor, taking into account all the available knowledge, will then be established.

Expected Results

TECC-AE will have a major impact on short and long-term engine manufacturer competitiveness as it will provide:
- an acceleration towards the entry into service for lean technologies based on internally staged injection systems;
- knowledge and material for optimising the relevance of the technological strategy developed during the R&T phase to gain excellent performance (both operational and environmental) while maintaining exploitation costs at market acceptance levels;
- an increase of the technology robustness regarding some vital trade-off (NO_x emissions reduction/combustor durability, transient operations/coking, CO-UHC emissions/NO_x emissions);
- knowledge and multi-physics CFD methodology for scaling technology and for carrying out performance optimisation for the whole combustion system, ensuring that the product will have optimal environmental and operational performance;
- an extension of the acquired knowledge to the problem of lean combustion and its embodiment into a more or less automatic system, (which is of vital importance for ensuring that the combustion system will be designed within the shortest possible time, and will fully meet its operational and environmental objective performance).

Combustion Chamber with Optical Access



Acronym:	TECC-AE	
Name of proposal:	Technology Enhancements for Clean Combustion	
Grant Agreement:	211843	
Instrument:	CP – FP	
Total cost:	11 912 597 €	
EU contribution:	7 999 303 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.07.0008	
Ending date:	30.06.0012	
Duration:	48 months	
Technical domain:	Propulsion	
Coordinator:	Mr. Michel Cazalens	
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	Rolls Royce plc	UK
	Avio S.p.A.	IT
	MTU Aero Engines	DE
	Institut National des Sciences Appliquées de Rouen - UMR 6614 - CORIA FR	
	Office National d'Études et de Recherches Aerospatiales	FR
	Deutsches Zentrum für Luft- und Raumfahrt e.V	DE
	Loughborough University	UK
	Università degli Studi di Firenze	IT
	The Chancellor, Masters and Scholars of the University of Cambridge	UK
	University of Karlsruhe	DE
	University of Sheffield	UK
	Brandenburgische Technische Universität	DE
	Centre de Recherche et de Formation avancée en calcul scientifique	FR
	University of Genoa	IT
	ARTTIC	FR

COSMA
Community Oriented Solutions to Minimise aircraft noise Annoyance

State of the Art - Background

The SEFA EC-funded project (02/2004-06/2007) was the first, and so far unique, approach to applying sound engineering practices to external aircraft noise, i.e. reducing noise (annoyance), not just by lowering levels but also by improving the characteristics of aircraft noise signatures. Regarding lowering the level, related to an analysis of single events, it was a breakthrough in its innovative concept and performance.

In addressing the other, within innovative field and laboratory annoyance studies, COSMA will continue the successful collaboration amongst aircraft noise engineers, sound designers and the noise-effects experts. It provides the best possible paradigm for ensuring that the work on noise effects is clearly targeted at improving aircraft design and operations, and therefore is already taking into account the ultimate goal described above.

The COSMA objectives bring together three different scientific and engineering domains:
- the noise annoyance psychometrics domain;
- the sound engineering domain;
- the aircraft noise engineering domain.

This innovative and collaborative approach aims to reduce perceived noise annoyance by 50% by 2020.

Objectives

COSMA aims to develop engineering criteria for aircraft design and operations in order to reduce the annoyance of exterior aircraft noise within airport communities. Such criteria do not currently exist since aircraft noise engineering has historically focused on achieving ever-lower noise levels for individual events and at close distance from the runway.

Within the framework of a unique approach, COSMA will:
- improve the understanding of noise annoyance effects from aircraft in the airport community through field studies and psychometric testing;
- use these findings to set up optimised aircraft noise shapes;
- develop techniques for realistic synthesis of aircraft noise around airports;
- validate the optimised aircraft noise shapes and their associated engineering guidelines;
- put in place a knowledge management for design practices and scientific information on an aircraft's exterior noise annoyance effects.

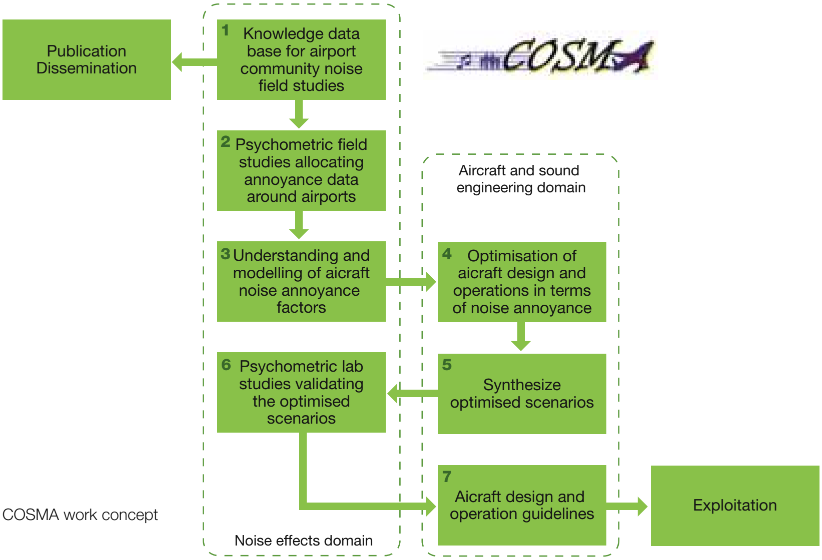
The scientific research results will be used for reducing the noise annoyance at source, by technological or operational means, through an improved understanding of the effects of aircraft noise in the surrounding airport community.

Description of Work

1. COSMA will use recent and ongoing research on airport community field studies by setting up an Aviation Noise Impact Knowledge Base to collect all available data and methods on annoyance measurements.

2. Psychometric testing will be carried out in the field, as it is the only experimental paradigm to collect relevant data on acute and long-term annoyance.

3. Data will be collected within the virtual resident platform VRes, which started in SEFA. The VRes tool is going to simulate the human subjective perception and long-term annoyance. Mathematical algorithms will be developed to identify and describe the input audio data by identifying the decisive annoyance factors of aircraft noise.



COSMA work concept

4. Aircraft engineers will modify and optimise future airport noise scenarios in terms of level, duration, frequency and sound characteristic effects.
5. Optimised scenarios will be synthesised based on source components and flight path data and automatically associated with engineering criteria for aircraft designs and operations. Actual low noise technologies and operations will be considered along with future noise scenarios at aircraft and engine manufacturers.
6. Optimised future airport noise scenarios will be validated to typical current airport noise scenarios by laboratory experiments and from these engineering guidelines for aircraft design and operations will be defined.

Expected Results

This project will produce design criteria and tools, so that the measure of its success will really be associated with their effective availability at the end of the project. The specific nature of this project makes it difficult to assess the satisfaction of objectives in terms of decibels, but an important expected benefit is that the loose notion of environmental friendliness – that is often used as an expression of the ultimate goal for noise research – will be described in scientific and technical terms as being able to influence future aircraft designs and operations.

Acronym:	COSMA	
Name of proposal:	Community Oriented Solutions to Minimise aircraft noise Annoyance	
Grant Agreement:	234118	
Instrument:	CP – FP	
Total cost:	5 913 945 €	
EU contribution:	4 096 034 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.06.2009	
Ending date:	31.05.2012	
Duration:	36 months	
Technical domain:	Noise and Vibration	
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	01dB-Metravib SAS	FR
	SASS Accoustic Research and Design GmbH	DE
	Institut für Technische und Angewandte Physik GmbH	DE
	Zeus GmbH - Zentrum für Angewandte Psychologie, Umwelt- und Sozialforschung	DE
	Projecto, Empreendimentos, Desenvolvimento e Equipamentos Cientificos de Engenharia	PT
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	Institut National de Recherche sur les Transports et leur Sécurité	FR
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	Forschungsgesellschaft für Arbeitsphysiologie und Arbeitsschutz e.V.	DE
	Università degli Studi Roma Tre	IT
	University of Cergy Pontoise	FR
	Kungliga Tekniska Högskolan	SE
	Università degli Studi di Napoli ‘Federico II’	IT
	University of Southampton	UK
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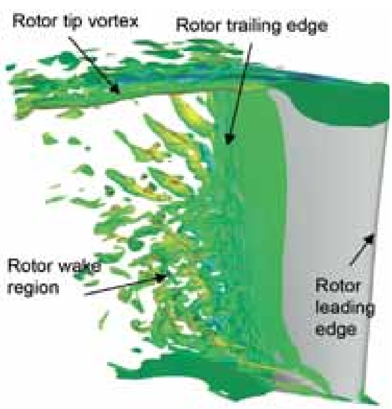
FLOCON

Adaptive and Passive Flow Control for Fan Broadband Noise Reduction

State of the Art - Background

Air traffic is predicted to grow by 5% per year in the short and medium term. Technology advances are required to facilitate this growth with acceptable levels of noise. FLOCON addresses this requirement by delivering the technology to reduce fan noise at source through the development of innovative concepts based on flow control technologies.

Due to the continuously increased bypass ratios of aero engines and the fact that in the past noise reduction efforts have been focused mainly on tone noise, today's engines are generally designed in a way that the tone noise does not significantly emerge from the broadband noise floor. A quantitative assessment shows that if all tones are removed from the total engine noise spectrum, the resulting EPNL (Effective Perceived Noise Level) at approach is reduced by only 2.2 EPNdB for a turbo-fan engine with a bypass ratio (BPR) of 5, and by 1.5 EPNdB for a geared fan engine with an extremely high BPR of 16. As most of this broadband noise is generated by the fan (summed up over the three noise certification conditions), the reduction of fan broadband noise has the maximum effect on aero engine noise reduction. To fulfil future demands in aircraft noise reduction, the reduction of fan broadband noise by design (e.g. tip speed or blade shape) is expected to be insufficient, thus new concepts involving flow control have to be developed.



Example result of an advanced large-eddy-simulation of broadband rotor-stator interaction noise

Objectives

Previous attempts at reducing broadband noise have been inhibited by a limited understanding of the dominant mechanisms and by a lack of high-fidelity numerical models. These issues are addressed in the ongoing PROBAND FP6 project. In FP7, FLOCON moves beyond the scope of PROBAND to the development of specific concepts for reducing broadband noise in aero-engine fan stages.

FLOCON will demonstrate methods capable of reducing fan broadband noise from aero engines at source by 5dB at approach and takeoff conditions, contributing to the European objective of reducing aircraft external noise per operation by 10dB by 2020.

To achieve this, FLOCON will:
- design noise-reduction concepts and associated devices able to reduce fan broadband noise from aero engines;
- assess the noise reduction concepts by conducting lab-scale experiments;
- complement the experiments by numerical simulations that are assessing the capability of currently available numerical tools to design low broadband noise treatments and configurations;
- develop understanding of the mechanisms involved and extrapolate the results to the aero engine environment using state-of-the-art numerical methods;

- select the best concepts by balancing noise benefit and integration impact.

Description of Work

In FLOCON, a wide range of concepts will be considered and developed to Technology Readiness Level 4 (laboratory-scale validation):
- Rotor trailing edge blowing;
- Rotor tip vortex suction;
- Rotor overtip treatments;
- Rotor and stator leading and trailing-edge treatments;
- Partly lined stator vanes.

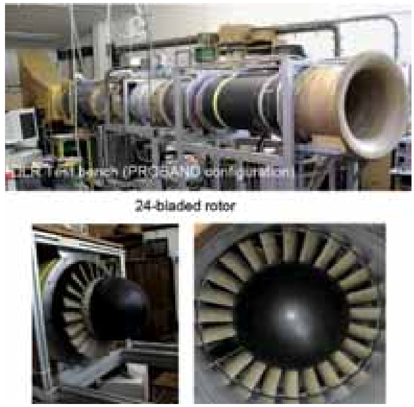
Experiments will be performed on two rotating rigs, supported where possible by more detailed measurements on a single airfoil and a cascade. Numerical methods will be used to optimise the concepts for experimental validation and to extrapolate the results from laboratory scale to real-engine application.

The impact of scaling from lab- to engine-relevant operating conditions will be assessed, as well as the side/complementary effect of broadband noise reduction features on fan-tone noise. Generally speaking, FLOCON will increase the understanding of the flow physics and broadband noise generation and control mechanisms.

The potential benefit of each concept will be assessed, including any associated penalties (weight, complexity and aerodynamic performance). Recommendations will be made as to which concepts could be integrated into new engine designs and which will require further validation at industrial rig or full engine-scale. Any developments required in enabling technologies will also be identified.

Expected Results

FLOCON will provide the European aero-engine industry with demonstrated methods to reduce broadband noise at source. In doing so it will contribute towards achieving European aerospace industries' objectives for reduced noise from aircraft to meet society's needs for more environmentally friendly air transport, and enhance European aeronautics' global competitiveness.



DLR laboratory-scale fan rig for broadband noise investigations

The broadband noise reduction concepts developed in FLOCON will be broadly applicable to the fan stage of all new aero-engine designs. A subset of the methods (to be determined within the programme) will be also applicable to core compressor designs. FLOCON itself will bring each concept up to Technology Readiness Level 4 (validation at laboratory scale) and recommend a subset for development to engine-ready level.

Recommendations will be produced which contain all the necessary information for further development and exploitation of the recommended noise-reduction methods. In particular, the experimentally determined efficacy of the method, together with an extrapolation to expected performance at full-engine scale, will be given, in addition to an initial assessment of any penalties related to weight, aerodynamic performance, stress or mechanical complexity.

Acronym:	FLOCON
Name of proposal:	Adaptive and Passive Flow Control for Fan Broadband Noise Reduction
Grant Agreement:	213411
Instrument:	CP – FP
Total cost:	5 311 013 €
EU contribution:	3 562 536 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.09.2008
Ending date:	31.08.2011
Duration:	36 months
Technical domain:	Noise and Vibration
Website:	http://www.xnoise.eu

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Avio S.p.A	IT
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Institute of Sound and Vibration Research, University of Southampton	UK
Ecole Centrale de Lyon	FR
Universität Siegen	DE
Fluorem SAS	FR
Chalmers University of Technology	SE
Technische Universität Berlin	DE
Nationaal Lucht- en Ruimtevaartlaboratorium	NL
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OPENAIR

Optimisation for Low Environmental Noise Impact Aircraft

State of the Art - Background

In the view of reducing aircraft noise for people living around airports, several options are available, as outlined in ICAO's balanced approach:

- Noise reduction at the source;
- Low noise operational procedures;
- Land use management;
- Operational restrictions.

Since «operational restrictions» have a severe economic impact, the focus of the solutions should be to work in parallel on the other 3 options. OPENAIR focusses on the first approach: «Source noise reduction», which in practice means lower noise emissions from the aircraft's engines, landing gear and wing.

Several European research projects working on these subjects have already been performed: In 2001, the SILENCE(R) project gathered the preparation activities from FP3 and FP4, which had resulted in a large number of technologies achieving TRL 3-4. SILENCE(R) then took these efforts to a TRL6-7 level by performing ground and flight tests on engines and aircraft. Full scale TRENT and CFM56 engines as well as A320 and A340 aircraft took part in this validation exercise that ended in 2007. A technology evaluation exercise at the end of this project, showed that these «generation 1» technologies, when applied to a future fleet would improve the noise impact by 3 dB. Taking into account also improved operational procedures that were developed in parallel in other projects, a total improvement of 5 dB was achieved. This is considered as a good result given the 10 dB ACARE objectives for 2020.

Among the SILENCE(R) technologies, there were also a few future generation or «generation 2» technologies, like the «Active Stator», which were tested succesfully, but did not yet achieve the full technology readiness status. These, and other «generation 2» technologies are now further developed in OPENAIR.

Objectives

By adopting a whole aircraft approach based on the latest developments in active/adaptive technologies, flow control techniques and advances in computational aero-acoustics applied to the major causes of noise at source, OPENAIR aims to deliver a 2,5 dB step change in noise reduction, beyond the SILENCE(R) achievements. The plan supports realistic exploitation of promising design concepts driven by noise reduction and should result in the development and validation of up to TRL 5 of '2nd Generation' technology solutions.

Description of Work

OPENAIR's multidisciplinary approach and composition is suited to the projected integrated, lightweight solutions. The process includes a down-selection at half life of the project. The selected technologies will be subjected to scaled rig tests, and the resulting data will support assessment of the noise reduction solutions on powerplant and airframe configurations across the current and future European range of products. The project exploitation plan is expected to include proposals for further demonstration in the Clean Sky JTI. The verification of the technologies' applicability will be assured by addressing identified integration and environmental tradeoffs (performance, weight, emissions).

Expected Results

OPENAIR will develop solutions that can play a significant role, along with the previous Generation 1 effort, enabling future products to meet the ACARE noise goals and improving current fleet noise levels through retrofitting. This capability is key to providing the flexibility needed to simultaneously accommodate market requirements in all segments, global traffic growth and environmental constraints, while addressing the global environmental research agenda of the EU.

Acronym:	OPENAIR
Name of proposal:	Optimisation for Low Environmental Noise Impact Aircraft
Grant Agreement:	234313
Instrument:	CP – IP
Total cost:	30 134 670 €
EU contribution:	18 273 829 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.04.2009
Ending date:	31.03.2013
Duration:	48 months
Technical domain:	Noise and Vibration
Website:	http://www.xnoise.eu/index.php?id=387

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Free Field Technologies SA	BE
Gkn Aerospace Services Limited	UK
INASCO - Integrated Aerospace Sciences Corporation o.e.	EL
Industria de Turbo Propulsores SA	ES
Institution of the Russian Academy of Sciences Joint Institute for High Temperatures Ras	RU
Kungliga Tekniska Högskolan	SE
Messier-Dowty SA	FR
Microtech International spolka akcyjna	PL
NasTech srl - Novel Aerospace Technologies	IT
Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
Office national d'études et de recherches aerospatiales	FR
Qinetiq Limited	UK
Rolls-Royce Deutschland Ltd & Co KG	DE
Rolls Royce plc	UK

Short Brothers plc	UK
Snecma Propulsion Solide	FR
Federal State Unitary Entreprise the Central Aerohydrodynamic Institute named after prof. n.e. Zhukovsky	RU
Chalmers tekniska högskola ab	SE
Imperial College of Science, Technology and Medicine	UK
University of Patras	EL
Centre national de la recherche scientifique (cnrs)	FR
University of Southampton	UK
Volvo Aero Corporation ab	SE
Valtion teknillinen tutkimuskeskus	FI
Universidad Politecnica de Madrid	ES
Universita degli Studi Roma Tre	IT
The Chancellor, Masters and Scholars of the University of Cambridge	UK

TEENI
Turboshaft Engine Exhaust Noise Identification

State of the Art - Background

Helicopters can generate a large amount of external noise, which can be perceived as aggressive by citizens; a helicopter's traditional missions – rescue, medical, law enforcement – are normally very close to populated areas. As emphasised in the ACARE Strategic Research Agenda 2 (SRA2), the tendency to increase rotorcraft missions in the public vicinity should not lead to an increase of public disturbance.

The main exterior noise sources on helicopters include the main rotor, tail rotor and engine. The turboshaft engine is known to be a major contributor to exterior noise at take-off.

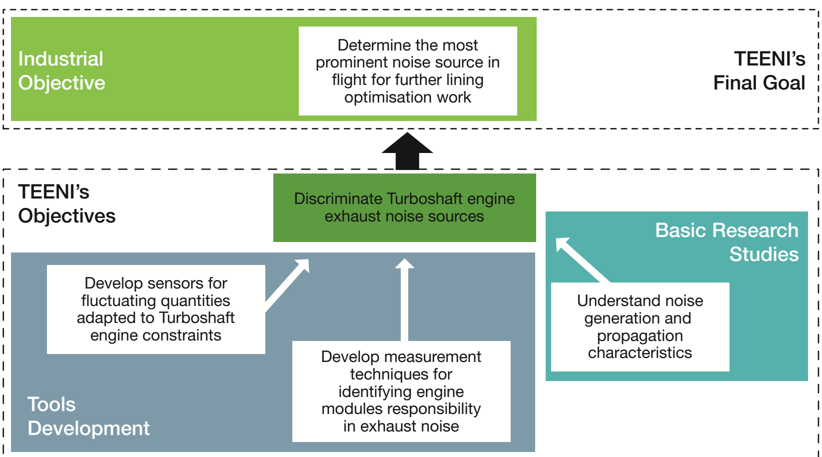
Former projects (Hortia, Silence(R)), or ongoing ones (Friendcopter) have managed to reduce significantly the noise coming out of the exhaust of the engine, and show the industrial evidence that a liner can viably be installed on the exhaust.

Though, in order to comply with ACARE SRA2 objectives, this attenuation has to be maximised for the most dominant engine noise source in flight requiring a better knowledge of the exhaust sound-source balance. Broadband noise at a turboshaft exhaust – generally called core noise – is assumed to be a mix between combustion and turbine noise.

Objectives

TEENI deals with understanding aeronautical noise, in particular helicopter noise, with the goal of noise reduction. As engine noise is a main contributor to the entire exterior noise at take-off, and because exhaust noise still needs an increased attenuation, this project focuses on understanding exhaust noise sources.

The main aim is to determine on which noise source a turboshaft exhaust liner should be optimised. Four objectives can be summarised as follows:



- Discriminate the origin of the sound field radiated from a turboshaft engine's exhaust and highlight the priorities for exhaust liner optimisation on the most prominent engine noise source in flight;
- Develop and test sensors, adapted to fluctuating quantities (such as acoustic pressure, acoustic velocity, temperature fluctuations, etc.) and resistant to the engine environment (temperature, grazing flow);
- Understand how the broadband noise propagates through turbine blade rows;
- Develop and apply noise-source breakdown techniques which are able to locate the noise origin from inside the engine casings.

Tackling this broadband noise identification problem is an ambitious goal, due to:
- The complexity of the physics involved;
- The severe environmental conditions in the exhaust which prevent using standard instrumentation;
- The small space available on this kind of engine.

Description of Work

These important challenges need to be answered in order to maximise liner attenuation. Therefore, to achieve the previously mentioned four objectives, TEENI's work plan includes:
- Innovative sensor development, from design to laboratory test in representative engine conditions;
- New noise-source breakdown techniques, to help discriminate the far-field noise origin with respect to each engine module. This includes the use of both acoustic near-field and far-field arrays, with newly developed algorithms that should provide an insight into noise generation from the exterior;
- Basic studies, including rig experiments, to understand the propagation effects of broadband noise through blade rows. These studies will also give an opportunity to verify noise-breakdown techniques and algorithms;
- New instrumentation and source-breakdown techniques will be applied to a full-scale engine test;
- Study the development in HELENA (numerical platform developed in Friendcopter) of the source-breakdown capability;
- Using this new tool, and the TEENI and Friendcopter outputs, estimate the engine-noise source, which should be reduced.

Expected Results

The most important TEENI deliverables will be:
- A set of sensors for measuring unstationary quantities, adequate for full-scale engine testing (650 <T<1000 C);
- A noise breakdown technique selected out of a panel of methods due to an adapted treatment of the engine-noise database;
- A thorough understanding of noise generation, propagation and radiation through the exhaust;
- A comprehensive full-scale engine-test database;
- A ranking of exhaust-noise sources, with a recommendation on the noise source to be reduced.

Acronym:	TEENI
Name of proposal:	Turboshaft Engine Exhaust Noise Identification
Grant Agreement:	212367
Instrument:	CP – FP
Total cost:	4 628 434 €
EU contribution:	3 297 418 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.04.2008
Ending date:	31.03.2011
Duration:	36 months
Technical domain:	Noise and Vibration
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	Bruel & Kjaer Sound & Vibration Measurement A/S	DK
	Institutul National de Cercetare-Dezvoltare Turbomotoare-Comoti	RO
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	Ecole Polytechnique Fédérale de Lausanne	CH
	INASCO - Integrated Aerospace Sciences Corporation O.E.	GR
	Microflown Technologies BV	NL
	Office National d'Études et de Recherches Aérospatiales	FR
	The Provost, Fellows & Scholars of the College of the Holy and Undivided Trinity of Queen Elizabeth near Dublin	IE

VALIANT

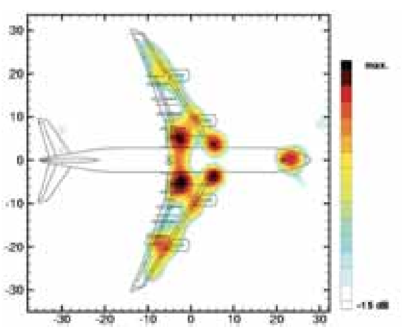
VALidation and Improvement of Airframe Noise prediction Tools

State of the Art - Background

The overall noise radiated by modern aircraft has two sources which are quite balanced at approach: the engine and the airframe. The airframe noise (AFN) has a broadband character and is mainly due to the interaction of the turbulent airflow with the high-lift devices (slats and flaps) and landing gears, and to a lesser extent to cavities, spoilers and to boundary layers developing along the fuselage.

One of the major ACARE objectives is a reduction in perceived noise level of fixed-wing aircraft by 50% by 2020 compared to 2001. In achieving this required breakthrough towards quieter aircraft, reducing AFN is very important now and will become even more important in the future, especially for large aircraft, due to the already anticipated development of quieter engines.

With the clearly expressed tendency of the modern airframe industry towards virtual prototyping and the increasing reliability of the design cycles on numerical simulations with the experimental verifications performed only at later stages of the design cycle, it is of utmost importance to increase the trust in noise predictions. However, the complexity and diversity of broadband turbulent AFN sources makes that prediction and subsequent reduction with present numerical tools extremely challenging.



Example of AFN source localisations of a landing A340 with high-lift device and landing gears (from flight test campaign)

Objectives

VALIANT is tackling this challenge by generating new experimental data, and validating and improving numerical tools for predicting AFN generated from landing gears, slats, flaps and local separation regions.

Due to the extremely complex physical nature of the phenomenon and the high cost of computing full aircraft configurations on the one hand, and the lack of a reliable experimental database on the other, VALIANT focuses on key generic test cases revealing the basic mechanisms of AFN generated by the most 'noise-dangerous' elements of a real aircraft:

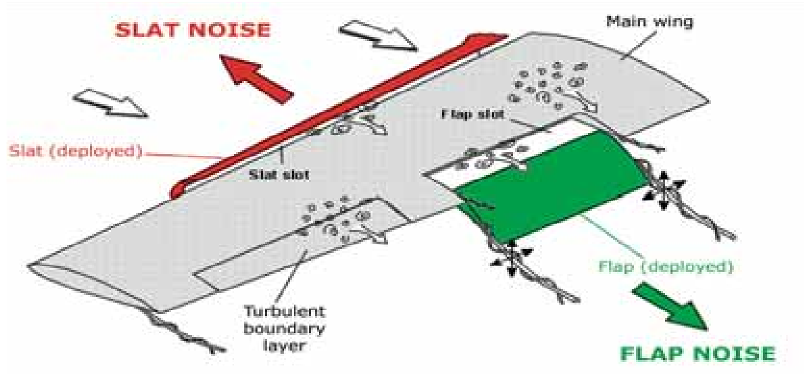
- turbulent flow over a gap;
- flow past an airfoil with a flap;
- flow past an airfoil with a slat;
- flow past two struts (landing gear).

These four generic flows actually 'cover' the most important sources of AFN generated by a real aircraft and therefore their study provides a sufficient basis for evaluation and improvement of the Computational Aero Acoustic (CAA) tools aimed at predicting AFN. On the other hand, these flows are 'simple' in the sense that their accurate simulation and noise generation are computationally affordable.

For all these configurations, the components of the noise prediction chain (for the turbulent/source region, and near- and far-field propagation domains) and their mutual interactions are evaluated and avenues of improvement developed.

Description of Work

The project is divided into four technical work packages (WP).



High-lift device broadband noise mechanisms to be investigated within VALIANT

WP1 focuses on generating a detailed and reliable experimental database for validation purposes for the four generic test cases listed above. Expected results are steady and unsteady aerodynamic data, as well as noise-source localisation and far-field noise spectra and directivities. Acoustic measurements will be performed in a cheap large aerodynamic wind tunnel.

WP2 is aimed at a thorough assessment of currently available CAA approaches in terms of turbulence and acoustics by comparing both with each other and with the experimental data. This systematic comparison will highlight both strong and weak points of the numerical approaches and suggest avenues of further improvements on the weak points within WP3.

Based on the remedies proposed in WP2, the CAA approaches will be improved in terms of turbulence representation and near-, mid- and far-field noise predictions. WP3 aims also at improving the analytical methods which are of significant importance to assess the noise around airports in term of EPNdB (Effective Perceived Noise in Decibels) and to help interpretation of the numerical results.

WP4 assesses the influence of the successive improvements in the numerical and analytical approaches and identifies the best-suited AFN prediction tools to be integrated into industrial processes in the future.

Expected Results

This project, being an essential step towards new efficient AFN reduction concepts and their optimisation, impacts the EU directly by:

- providing a high quality experimental database for validation on broadband noise associated with generic configurations representative of the most ‘noise-dangerous’ AFN mechanisms;
- validating and improving Computational Fluid Dynamics (CFD) / CAA tools for broadband AFN prediction within an expected accuracy of 1 dB, and generating a detailed numerical database;
- identifying the best suited AFN prediction tools which may have the potential to be integrated into industrial processes in the future, for designing efficient AFN reduction technologies expected to result in a further 3 - 5 dB overall AFN gain during approach (compared to 2000 state of the art).

VALIANT will also improve cost efficiency by reducing the design and development costs. This will be achieved by providing efficient AFN prediction tools in terms of CPU time reduction and by allowing a partial replacement of extremely expensive experiments aimed at testing and optimising AFN reduction technologies by reliable numerical predictions.

Finally, VALIANT will promote the participation of organisations from International Co-operation Partner Countries by building a strong collaboration with Russia, relying on their complementary expertise in aero-acoustics.

Acronym:	VALIANT
Name of proposal:	VALidation and Improvement of Airframe Noise prediction Tools
Grant Agreement:	233680
Instrument:	CP – FP
Total cost:	3 661 682 €
EU contribution:	2 700 000 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.09.2009
Ending date:	31.08.2012
Duration:	36 months
Technical domain:	Noise and Vibration
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	Federal State Unitary Enterprise - The Central Aerohydrodynamic Institute named after Prof. N.E. Zhukovsky	RU
	Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	Centre Internacional de Mètodes Numèrics en Enginyeria	ES
	New Technologies and Services LLC	RU
	Numerical Mechanics Application International S.A.	BE
	LMS International NV	BE

ACFA 2020

Active Control of Flexible 2020 Aircraft

State of the Art - Background

Blended wing-body (BWB) type aircraft configurations, i.e. generally tailless aircraft configurations with aerodynamic wing/fuselage blending, are highly promising concerning improved low fuel consumption. This is mainly achieved by reduced structural weight and through a minimum wetted area which is significantly lower for BWB-type aircraft compared to other configurations. Major design issues of such BWB-type aircraft have already been solved or are currently under investigation in the European funded projects VELA and NACRE. The fuel efficiency of the so-called 750-passenger NACRE flying-wing configuration is comparable to the 1990s BWB concepts in the US. However, the biggest market share in long haul flights today is taken by mid-size aircraft (400-500 passengers). Therefore, there is an urgent need to exploit the advances from the VELA and NACRE projects for the pre-design of a marketable European mid-size flying-wing aircraft with a high fuel efficiency. The challenge created by the complex active control system for BWB-type aircrafts has been identified, but not yet addressed in the European projects VELA and NACRE. The aspects of ride comfort and loads alleviation under consideration of the flexible aircraft structure are of particular interest.

Objectives

The ACFA 2020 project addresses two main objectives, namely:

1. To provide solutions for the active control system for BWB-type aircrafts to supply the required handling qualities and, in particular, to alleviate gust and manoeuvre loads, as well as to improve ride comfort. BWB-type aircraft set completely new challenges in regards to complexity of control algorithms, control design and optimisation, as well as control system architecture. Instead of various single-channel or single-input-single-output (SISO) controllers, a highly coupled multi-channel or multiple-input-multiple-output (MIMO) controller is

ACFA 2020 blended wing-body aircraft design

required. Moreover, the high interaction between control and system aspects will be taken into account.

2. To provide a pre-design for a marketable European ultra-efficient flying-wing aircraft – the ACFA 2020 aircraft configuration. The ACFA 2020 aircraft configuration structure will be finally sized according to the achieved loads reduction by active control of the flexible aircraft in order to minimise the structural weight. The ACFA 2020 aircraft configuration's airframe will aim for at least half of the 50% reduced fuel consumption compared to current standard aircraft configurations of similar size.

Description of Work

In order to achieve the objectives of ACFA 2020, the work is organised into four technical subsequent work packages (WP). The core of the ACFA 2020 project is WP3 'Development & evaluation of active control concepts', where MIMO active control systems for BWB-type aircraft are designed by a community of partners involved in the NACRE and VELA projects, as well as additional key players in control design from Europe and Israel. The main objective of the designed control systems is to reduce structural vibrations and unwanted rigid body motions on the one hand, and gust and manoeuvre loads on the other. The reduced static and dynamic loads are the basis for a structural resizing performed in WP4 'Assessments and integration for the ultra-efficient 450-passenger ACFA 2020 aircraft configuration' which is designed in WP1 'Aircraft configurations definition and down-selection'. WP2 'Dynamic modelling' generates parameterised reduced-order state-space models (ROM) of the NACRE flying-wing aircraft, as well as the ACFA 2020 BWB. The investigations on the multi-objective MIMO control algorithms will start with the ROM of the NACRE flying-wing aircraft due to their early availability.

Expected Results

The key deliverables of the project are:

Deliverable I: Solutions for active MIMO control for BWB-type aircraft.

Active control systems for the alleviation of structural vibrations as well as of gust and manoeuvre loads have been investigated for conventional aircraft configurations in the European AWIATOR project, as well as in the German national project MODYAS. Such active control systems are an important means for the reduction of critical loads, as well as for the improvement of ride comfort and handling qualities. It is self-evident to also incorporate active structural control into future aircraft configurations. Thus the main deliverable of ACFA 2020 will be robust as well as adaptive MIMO architectures for active control of BWB-type aircraft.

Deliverable II: ACFA 2020 aircraft configuration consisting in the pre-design of an ultra efficient 450-passenger BWB type aircraft.

The active MIMO control strategies developed in ACFA 2020 will be applied to this new 450-passenger aircraft for load reduction as well as for improved ride comfort and handling qualities. Based on the achieved load reduction the ACFA 2020 aircraft configuration structure will be resized to demonstrate the potential weight benefit achieved with an integrated active control of the flexible aircraft.

Acronym:	ACFA 2020	
Name of proposal:	Active Control of Flexible 2020 Aircraft	
Grant Agreement:	213321	
Instrument:	CP – FP	
Total cost:	4 558 372 €	
EU contribution:	3 124 968 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.03.2008	
Ending date:	31.08.2011	
Duration:	42 months	
Technical domain:	Flight Physics	
Website:	http://www.acfa2020.eu	
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	DLR	DE
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	Swedisch Defence Research Agency	SE
	Technische Universität München	DE
	Technische Universität Wien	AT
	Czech Technical University	CZ
	National Technical University of Athens	GR
	Bialystok Technical University	PL

ALICIA
All Condition Operations and Innovative Cockpit Infrastructure

State of the Art - Background

ALICIA addresses the Vision 2020 goal of improved time efficiency in the air transportation system directly by developing new cockpit systems that can deliver significantly more aircraft movements than is possible today. The aim within ALICIA is to develop new systems which will permit aircraft to operate in almost all weather conditions and to fly closer together at lower risk, whilst simultaneously driving down air transport delays. ALICIA will couple the latest thinking in air traffic management (SESAR) with new cockpit concepts capable of providing improved mission performance whilst also enhancing situation awareness. The two key areas of technological advance will be an All Conditions Operations (ACO) system capable of delivering robust worldwide operations capability, allowing aircraft to use airports with less capable ground-based approach aids, in a wider range of degraded flight conditions. The second key area of technological advance will be a new cockpit architecture facilitating the introduction of new cockpit technologies and applications capable of driving down crew workload whilst enhancing safety and improving crew situational awareness. The rationale for the new cockpit architecture is borne of the certainty that within the next decade the cockpit design will be stressed by the introduction of a series of new concepts such as ACO and those being developed within the SESAR programme.

Objectives

The two overarching project objectives are:

1. The development of an ACO capability to reduce weather-related delays by 20%.
- Delivering a robust worldwide operations capability, allowing aircraft to use airports with less capable ground based approach aids, in a wider range of degraded flight conditions;
- Delivering more autonomous aircraft operation, including anticipation and avoidance of weather disturbances and other possible perturbations in-flight or on the ground;
- Delivering improved punctuality while simultaneously enhancing safety.

2. Development of a new cockpit architecture facilitating the introduction of new technologies and applications.
- Delivering a competitive, scalable core cockpit architecture applicable to all aircraft types;
- Delivering seamless integration of innovative avionics technologies and new applications such as All Conditions Operations to respond to the new challenges of aircraft operation;
- Delivering the architecture to enable the next step towards single crew operation.

Description of Work

The ALICIA programme provides an opportunity for many key stakeholders in Europe to work together towards a new approach to cockpit design. The application focus within the project will be All Conditions Operations because the technology integration implicit in the implementation of this system will challenge the cockpit design. However, All Conditions Operations is just one element of a diverse range of new systems that will arrive in the next generation cockpit and the cockpit architecture must be flexible enough to support this. Accordingly, within ALICIA, new core concepts applicable to all new flight-decks will be defined that facilitate the efficient introduction of a broad and expanding range of operational requirements, whilst achieving the lowest through life cost.

The utility and scalability of the new concept will be demonstrated using simulation / synthetic environments and bench testing to illustrate the feasibility of highly integrated on board functions performing:
- Strategic Surveillance of the Aircraft Environment;
- Enhanced Navigation;
- Robust Worldwide Operations in demanding Flight Conditions.

The ALICIA activities will be performed within a structure covering the following six technical areas:

1)Requirements Capture

2)Concept Generation

3)Technology Selection/Refinement

4)Application Development

5)Evaluation in Cockpit Simulators

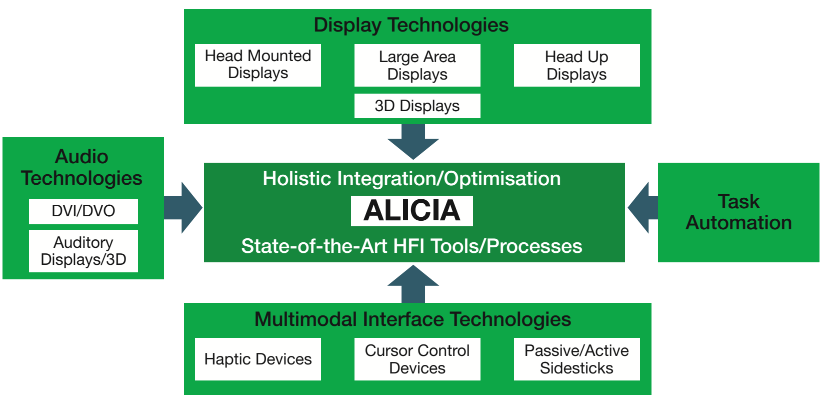
6)Dissemination and Exploitation

Expected Results

Low visibility in the critical phases of a flight near to or on the ground is one of the most disruptive factors in European aviation today. It has been estimated that 16800 airline flights were cancelled in 2007 in Europe due to low visibility conditions, and in some major airports almost 50% of arrival delays are due to low cloud and poor visibility. ALICIA aims to provide the critical building blocks necessary to reduce delays in Europe associated with poor weather by at least 20%. This will provide very significant economic advantages as well as welcome benefits to the European traveller.

ALICIA will also make advances in the design of next generation cockpits using an approach that embraces the principles of increased standardisation and commonality across multiple aircraft types. This will contribute to an increase in re-use of European technology creating further competitive advantage whilst reducing time to market.

Some of the key innovations that will be pursued within ALICIA include:
- Robust management of flight phases near and on the ground;
- Enhanced vision system and synthetic imagery;
- Holistic approach to Human Machine Interface design and integration;
- Integration with the future airspace infrastructure;
- Enhanced use of synthetic environments to support concept validation and product certification;
- Novel display, control and audio concepts, e.g. head mounted displays, direct voice input, audio environment including 3D audio, large area/high resolution displays;
- Improved sensor technologies supporting all environment capabilities;
- High integrity architectures and databases;
- Enhanced navigation techniques.



Technology Integration Approach

Acronym:	ALICIA
Name of proposal:	All Condition Operations and Innovative Cockpit Infrastructure
Grant Agreement:	233682
Instrument:	CP – IP
Total cost:	46 681 422 €
EU contribution:	27 813 675 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.09.2009
Ending date:	31.08.2013
Duration:	48 months
Technical domain:	Avionics, Human Factors and Airports
Website:	http://alicia-project.eu
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	Dassault Aviation SA	FR
	Alenia Aeronautica S.p.A.	IT
	Saab AB	SE
	Aircraft Industries, a.s.	CZ
	CAE (UK) Plc	UK
	Wytwornia Sprzetu Komunikacyjnego 'PZL-Swidnik' Spolka Akcyjna	PL
	BAE SYSTEMS (Operations) Limited	UK
	GE Aviation Systems Limited	UK
	Agusta SpA	IT
	EADS Deutschland GmbH	DE
	Jeppesen GmbH	DE
	Rockwell Collins France	FR
	Barco n.v.	BE
	LATECOERE	FR
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	Office national d'études et de recherches aerospatiales	FR

Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
Federal State Unitary Enterprise CENTRAL AEROHYDRODYNAMIC INSTITUTE	RU
Météo-France	FR
Centro Italiano Ricerche Aerospaziali	IT
Ingeniería de Sistemas para la Defensa de España, S.A.	ES
IntuiLab	FR
USE2ACES b.v.	NL
GTD SISTEMAS DE INFORMACION	ES
Deep Blue srl	IT
DBS Systems Engineering GmbH	DE
A-Volute	FR
Uzay ve Savunma Teknolojileri A.S.	TR
European Virtual Engineering	ES
AVTECH Sweden AB	SE
Technische Universität Carolo-Wilhelmina zu Braunschweig	DE
The University of Malta	MT
Alma Mater Studiorum - Università di Bologna	IT
Stirling Dynamics Ltd	UK
Aydin Yazilim Ve Elektronik Sanayi A.S.	TR
Interconsulting S.r.l.	IT
The Provost, Fellows and Scholars of the Holy and Undivided Trinity of Queen Elizabeth near Dublin (hereinafter called TCD)	IE
University of Southampton	UK

ASSET
Aeronautic Study on Seamless Transport

State of the Art - Background

At the moment, Air Transport punctuality in Europe is far from the 99% punctuality target set by ACARE's Vision 2020 and has shown a tendency to drop below 80% in the past 3 years.

The main challenge to be met in reaching the ACARE research goals in terms of time efficient air transport is due to the system performance at airports.

Recent studies reveal that the main contribution to insufficient punctuality at airports is a result of varying times an aircraft leaves its stand for departure ('off-block time'). This leads to poor predictability within flight planning. In order to maintain basic stability, airlines introduce costly time buffers within their schedules and/or reserve extra aircraft. Reducing just five minutes of buffer time in 50% of the flight-plans in Europe would save over one billion Euros a year.

Current research activities in Europe, but also in the United States, are more advanced on airside aspects.

Objectives

ASSET aims at finding an integrated approach for improvement of various modules of the airport process chains:

- passenger inbound and transfer flows timeliness at airports including boarding and deboarding of aircraft,
- the associated processes for baggage/freight handling at aircraft and within the airport,
- aircraft service processes at stand/gate (fuelling, cleaning, catering maintenance etc.),
- effects of air transport network on late arrivals due to previous delays at prior departure airport,
- there are multiple control procedures involving multiple stakeholders who all have reinforced their duties and constitute many bottlenecks prior to embarking: check-in, security, customs and immigration, boarding, etc.

Improvements of the off-block punctuality can therefore only be obtained if all those processes are improved in an integrated manner.

The proposed ASSET project is to develop four main outcomes:

1. A list of solutions to enhance time efficiency at airports which includes technical, operational and strategic approaches,
2. A ranking of above-mentioned measures according to their level of target contribution towards more time-efficient and thus economically viable air transport,
3. An objective and comparable scheme of two generic airport models (hub and medium-sized airport) to assess future technological and/or procedural changes in typical airport environments,
4. A financial approach that will clearly indicate the benefits for the various stakeholders.

The analysis of solutions improvement potential will not only be limited to single solutions addressing single elements of different airport process chains. ASSET targets at an integrated approach which allows the assessment of promising combinations of different single solutions.

Description of Work

The envisaged work is broken down into four logical steps (WP 1 – WP 4).

The objective of Work Package 1 is to precisely identify what the bottlenecks and requirements of the various air transport stakeholders are to address passenger, baggage and aircraft turnaround time issues.

The focus of Work Package 2 is the development of generic simulation models for the two types of airports: medium-size and hub. A similar, but independent, approach is followed for both types.

Work Package 3 deals with both the development and the evaluation of solutions for improving the performance of various airport processes with regard to stakeholders' requirements in the field of time efficiency.

Work Package 4 activities are based on the results of WP3, in particular the evaluation and ranking of afore developed single solutions for improving time performance of airport processes. The current WP constitutes of an expansion of the present analysis to an integrated approach, including all relevant elements of the airport process chains passenger, baggage and aircraft turnaround.

Expected Results

ASSET delivers a list of solutions that have been assessed in terms of time efficiency for airport processes throughout the whole process chain, from the entry of a passenger (and his baggage) to the airport, up to the point where the aircraft leaves its stand. The assessments of the solutions within the ASSET project are also judged against their technological readiness for 2020.

Searching and finding more time efficient - more predictable and/or faster - processes at airports will pave the way to increased capacity of aircraft movements, as more predictable and faster turnaround processes enable to serve more aircraft at a given airport gate or remote position.

Because performance of aircraft punctuality depends on a precise functioning and integration of airside and landside airport processes, isolated solutions to improve punctuality of the air transport system have not been successful in the past.

Acronym:	ASSET	
Name of proposal:	Aeronautic Study on Seamless Transport	
Grant Agreement:	211625	
Instrument:	CP – FP	
Total cost:	3 638 512 €	
EU contribution:	2 291 255 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.06.2008	
Ending date:	31.05.2011	
Duration:	36 months	
Technical domain:	Avionics, Human Factors and Airports	
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	ICTS (UK) LTD	UK
	ID PARTNERS	FR
	ADP Ingéniérie	FR
	Smiths Heimann GmbH	DE
	Žilinská univerzita v Žiline	SK
	Sagem Securite S.A.	FR
	Siemens AG	DE
	Rheinisch-Westfaelische Technische Hochschule Aachen	DE

TITAN
Turnaround Integration in Trajectory and Network

State of the Art - Background

In 2006, turnaround delays amounted to 79% of primary delays (according to the EUROCONTROL Performance Review Report covering the calendar year 2006). The report just stated that local turnaround delays were caused by airlines, airports or other parties, such as ground handlers.

The turnaround commences when the flight arrives at a block (AIBT, Actual In-Block Time). An accurate estimate of the in-block time (derived from a variable taxi-in time) prior to landing would enable ground handlers to make more efficient use of existing facilities and resources, and optimise the Stand and Gate Management.

Airport Collaborative Decision Making (CDM) is a concept which aims at improving Air Traffic Flow and Capacity Management (ATFCM) at airports by reducing delays, improving the predictability of events and optimising the use of resources. The airport CDM concept is divided into several elements, one of which is the milestone approach to the turnaround process. CDM defines a total of 16 basic milestones in which the flight is seen from the airport's perspective (inbound, ground and outbound phase).

Objectives

TITAN directly addresses airport operations by focusing on the turnaround process. The project intends to develop a new advanced operational concept for this process which is fully compatible with the SESAR ConOps (concept of operations), as well as a specific tool for the airlines in order for them to benefit from the concept. This tool will also feed information to the other actors so that they too can improve their operations thanks to better knowledge of the turnaround process.

The main objectives are:
- To enhance the efficiency of aircraft operator operations, specifically ground operations. The definition of predictability focuses on the dispersion associated to the off-block time. System predictability allows improved scheduling and more efficient operations.
- To reduce operational costs during the turnaround process. There is a clear relationship between the predictability, efficiency and cost-effectiveness of airlines, ground handling companies and airport operators.
- To ensure punctual turnaround on the apron and, thus, a higher level of passenger service.
- To optimise the use of all resources for all involved partners.
- To increase ATFM and airport slot adherence.
- To improve punctuality and reduce delays. Punctuality is essential from a passenger's viewpoint and a key determinant of airline and airport service quality.

Description of Work

The project is divided into several technical work packages (WPs):
- WP1: Concept analysis and definition: identification of problems, user needs and expectations, setting the performance target objectives and proposing an operational concept fully in line with SESAR ConOps.
- WP2: Development of the TITAN model: the development of a turnaround model to support the operational validation of the project's concept. It will be based on the aggregation of several single aircraft turnaround models plus the airline politics in terms of priorities and constraints.
- WP3: Validation of the TITAN concept, following the European Operational Concept Validation Methodology (E-OCVM).

- WP4: Development of the TITAN tool: the development of a decision-support tool in a CDM environment for an airline to improve the evaluation and negotiation of any changes in their schedule due to modifications affecting the turnaround process.
- WP5: Cost benefit analysis (CBA): the development of a CBA methodology customised for this project and its application to the TITAN tool.
- WP6: Integration of TITAN in the air transport system: defining the details of integrating the output of the TITAN model into the information stream of the different partners concerned with the turnaround process, with particular attention to the airlines.

The turnaround relay process

Expected Results

TITAN will propose a Turnaround Operational Concept which will identify the different processes (landside and airside) interacting with the ground sector and how a change on any parameter will have an impact on it.

Once this concept is defined, the TITAN team will implement a model which represents this process for a single aircraft, reacting to the defined external inputs and triggers, and readapting its final EOBT (estimated off-block time) according to the defined rules. Based on that, a validation model will be built which includes the aggregation of the turnaround processes of the different airlines' aircraft at an airport and their relations with the other actors.

This model will be implemented in a validation platform in order to verify the concept, using simulated agents for the other actors to reflect the limited resources of, for instance, fuel trucks.

Within the TITAN project, a demonstrator for a collaborative decision-making tool for airlines will also be developed to show the feasibility of the model. The tool will utilise the designed and proven turnaround model. It will allow for the negotiation and finalisation of milestones, as well as the publication of progress information related to public milestones. The overall solution will be integrated in future CDM processes at an airport, taking into account the technological communication among the stakeholders.

Acronym:	TITAN	
Name of proposal:	Turnaround Integration in Trajectory and Network	
Grant Agreement:	233690	
Instrument:	CP – FP	
Total cost:	3 918 349 €	
EU contribution:	2 794 337 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.12.2009	
Ending date:	30.11.2012	
Duration:	36 months	
Technical domain:	Avionics, Human Factors and Airports	
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	ECORYS Nederland B.V.	NL
	Ingeniería de Sistemas para la Defensa de España S.A.	ES
	BluSky Services Zerkowitz GCV	BE
	Boeing Research and Technoloy Europe	ES
	Slot Consulting Ltd	HU
	ISA Software	UK
	Rheinisch-Westfälische Technische Hochschule Aachen	DE

ADDSAFE

Advanced Fault Diagnosis for Safer Flight Guidance and Control

State of the Art - Background

The state of practice for aircraft manufacturers to diagnose guidance and control (G&C) faults and obtain full flight envelope protection at all times is to provide high levels of hardware redundancy in order to perform coherency tests and ensure sufficient available control action.

Nowadays this hardware-redundancy-based Fault Detection and Diagnosis (FDD) approach is the standard industrial practice, which also fits into current aircraft certification processes. However, these FDD solutions increase the aircraft's weight and complexity, and thus its manufacturing and maintenance costs. Moreover, its applicability is becoming increasingly problematic when used in conjunction with the many innovative technical solutions being developed by the aeronautical sector to satisfy the 'more affordable, safer, cleaner and quieter' imperatives being demanded by society.

Indeed, these novel 'green and efficient' technical solutions have widened the gap between the FDD scientific methods advocated within the academic community and the technological developments required by the aeronautics industry, creating a de facto 'safety bottleneck', a technological barrier constraining the full realisation of the next generation of air transport systems.

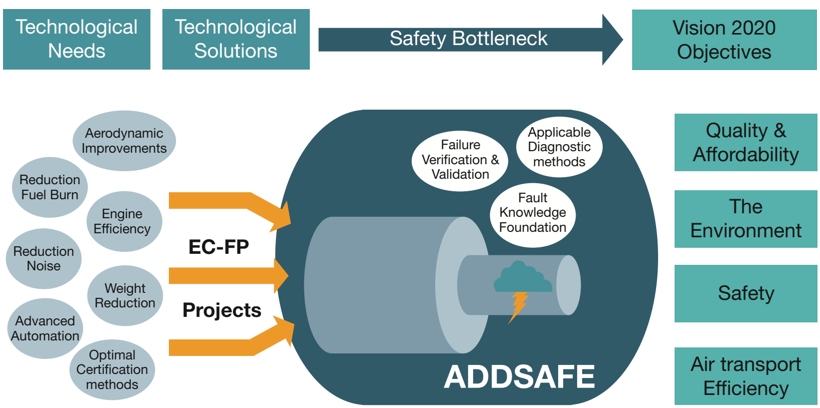
ADDSAFE addresses the fault detection and diagnosis challenges arising from this safety bottleneck.

Objectives

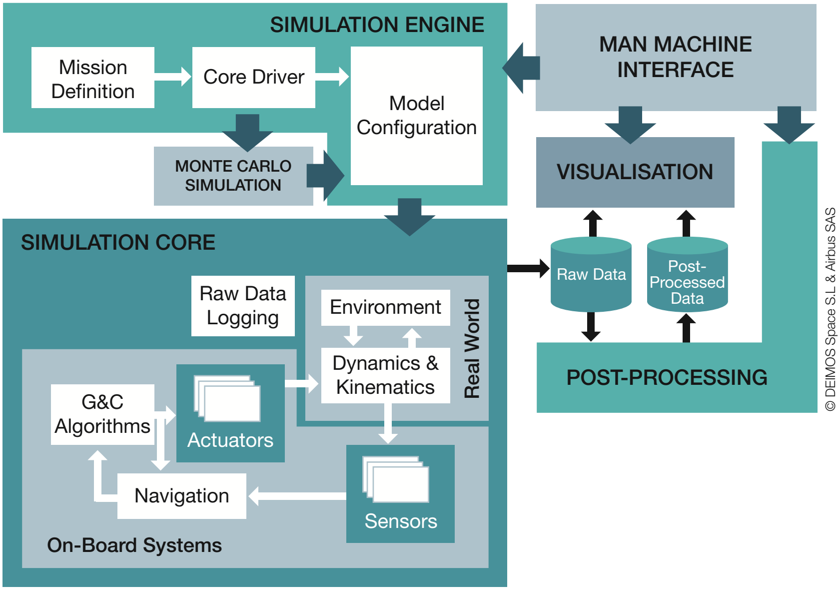
The overall aim is to research and develop model-based FDD methods for aircraft flight control system faults, predominantly sensor and actuator loss-of-control malfunctions.

The main benefits from a technological and scientific perspective are:

1. Identification of a set of guidelines for FDD design and analysis for aircraft G&C. Joint work between industrial practitioners and academic researchers will provide a consistent set of fault diagnosis requirements and suitable performance evaluation metrics.



ADDSAFE safety bottleneck



ADDSAFE benchmark and validation demos

2. Improved FDD methods and understanding of their applicability to aircraft FDD. This encompasses the enhancement of the most widespread fundamental fault diagnosis methods, and the development of advanced FDD synthesis and optimal-tuning methods giving increased performance and robust theoretical guarantees.

3. A step towards a verification and validation (V&V) process for aircraft diagnostic systems, by bringing together advanced industrial software assessment tools and state-of-practice flight simulators.

4. A demonstration of the most promising model-based FDD designs on industrial state-of-the-art flight simulation platforms.

From the perspective of the benefits to society, ADDSAFE will:
- improve aircraft safety;
- allow the use of greener technical solutions;
- improve aircraft transport cost and efficiency;
- secure European aircraft leadership.

Description of Work

The project is divided into six work packages (WP).

WP0: Management and dissemination.

WP1: ‘Industrial benchmark problem and assessment tools’ focuses on defining the benchmark problem and in developing the associated fault diagnosis metrics, guidelines and software assessment tools.

WP2: ‘Development of FDD methods and tools’ starts in parallel to WP1 and is the main scientific development component of the project. It focuses on enhancing the current model-based FDD methods as well as in researching new methods with stronger theoretical guarantees.

WP3: ‘Application to benchmark’ is divided into two stages: preliminary design, where the goal is to perform an initial design and assessment, and a detailed design stage, where information from WP4 is used to guide the final design and tuning.

WP4: 'Industrial benchmarking assessment': is where all the developed FDD designs will be benchmarked and the two most promising will be selected for full industrial validation (i.e. up to implementation and testing in Airbus flight simulators).

WP5: 'Integration issues and demonstration', the main purpose of which is to help transfer the developed FDD methods and technologies to the industrial aeronautics sector by means of a technology demonstration on DEIMOS and Airbus simulators, and a study of the potential integration issues.

Expected Results

The results will help achieve the European Vision 2020 safety challenge of an 80% reduction in aircraft accidents as well as making aircraft 'greener'.

The three main scientific and technological benefits that will be achieved in pursuit of ADDSAFE's aim are:

- definition of a set of guidelines for aircraft G&C model-based fault detection and diagnosis.
- improved FDD methods and software tools for aircraft G&C FDD synthesis and analysis.
- the demonstration of a unified software and test-bench V&V process for diagnostic systems.

Acronym:	ADDSAFE	
Name of proposal:	Advanced Fault Diagnosis for Safer Flight Guidance and Control	
Grant Agreement:	233815	
Instrument:	CP – FP	
Total cost:	3 662 624 €	
EU contribution:	2 608 594 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.07.2009	
Ending date:	30.06.2012	
Duration:	36 months	
Technical domain:	Systems and Equipment	
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	Centre National de la Recherche Scientifique	FR
	Technische Universiteit Delft	NL
	Magyar Tudományos Akadémia Számítástechnikai és Automatizálási Kutató Intézet	HU

DANIELA
Demonstration of ANemometry InstrumEnt based on LAser

State of the Art - Background

The aim of the DANIELA project is to prepare the operational use of a flush-mounted air data system (ADS) built around a three-axis Doppler LiDAR function as a primary air data channel on civil aircraft.

A typical air data system is composed of probes and pressure sensors and delivers parameters during flight such as air speed, angle of attack and altitude.

Such systems need de-icing, leading to high power consumption (typically 4kW for the three channels) and require maintenance as the externally mounted probes are exposed to corrosion. A laser-based anemometry instrument will avoid these drawbacks and feature enhanced reliability and an extended lifetime.

Air data parameters are inputs for the flight systems. Therefore the main issue to address before implementing a change of sensor technology in future airliner programmes is to make sure that the new system will perform as expected in all flight phases.

Objectives

The use of LiDAR, for one of the three channels, is seen as an appropriate solution to improve performance. An implementation using a three-axis velocity is envisioned in the next airliner programmes, enabling the removal of the most exposed external probes: Pitot and AOA/SSA. Furthermore, the introduction of a new measurement principle allows for a dissymmetric system, resulting in an improved configuration.

Based on the NESLIE results, DANIELA aims to provide a further step via two parallel objectives:
- To demonstrate data availability in adverse conditions;
- To explore the promising technologies leading to a full Optical Air Data System.

The main expected result is to improve the laser-based anemometer developed in the frame of NESLIE in order to make it affordable and to verify that the system will be available over the full flight envelope, particularly in areas where particles are supposed to be rare. This second objective is very important for the certification aspects of the LiDAR.

This system, as a replacement for conventional air data probes, will increase system availability and robustness (dissymmetric technologies, improved maintenance).

Description of Work

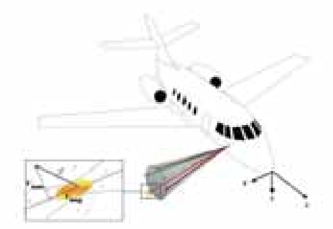
The project has been organised into four work packages which will run in parallel:
- The development of Infrared Doppler LiDAR technology, focused on a smart heterodyne detector and glass-integrated optical components;
- The development of a LiDAR mock-up suitable for ground and flight-test performance assessment;
- The validation of optical temperature measurement concepts;
- The consortium management.

The consortium is made up of skilled partners, and benefits from the results of the NESLIE project. The main tasks are:
- Integration of the passive and active optical functions through monolithic and hybrid technologies in order to reduce the weight, size and cost;
- Development of a self-sufficient balanced heterodyne photo-detector device;
- Studying the occurrence and microphysical properties of aerosol;
- Optimising signal processing specification and implementation;
- R&D on optical window and related aircraft-installation issues;
- LiDAR mock-up realisation, flight-testing and records analysis;

- Assessing UV and IR temperature-measurement concept;
- Management of the consortium.

Expected Results

The main expected result is the demonstration of accuracy and availability of a laser-based anemometry system. Based on further enhancement applied to the NESLIE mock-up demonstrator, it will be assessed by ground and flight tests, in worst-case scenarios.



The developed technologies will then pave the way for LiDAR anemometry full-scale development for next-generation transport aircraft.

The second result is the availability of optical temperature-measurement concept, enabling the development of a fully optical air data system.

Other expected results are:
- Integrated passive and active optical components;
- Self-sufficient balanced heterodyne photo-detector device;
- LiDAR window installations and coatings;
- Enhanced signal processing;
- Recording flight-test results;
- LiDAR sufficiently ready to start early-stage certification process;
- Technologies enabling a dissymmetrical air data system.

Acronym:	DANIELA	
Name of proposal:	Demonstration of ANemometry InstrumEnt based on LAser	
Grant Agreement:	212132	
Instrument:	CP – FP	
Total cost:	6 431 583 €	
EU contribution:	4 140 000 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.05.2008	
Ending date:	30.04.2011	
Duration:	36 months	
Technical domain:	Systems and Equipment	
Website:	http://www.danielaproject.eu	
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	EADS Deutschland GmbH	DE
	Teem Photonics	FR
	National Aerospace Laboratory (NLR)	NL
	Cranfield University	UK
	Alfred Weneger Institute (AWI)	DE

DELICAT
DEmonstration of LIdar-based Clear Air Turbulence detection

State of the Art - Background

Atmospheric turbulence encounters are the leading cause of injuries to passengers and flight crews in non-fatal airline accidents. A whole class of turbulence, representing 40% of turbulence accidents, and designated as Clear Air Turbulence (CAT), cannot be detected by any existing airborne equipment, including state-of-the-art weather radar. The number of turbulence accidents has been growing by a factor of 5 since 1980, three times faster than the increase in air traffic.

Studies conducted during various projects (FP5 AWIATOR, FP6 FLYSAFE, etc.) have shown that operational concepts for the protection against turbulence hazards include:
- Short-range (50 m to 300 m) measurement of air speed ahead of the aircraft, and action on the aircraft flight controls to mitigate the effect of turbulence;
- Medium-range (10 km to 30 km) detection of turbulence, and securing of passengers and crewmembers by fastening seat belts.

Both short and medium-range concepts are based on the UV LIDAR technology (Light Detection And Ranging), and there would be a great interest in integrating both functions into a single LIDAR system, for both operational (medium-range detection increasing the overall reliability and integrity of the system) and economical reasons.

Objectives

The short-range concept for protection against turbulence has been validated in the frame of the Fifth Framework Programme AWIATOR project.

The technical objective of DELICAT is to validate the concept of LIDAR-based medium-range turbulence detection. This validation will be based on comparing the information on a turbulent atmospheric area, provided on one hand by the remote UV LIDAR and on the other by the aircraft sensors (acceleration, air speed, temperature, etc.).

Description of Work

The validation of the LIDAR-based medium-range turbulence detection includes the following steps:
- A UV LIDAR mock-up will be designed and manufactured, tested in a laboratory on the ground, and then installed onboard a research aircraft, which will fly in both turbulent and non-turbulent conditions.
- During the flight tests, the atmosphere will be analysed remotely by the UV LIDAR, and by the in situ aircraft onboard sensors.
- The data obtained from the LIDAR and from the aircraft sensors will then be compared off-line once the aircraft is on the ground. The correspondence between the LIDAR backscattered signals and the turbulence experienced by the aircraft for a given atmospheric area will be assessed and evaluated.
- Conclusions will then be drawn on the capabilities of the LIDAR technology, regarding Clear Air Turbulence detection, and a preliminary equipment architecture will be defined, for both short and medium-range concepts.

DELICAT will take advantage of existing hardware (laser sub assemblies, test aircraft fairing) to achieve its goal at the lowest possible cost.

Expected Results

The DELICAT project will directly contribute to the validation of an advanced technology for aircraft protection against Clear Air Turbulence hazards. This will increase both customer comfort and aviation safety.

Based on traffic and accident statistics, one can estimate that such a UV LIDAR turbulence protection equipment would have avoided between 8 and 10 turbulence accidents in 2005 and will reduce by up to 20 (or 40%) of the number of turbulence accidents per year, once this system has been developed by DELICAT's industrial partners.

The DELICAT project will also contribute towards increasing the knowledge about Clear Air Turbulence phenomenon, and the capability to forecast such hazardous phenomenon.

Dissemination of DELICAT will be ensured by setting up a website, and by gathering an External Experts Advisory Group (EEAG). Through the EEAG and the website, the external stakeholders (airlines, aircraft manufacturers, meteorological service providers) will be informed about the objectives and progress of DELICAT, they will be able to provide feedback and also to update and refine their needs regarding protection against turbulence (both for short-range and medium-range concepts).

Acronym:	DELICAT	
Name of proposal:	DEmonstration of LIdar-based Clear Air Turbulence detection	
Grant Agreement:	233801	
Instrument:	CP – FP	
Total cost:	5 584 791 €	
EU contribution:	3 811 000 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.04.2009	
Ending date:	31.03.2012	
Duration:	36 months	
Technical domain:	Systems and Equipment	
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	Météo-France	FR
	Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	Office National d'Études et de Recherches Aérospatiales	FR
	National Institute of Research and Development for Optoelectronics	RO
	Organization of Russian Academy of Sciences A.M. Obukhov Institute of Atmospheric Physics RAS	RU
	Laser Diagnostic Instruments AS	EE
	Uniwersytet Warszawski	PL
	EADS Deutschland GmbH	DE

GREEN-WAKE

Demonstration of LIDAR-based wake vortex detection system incorporating an Atmospheric Hazard Map

State of the Art - Background

Wake vortices and wind shear are potential causes of accidents and injuries to passengers and crew of all aircraft types. They cannot be detected by sight and result in sudden disruption to the aircraft's trajectory, potentially resulting in a crash if encountered during take-off or landing. There are currently few options for protection against these phenomena, and the main way of reducing accidents due to wake vortices is to impose mandatory separation times between aircraft which can affect the operating performance of airports from the resulting delays.

Wake vortex and wind shear detection is therefore the focus of research programmes funded within Europe and the USA, and the LIDAR technique (LIght Detection And Ranging) has already been shown to offer a technical solution for detecting wake vortices and wind shear. Since LIDAR requires the use of a LASER, there is a considerable challenge to design and build a system with the performance required to detect the hazard that is suitable for installation on aircraft, and which also meets the safety, performance and cost requirements of the aerospace industry.

Objectives

The objective of Green-Wake is to develop and validate innovative technologies that will detect the hazards in a timely manner to improve passenger safety and comfort, and improve the operating efficiency of airports by providing a safe means to decrease separation times between trailing aircraft.

Green-Wake will develop and test an Imaging Doppler LIDAR system that is capable of detecting and measuring wake vortexes and wind shear phenomena 50-100 metres in front of an aircraft, allowing action to be taken to reduce or avoid the hazard. The aim of the project is to develop a system suitable for integration into a commercial aircraft, but also to look at how data are to be presented to the aircrew.

Firstly, a simulation will be developed which allows modelling the large number of variables involved in order to understand how optimum performance can be achieved. This requires a well-developed understanding of the requirements of the users, the meteorology of the hazard phenomena and the state of the art in the optical and hardware engineering.

Based on the outcomes of the modelling a new wind shear and wake vortex imaging Doppler LIDAR system will then be developed and implemented. A prototype will be used to determine the overall performance of the system.

Description of Work

There are four main innovations involved in Green-Wake.

The first is the extension of existing modelling and simulation research to allow development of the Green-Wake project simulation. This will allow for a cost-effective design of a system which is optimised for the application, despite the enormous number of variables involved.

The second innovation is a fast scanning system. This is a requirement due to the large volume of airspace in front of the aircraft which must be scanned and data gathered at sufficient density to allow for the effective detection of the hazard.

The third is in the data collection. Scanning a large volume in front of the aircraft requires fast and accurate processing. A new detector will be developed as part of the project which will permit the degree of real-time data handling required, and the techniques will be investigated for analysing the data generated and providing information in a suitable format for the aircrew.

Finally, the integration of the wind shear and wake vortex data into an overall map of features local to the aircraft will be researched. The objective is to deliver warnings of potential hazards most effectively to the aircrew.

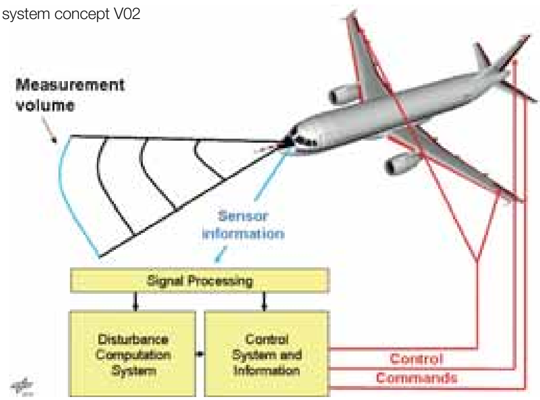
Expected Results

This project is building on research from previous Framework Programme projects and extending it in order to develop an imaging Doppler LIDAR system which is capable of detecting wake vortices and wind shear, but which is also suitable for installation in aircraft. The aim of the project is to produce a system which can ultimately be developed into a commercial product which will enhance the safety of aircraft passengers and crew, and permit more effective use of runways at congested airports. This will not only enhance the safety of citizens travelling by air but also reduce unnecessary delays in take-off and landings, increasing traveller convenience and reducing fuel consumption from aircraft being held up. This contributes to the ACARE environmental goals for 2020.

The consortium is composed of a relatively high proportion of SMEs for whom the commercial potential of the project is a major driver. No product of the type and capability envisaged is currently available anywhere in the world.

The main products from the project are the simulator which will allow the investigation and optimisation of the system which is to be built, and the system itself which will be designed, built and evaluated within the project. The outcomes of the project will be documented in a series of written deliverables, and will be disseminated in accordance with the project dissemination plan.

Sensor and control system concept V02



Acronym:	GREEN-WAKE
Name of proposal:	Demonstration of LIDAR-based wake vortex detection system incorporating an Atmospheric Hazard Map
Grant Agreement:	213254
Instrument:	CP – FP
Total cost:	3 128 373 €
EU contribution:	2 206 286 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.11.2008
Ending date:	31.10.2011
Duration:	36 months
Technical domain:	Systems and Equipment
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	VZLU - Výzkumný a Zkušební Letecký Ústav, A.S.	CZ
	Active Space Technologies	PT
	ADSE	NL
	Photonic Science Ltd	FR
	SensL Ltd	IE
	Sula Systems Ltd	GB
	SimSoftware Ltd	BG

HISVESTA
High Stability Vertical Separation Altimeter Instruments

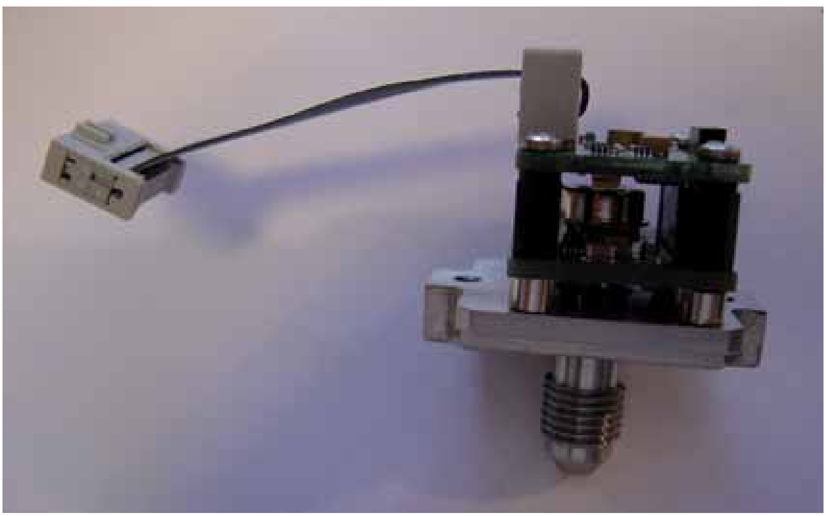
State of the Art - Background

HISVESTA is the next step in solving the remaining research and technological development challenges after the successful HASTAC project in the EC Framework Programme Six (www.sintef.no/hastac). The project will develop a new generation of barometric altimetry modules, suitable for fixed-wing and helicopter applications, which will provide significantly improved capabilities for altitude accuracy. Altitude transducers, air data computers and meteorological testing performed in the project will demonstrate the effectiveness of the performance improvement.

A key HISVESTA target is for the European avionic system industry to regain the market lead in altimetry and automatic air traffic control (ATC) solutions, as well as to manufacture altitude pressure transducers with the best long-term stability.

Objectives

The strategic objective of the project is to increase the safety in all in-flight situations, particularly in low visibility, by improving the barometric altimetry transducers used in air data computers and auto pilot systems for aircraft. The project is particularly relevant in situations in the reduced vertical separation minima legislation of 1 000ft (RVSM), as well as in demanding manual flying situations such as darkness and low visibility. Used in enhanced transponder applications, the project will contribute to significantly increased reliability in altitude information for manual and automated air traffic control systems. Aircraft Traffic Collision Avoidance Systems will also benefit from more accurate and reliable altitude information, which will allow the automated avoidance instructions to be more accurate and effective.



Pressure transducer with manifold for FADEC, air data and cabin pressure controller

Another project objective is to contribute towards reducing CO_2 and NO_x emissions in the next generation aero engines, by improving accuracy in the multifunctional pressure control system in the Full Authority Digital Engine Control systems (FADECS). The HISVESTA project will develop a range of high temperature micro-machined silicon structure (MEMS) pressure sensors, designed for accurate pressure measurements in multistage FADECS.

Description of Work

The main concept is to create a new state-of-the-art high precision altimetry sensor system that monitors the aircraft barometric altitude in real time with a very high accuracy. This will be done based on new technology in MEMS and new concepts using microcontrollers and FPGAs for compensation and warning algorithms.

The project will develop new generations of altimetry modules, suitable for fixed wing and helicopter applications, which will provide a significant improvement in altitude and pressure reading accuracy over those currently available. Comprehensive modelling, analysis, lab testing and flight data collection performed in the project will demonstrate the effectiveness of the performance improvement.

The altimetry transducer long-term drift goal is <0.01 %FS/year, which will increase altitude accuracy by a factor 2 and will allow longer calibration intervals of the entire system. The root causes for long-term drift will be determined by modelling and detailed statistical characterisation and analysis. Resulting effects of these causes will be minimised by careful co-design of the MEMS sensor element, fabrication processes, pressure sensor package, electronics and software. The final result is a new range of barometric pressure transducers optimised for superb stability, accuracy and repeatability.

Pressure transducers in MEMS technology

Expected Results

HISVESTA's goals will contribute to the promotion of real progress, based on scientific and technical excellence and long-term innovation due to:

- Barometric MEMS sensor technology in silicon;
- Unique hardware/software compensation techniques;
- Instruments and air data computer systems;
- Technologies to enable a full and permanent automatic approach and landing in all weathers;
- Onboard technologies for in-flight collision avoidance concepts;
- Techniques enabling the development of improved aviation safety metrics.

Acronym:	HISVESTA
Name of proposal:	High Stability Vertical Separation Altimeter Instruments
Grant Agreement:	213729
Instrument:	CP – FP
Total cost:	3 158 333 €
EU contribution:	2 208 250 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.01.2009
Ending date:	30.06.2011
Duration:	30 months
Technical domain:	Systems and Equipment
Website:	http://www.sintef.no/hisvesta

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	Ceramica Ingenua S.R.L.	RO

ON-WINGS
ON-Wing Ice DetectioN and MonitorinG System

State of the Art - Background

When an aircraft flies in cold, moist air, especially at low altitudes, ice can form rapidly, both on and behind the leading edge of aerofoils and other structures. The growth of the ice disturbs the local airflow and can radically alter the lift of the aerofoil and hence the handling characteristics of the aircraft. This phenomenon has caused a number of fatal accidents and loss-of-control events, and is a problem that will intensify as increased pressures on airports mean that aircraft will spend much longer in low-altitude holding patterns. Large aircraft use hot gases diverted from the engines to remove ice from flight-critical surfaces, while smaller aircraft sometimes use pneumatic 'boots' which expand under pressure to shed the ice layers. These technologies are incompatible with future generations of air transport, in which composite materials will be used extensively. Furthermore, current ice detectors are insensitive, cannot distinguish between ice types and are not co-located with the safety critical zones. Building on electro-thermal de-icing technology now widely used in helicopters, the ON-WINGS project will develop a smart, autonomous, composite electro-thermal de-icing system for fixed-wing, helicopter rotor blade and engine inlet applications.

Objectives

The initial objective is to produce a robust fixed-point optical ice-detector sensor whilst the ultimate objective of the programme is to develop and demonstrate sensor technology that is fully integrated into an ice-protection system mounted into a composite structure and offering real-time control. The sensor will be capable of detecting:
- the onset of icing,
- ice presence, and at a later stage
- ice thickness.

The sensing system will be made 'smart' by using dedicated algorithms, and will be integrated in a representative wing-slat, along with composite electro-thermal zone heaters.

A second work package of advanced sensing concepts will develop a multi-zone-based system, each with its dedicated sensor and control electronics.

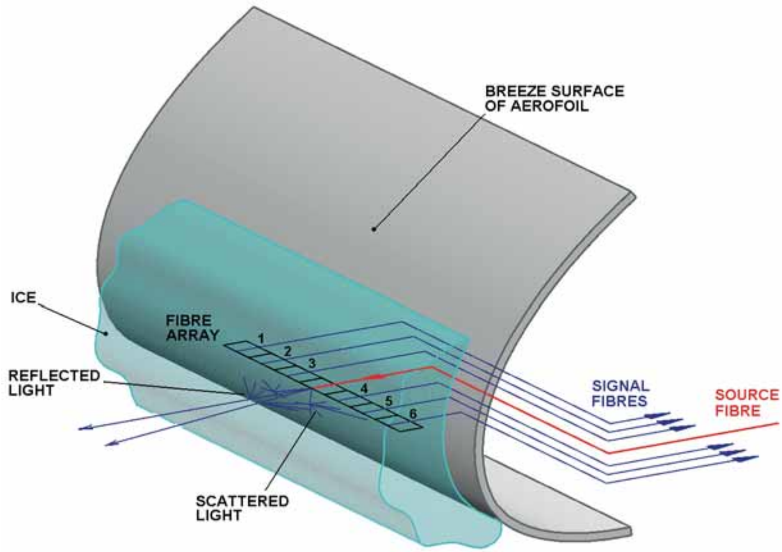
As part of the advanced concepts:
- use the point ice sensor to investigate parameters for detecting ice thickness and roughness;
- specify, design and develop a quasi-distributed fibre-optic ice sensor which will be integrated in the wing-slat coupon with electro-thermal heating capable of detecting the presence of ice at a multitude of points.

Another focus is on health monitoring, and in particular distributed temperature sensing of the heating zones using fibre optics.

A 'threshold' impact detection method will also be investigated with the aim of detecting impacts that may lead to de-lamination of an electro-thermal ice-protection system.

Description of Work

A generic air-conformal direct ice-detection technology, based on optical methods capable of being adapted and multiplexed in the wing-slat of an aircraft, will be developed and calibrated to measure the ice thickness and accretion rate of ice in real time, as well as ice roughness to determine the criticality of ice type. This will be further developed and calibrated to measure the onset of icing and used as an engine inlet ice sensor. A distributed ice sensor will also be developed and calibrated to detect the presence of runback ice and used in fixed-wing aircraft. A generic data acquisition system will be developed



ICE SENSOR - EXPERIMENTAL ARRANGEMENT

with suitable algorithms that will be able to interrogate the ice sensors described above.

'Smart' composite electro-thermal heaters will be achieved by developing and integrating a generic composite-zoned electro-thermal heater with the ice sensors and controllers. Generic distributed temperature sensing and interrogation electronics will also be developed and integrated in the composite heaters.

The prototypes will be manufactured, tested and evaluated with the integrated de-icing system in an icing tunnel.

A prototype parasitic 'coupon' will be manufactured to flight standards and proof of concept validated, thus paving the way to case-specific certifications.

The technology will be disseminated to aviation and more generally to the transport industry.

Expected Results

The resulting system will incorporate, for the first time, the following:

- a primary 'on-wing' ice detector used to activate the ice-protection system;
- a 'smart' electro-thermal de-icing system to demonstrate the interaction and control of electro-thermal heater elements and an integral aero-conformal ice detection and distributive temperature/health monitoring system;
- air conformal optical ice detectors used for primary activation of the ice-protection system;
- novel concepts based on sophisticated fibre-optic methods capable of measuring ice distributed over large areas.

A complete smart air conformal ice-detection system will be demonstrated, capable of detecting the ice thickness and roughness for critical aerospace applications.

Acronym:	ON-WINGS	
Name of proposal:	ON-Wing Ice DetectioN and MonitorinG System	
Grant Agreement:	233838	
Instrument:	CP – FP	
Total cost:	3 982 356 €	
EU contribution:	2 503 056 €	
Call:	FP7–AAT–2008–RTD–1	
Duration:	36 months	
Technical domain:	Systems and Equipment	
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	TWT GmbH Science and Innovation	DE
	Eurocopter Deutschland GmbH	DE
	Wytwornia Sprzetu Komunikacyjnego 'PZL-Swidnik' S.A.	PL
	GE Aviation Systems Ltd	UK
	Sensor Highway Limited	UK

SCARLETT

SCAlable and ReconfigurabLe Electronics plaTforms and Tools

State of the Art - Background

Early avionics solutions, which were based on federated architecture, used dedicated bespoke hardware and software to implement any aircraft function. As the number of functions being transferred to avionics increased, the federated architecture grew in size and complexity.

An aircraft of the 1980s contained a large number of 'black boxes' of dissimilar sizes and technologies. The aerospace community then turned to the Integrated Modular Avionics (IMA) concept. This concept replaces the numerous separate and dissimilar 'black boxes' with fewer, common processing modules.

The first generation of Integrated Modular Avionics (IMA1G) has been a successful step away from the federated architectures. However, additional socio-economic and market drivers have emerged since the implementation of IMA1G, forcing the industry to take a further significant step beyond the current IMA capability:

- a higher rate of new aircraft programmes will be launched with increasing frequency;
- reduced operating costs for the airlines, and a consequent reduction in passengers' fares. This in turn implies a reduction of costs, weight and volume of the avionics;
- reduced lead time for entry into service;
- full time availability – which impacts both the operating costs of the airlines and the comfort to passengers. The required aircraft operational availability is now reaching 100%.

Objectives

The key innovations of the IMA2G Distributed Modular Electronics (DME) concept researched by SCARLETT cover a broad scope of items, from architecture, hardware, software (including middleware), up to tools and processes. They are:

- a decentralised and distributed avionics architecture aimed at the fully digitised aircraft, using separate scalable modules for application processing and input/output (I/O) functions, standardised hardware, communications and application interfaces that can support all aircraft functions;
- the introduction of middleware services in order to provide the applications with a higher level of abstraction from the underlying resources, enabling smarter configuration and alleviated development effort;
- a new design methodology that readily supports the evolution of onboard electronics, enabling adaptations and upgrades according to market needs;
- common processes, methods and toolsets, enabling system integrators and application suppliers to reduce the development cycle and improve the development's effectiveness;
- new decentralised health monitoring to provide 100% detection of electronics failure;
- avionics solutions providing the highest level of availability, with reconfiguration capabilities to support fault tolerance. This will minimise the number of spare resources required while maintaining the highest dispatch rate.

Description of Work

The consortium has adopted an approach starting from the consolidation of requirements, followed by the definition of specifications, leading to development, then integration, verification, test and validation.

Four different capability demonstrators for the DME solutions, all built with the same types of components, are foreseen. These four demonstration platforms are:

- the 'High Performances Data Distribution' demonstrator, addressing high data flow

performances – typically for cockpit display applications;
- the 'I/O Intensive' demonstrator, demonstrating the DME concept for an I/O intensive application – typically fire/smoke detection or ventilation control;
- the 'Time Critical' demonstrator, demonstrating the DME concept for a highly safety-critical application with hard real-time constraint – typically flight controls or anti-skid braking;
- the 'Reconfiguration and Maintenance' demonstrator addressing the reconfiguration capabilities.

These four demonstrators are supported by an innovative approach in terms of:
- the smooth use of the set of IMA dedicated/required tools, thus creating an overall module-independent tool chain, to ensure a reduced lead time to the aircraft's entry into service;
- the definition of platform services (or IMA-dedicated middleware) to provide function suppliers with a better/faster software development environment.

Expected Results

The major deliverables of the project are:
- a set of hardware and software components representative of the future IMA2G platform basic building blocks;
- the four different capability demonstrators presented above, all based on the same DME building blocks so as to verify that each targeting functional domain can cope with solutions envisaged in the frame of the IMA 2G;
- the tool chain that sets the sound foundations for both data management consistency and productivity enhancement, which will cover all the embedded avionics actors' activities in an IMA2G-based solution.

SCARLETT also intends to demonstrate the concepts of reconfiguration solutions in civil avionics.

Acronym:	SCARLETT
Name of proposal:	SCAlable and ReconfigurabLe Electronics plaTforms and Tools
Grant Agreement:	211439
Instrument:	CP – IP
Total cost:	40 077 634 €
EU contribution:	22 999 657 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.05.2008
Ending date:	30.04.2011
Duration:	36 months
Technical domain:	Systems and Equipment
Website:	http://www.scarlettproject.eu
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Diehl Aerospace GmbH	DE
GE Aviation Systems Ltd	UK
AcQ Inducom	NL
Alenia Aeronautica S.p.A.	IT
ARION Entreprise	FR
Barco NV	BE
Dassault Aviation SA	FR
EADS Deutschland GmbH	DE
Galileo Avionica S.p.A.	IT
State Research Institute of Aviation Systems	RU
University of Bristol	UK
Hellenic Aerospace Industry SA	GR
Instituto de Soldadura e Qualidade	PT
Messier-Bugatti SA	FR
Naturen Industrial Informatics and Trading Ltd	HU
Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
SYSGO AG	DE
Office National d'Études et de Recherche Aérospatiales	FR
QinetiQ Ltd	UK
Saab AB	SE
Sagem Défense Sécurité	FR
Skysoft Portugal - Software e Tecnologias de Informação SA	PT
Syderal SA	CH
Thales Avionics Electrical Systems SA	FR
TTtech Computertechnik AG	AT
UNIS, Spol. S R.O.	CZ
Universität Bremen	DE
Technische Universität Hamburg-Harburg	DE
Politechnika Rzeszowska im. Ignacego Łukasiewicza PRZ	PL
Yamar Electronics Ltd	IL
TELETEL S.A. - Telecommunications and Information Technology.	GR
University of Nottingham	UK
Thales SA	FR
Apparatebau Gauting GmbH	DE

VISION

Immersive Interface Technologies for Life-Cycle Human-Oriented Activities in Interactive Aircraft-Related Virtual Products

State of the Art - Background

Virtual reality (VR) immersion and interaction features are widely used in engineering tasks in order to simulate cost and time-intensive activities. In aircraft design, efficient execution of man-in-the-loop simulation tasks has been used as a means for assessing the aircraft's life-cycle usage. However, when potential users of an aircraft-related virtual product are immersed into the virtual environment, they often feel the full synthetic environment like an unrecognisable ambient, and so they reject the immersion into the simulation as a work practice. This effect is due to the lack of realism of the virtual environments. Moreover, devices for interacting with digital mock-ups do not adequately match human capabilities, at least in comparison with a human's standard work practices. VISION will use the worldwide academic knowledge and the functionality provided by current world class VR software as a 'baseline'. It will advance the state of the art, at both technology and application level, by improving the performance of aircraft-related virtual products and environments with respect to criteria such as the realism of rendered virtual environment, trade-off of image quality during user interaction, tolerance to task execution changes, immersed user's presence, pick/grasp quality, training, acquisition and maintenance overheads, and input data configuration control.

Objectives

The technological objective of VISION is to specify and develop key interface features in fundamental cornerstones of virtual reality technology, namely in i) photorealistic immersive visualisation and ii) interaction. In particular, it aims at removing the current drawbacks of the underlying technology, thus better accommodating the specific needs of the human-oriented life-cycle procedures (design, validation, and training) related to critical aircraft virtual products (e.g. virtual cabin, etc.). The technological achievements of VISION will enhance the realism of the digital human-in-the-loop VR simulations and optimise the human-virtual product integration in the specific domain.

The application-oriented objective of VISION is to drive specific technological advances in immersive VR, improving the human-oriented functionality and usage of aircraft-related virtual products along the product life cycle. The immersive interface technologies to be developed will enhance the engineering context of these virtual products by enabling their increased use for activities, such as design verification, ergonomic validation, specifications of equipment displays, operational and situational training. Thus they will help address the development phase in a more flexible, reliable and cost efficient way, as well as the safety performance of these products.

Description of Work

The project includes eight work packages (WP).

In WP1, the specification of the virtual product requirements will provide the application space of the project solutions. For each of the basic VISION modules (visualisation, interaction), specific technology requirements will be defined. In WP2, the human-centred requirements and their implications in human-machine interaction within the aircraft-related virtual products will be analysed, then the two major simulation modules will be developed. WP3 is the Visualisation Module. Development work will address advanced rendering features considering the perception of the human towards light illumination and the real-time constraints of the immersive environment. WP4 is the Interaction Module. Development work will address advanced hardware/concepts for markerless body tracking and new methods for user interfacing along with interaction metaphors. The individual visualisation and interaction simulation modules will be next integrated into a common multi-modal interface platform (WP5). In WP6, the integrated platform will be demonstrated based on real-life industrial scenarios. The demonstration will give input to further improvement on system evaluation. WP7 and WP8 are for the exploitation/dissemination and the management of the project activities, respectively.

Expected Results

VISION aims to develop advanced VR-based simulation functionality in support of the design and 'virtual prototyping' of critical aircraft-related products. It will deliver specific advances in fundamental cornerstones of the VR technology, such as the immersive visualisation and interaction, so as to improve the human-oriented functionality and usage of these virtual products along their life cycle. The human factor perspective on the design of virtual reality interfaces is expected to facilitate the 'acceptance' of the new methodologies by new user groups, and their integration in the everyday business practices. The project will also deliver a common multi-modal interface platform, which will seamlessly integrate the novel simulation features. The platform will provide engineers with cost-efficient testing tools and methods, and will further enable the collaborative use of these tools by remotely located users for co-operative design activities. VISION will finally deliver a set of application demonstrators involving aircraft-related virtual-product-use cases, which will be based on real-life industrial scenarios. The technological output of the project is expected to have a significant impact on the reduction of aircraft development costs and time to market, as well as on the improvement of aircraft safety.

VISION expected achievements

Acronym:	VISION	
Name of proposal:	Immersive Interface Technologies for Life-Cycle Human-Oriented Activities in Interactive Aircraft-Related Virtual Products	
Grant Agreement:	211567	
Instrument:	CP – FP	
Total cost:	2 197 252 €	
EU contribution:	1 485 714 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.11.2008	
Ending date:	30.04.2011	
Duration:	30 months	
Technical domain:	Systems and Equipment	
Website:	http://www.project-vision.eu/	
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	EADS France (Innovation Works department)	FR
	Universität des Saarlandes	DE
	VTT Technical Research Centre of Finland	FI
	Vienna University of Technology	AT

iSPACE
innovative Systems for Personalised Aircraft Cabin Environment

State of the Art - Background

The traditional air conditioning system of current aircraft is designed mainly on compartments, such as cabin areas, flight deck or cargo. Only a few components are customised to provide personalised control, such as individual air outlets in the optional overhead personal service units.

Currently the cabin air temperature is controlled 'globally' by the environmental control system with the cabin separated into several temperature zones, dependent on the heat load within the different zones. A single zone covers 10 to 100 passengers and thus all of them are exposed to about the same temperature.

An individual cabin air temperature control for each passenger has not been realised so far. The provision of such personalised controls is expected to lower the percentage of dissatisfied occupants by up to 10% in the optimum case. Cabin surfaces such as the seat, lining and floor influence the thermal comfort of passengers. Currently these cabin surfaces are neither thermally controlled nor equipped to achieve a desirably low temperature asymmetry.

Cabin air is generally dryer than air normally experienced on ground. Dry cabin air (about 15% relative humidity) may lead to passenger discomfort but the impact of low humidity levels on the human body has not yet been fully investigated. Furthermore the number of air purification systems available for aircraft is limited.

Objectives

The primary objective of iSPACE is to provide a step change in passenger comfort during flight by providing aircraft manufacturers and the supplier industry with the knowledge and innovations needed to address the individualisation of a passenger's cabin environment.

This will be achieved by the following scientific and technological objectives:
- develop concepts for an individual passenger cabin environment and prove its general feasibility;
- develop and prove emerging step-change technologies for individualised passenger cabin environments;
- provide simulation tools for individualised cabin environments and give recommendations for existing and future commercial aircraft.

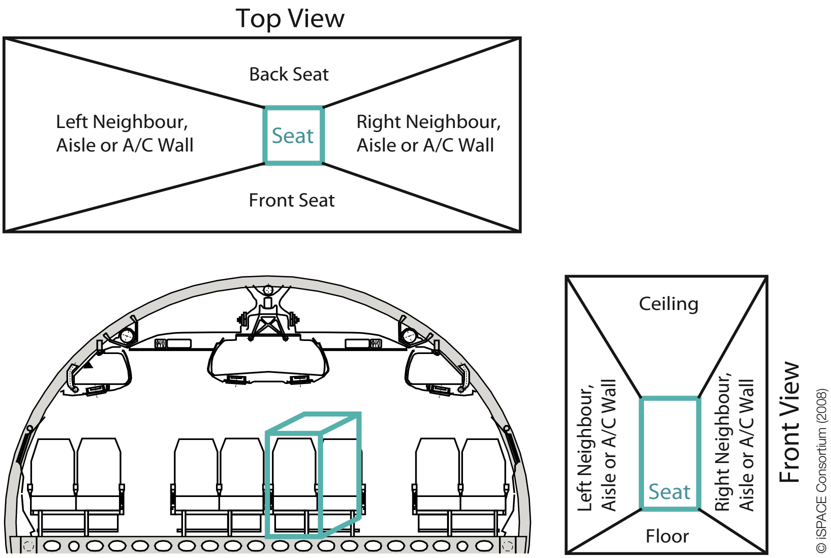
iSPACE will focus on the personal environment of cabin occupants. Concepts and systems will be developed for a revolution of the generation and control of the individual climate. The project intends to close existing technological gaps to achieve an enhanced cabin environment and passenger comfort with regard to temperature, humidity, ventilation and well-being by controlling the individual's climate. Therefore concepts and technologies will be developed and their proof of principle shown by simulation as well as hardware models in a most realistic test environment (including low cabin pressure).

Description of Work

The work within iSPACE is allocated to five technical work packages which raise the current knowledge and demands for technological solutions to a new and innovative level:

1. Compilation of current knowledge and specific requirements for technologies used in aircraft and for their simulation.

2. Selection of suitable technologies for further development, based on a feasibility study and a simulative parameter study; development of a test design to be able to test and evaluate the new concepts for



Personal environment of a single occupant (top and front view at seat level)

personal climate control and their simulation based on objective measurements and subjects' responses in the Fraunhofer Flight Test Facility.

3. Development of the selected technologies at seat level and their integration into the test bed.

4. Testing and analysis of the selected technologies; optimisation and validation of simulated environments capable of representing the new concepts.

5. Dissemination and exploitation of results and technological solutions; implementations to guarantee consideration of the market requirements and demands.

Expected Results

iSPACE provides major innovations beyond the state of the art in science and technology by:

- gaining knowledge about individual passenger cabin environments and their impact on human perception;
- developing concepts for individual climate control and comfort;
- proving the individualisation of passenger cabin climates in a realistic flight environment;
- developing validated simulation tools for the design of individualised cabin environments;
- developing and evaluating technologies for individualised passenger cabin climates.

Acronym:	iSPACE
Name of proposal:	innovative Systems for Personalised Aircraft Cabin Environment
Grant Agreement:	234340
Instrument:	CP – FP
Total cost:	3 714 550 €
EU contribution:	2 675 962 €
Call:	FP7–AAT–2008–RTD–1
Duration:	36 months
Technical domain:	Systems and Equipment
Website:	http://www.ispace-project.eu
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	Contour Premium Aircraft Seating	UK
	EADS Deutschland GmbH	DE
	Icon Computer Graphics Ltd	UK
	Medical University of Vienna	AT
	Pall Europe Ltd	UK
	SeaTex AG	DE
	Streit-TGA GmbH & Co. KG	DE

HUMAN

Model-Based Analysis of Human Errors During Aircraft Cockpit System Design

State of the Art - Background

The safety of aircraft has been significantly enhanced during the last decades by technical improvements and new training concepts. However, the accident rate has remained almost the same, varying between three and four accidents per million departures, because the safety improvements could not outweigh the dramatic increase of the overall air transport. For the future, an even stronger increase in traffic density is anticipated, which leads experts to expect one serious accident a week if the rate is not drastically reduced.

Worldwide commercial jet fleet statistical information reports that 55% of accidents involve flight crew errors. The examination of human errors has been developed in the aircraft industry and is now considered to be an important analysis to accomplish during the design and certification of the cockpit. However, the current approach of analysing systems is prone to errors as well as being costly and time-consuming (based on engineering judgement, operational feedback from similar aircraft and simulator-based experiments). Therefore, in order to enhance the safety of the aircraft itself and its systems, innovative solutions for improved human-centred design are needed that allow for the more accurate detection of potential pilot errors at an earlier stage (in the design) and with reduced effort.

Objectives

The objective of the HUMAN project is to develop a methodology with techniques and prototypical tools supporting the prediction of human errors in ways that are usable and practical for human-centred design of systems operating in complex cockpit environments.

The prediction of human errors will be achieved by developing and validating a cognitive model of crew behaviour. Cognitive models are a means to make knowledge about characteristic human capabilities and limitations readily available to designers in an executable form. They have the potential to automate parts of the analysis of human errors because they offer the opportunity to simulate the interaction with cockpit systems under various conditions, and to predict cognitive processes like the assessment of situations and the resulting choice of actions, including erroneous actions. In this way they can be used as a partial 'substitute' for human pilots in early developmental stages when design changes are still feasible and affordable. Model and simulation-based approaches are already well established for many aspects of the study, design and manufacture of a modern airliner, for the very same objective of detecting potential problems earlier and reducing the amount of testing required at a later stage. HUMAN will extend the modelling approach to the interaction of flight crews with cockpit systems.

Description of Work

The main research and development work in HUMAN will produce key innovations on three complementary research dimensions:

- Cognitive modelling: to develop an integrated cognitive crew model able to predict human error categories with regard to deviations from normative activities (standard operating procedure and rules of good airmanship).
- Virtual simulation platform: to develop a high-fidelity virtual simulation platform to execute the cognitive crew model in realistic flight scenarios in order to analyse the dependencies between the pilots, a target

system in the cockpit, the aircraft and its environment.
- Physical simulation platform: to thoroughly investigate pilot behaviour on a physical simulation platform to produce behavioural and cognitive data as a basis for building a detailed knowledge base about cognitive processes leading to deviations from normative activities, and for validation and improving the predictions of the cognitive model generated on the virtual simulation platform.

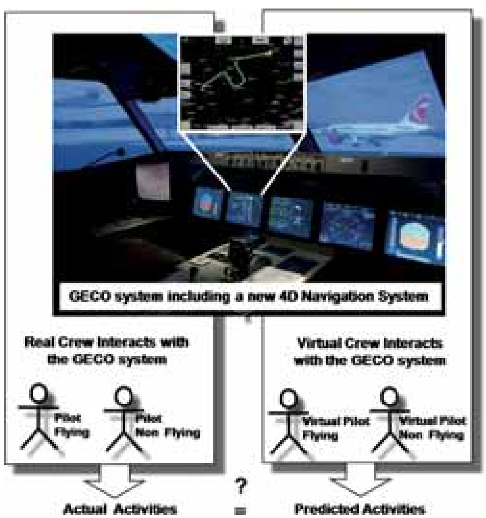
The general idea of the virtual and physical platform is to use the same core system for both in order to ensure the functional equivalence between the two platforms. This equivalence is a fundamental precondition for validating the cognitive model by producing and comparing predicted crew activities (on the virtual platform) and actual crew activities (on the physical platform).

Expected Results

The output of the HUMAN project will be:
- An innovative means enabling the considerable improvement of the human-centred design of cockpit systems, including a cognitive crew model able to predict design-relevant pilot errors;
- A high-fidelity virtual simulation platform enabling execution of the cognitive crew model;
- A prototypical tool based on the virtual simulation platform supporting usability of the platform and cognitive model;
- Formal techniques and prototypical tools for analysis of simulator data;
- A detailed knowledge base about cognitive processes leading to pilot errors and derived guidelines for cockpit system design;
- A methodology that integrates all the techniques and tools for their application during aircraft cockpit system design.

HUMAN will have an impact on aircraft safety. The project will contribute to the European Commission's objective of reducing the accident rate by enhancing the accuracy of pilot error prediction. Furthermore, it will contribute to the objective of achieving a substantial improvement in the elimination of and recovery from human error by reducing the design effort of active and passive safety measures, and by reducing the effort of flight simulator tests for active and passive safety measures.

Physical and virtual simulation platforms sharing the same core system



Acronym:	HUMAN	
Name of proposal:	Model-Based Analysis of Human Errors During Aircraft Cockpit System Design	
Grant Agreement:	211988	
Instrument:	CP – FP	
Total cost:	3 909 789 €	
EU contribution:	2 777 379 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.03.2008	
Ending date:	28.02.2011	
Duration:	36 months	
Technical domain:	Avionics, Human Factors and Airports	
Website:	http://www.human.aero	
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	Université catholique de Louvain - Belgian Laboratory of Human-Computer Interaction	BE
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	Netherlands Organization for Applied Scientific Research – TNO Human Factors	NL

ODICIS
One DIsplay for a Cockpit Interactive Solution

State of the Art - Background

After the advent of cockpits during World War I, World War II brought the second quantum leap in technology and complexity. This involved the development of more and more complex cockpits where multi-person crews were required to operate large aircraft.

In the early 1980s, digital computer technology supported the introduction of glass cockpits. The output of many sensors was efficiently merged onto screens for a better situational awareness.

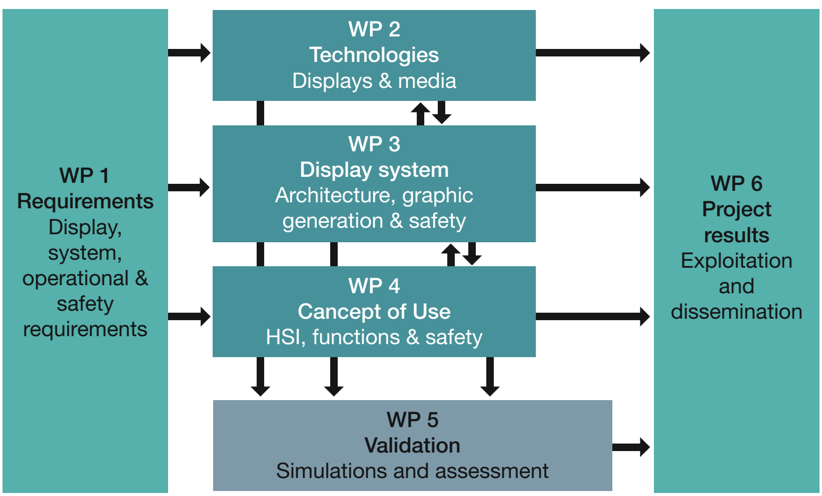
Nowadays, the main trends of cockpit evolution can be identified as follows:
- a rationalisation of cockpit equipment by reducing the number of dedicated input media/output devices and processing platforms;
- an increase in system flexibility to allow avionic upgrades;
- an increase in the display size.

Tomorrow's cockpits will also have to address new sky policies driven by projects such as SESAR and CLEANSKY. New functions like 4D trajectory, airport navigation systems or synthetic vision are expected to meet future mission management requirements and to support greener operations.

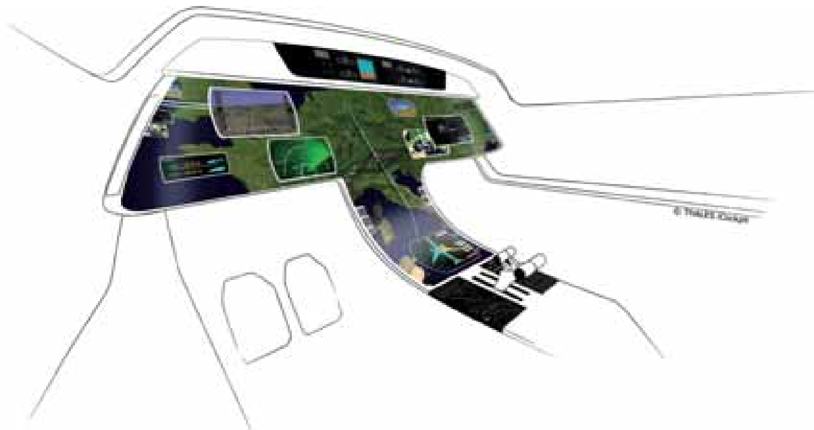
Due to the limited size of cockpit displays, the integration of these new applications on current displays will saturate the crew with information. The ODICIS project will thus provide a step-change improvement in cockpit design to meet these major challenges.

Objectives

The first objective is to prove the technical feasibility of a single, large, seamless, avionic display, which could be curved; this would involve optical but also graphic generation challenges. The adequate means of interac-



ODICIS work breakdown structure



© Thales iCockpit

Artist's impression of a single display cockpit

tion must also be defined and implemented. These include keyboards, cursor control devices but also tactile interfaces. Organising the buttons and control panels that were between the displays will be one of the objectives. At this point, a complete technological mock-up of a single display cockpit will be available.

At the same time, the concepts of use for the original single display cockpit must be reviewed and extended to prepare for the validation of the cockpit mock-up. A human-machine interface implementing standard but also innovative functions will be prepared to illustrate and evaluate the single display concept.

The design of the display must take into account user requirements and aircraft integration issues. The ODICIS consortium also aims at obtaining as much feedback as possible from various aeronautical actors – from pilots but also external experts via planned workshops.

The last objective is to produce a roadmap. This will take into account the different results from the project and will present the steps following the project, including a possible industrial scheme.

Description of Work

The ODICIS project has been divided into six technical work packages (WP) using key aspects of a formal system engineering process as follows:

- Requirements;
- Conceptual/functional analysis and development;
- Verification.

Requirements: WP1 will aim at defining the system to be designed. Avionic requirements remain mandatory, but the concept itself brings specific requirements, e.g. a seamless ability.

Analysis and development: the consortium will then work on adapting the technologies to comply with this list of general requirements. The key building blocks in the technological demonstration are the rear projection system (WP2), the graphical content generation (WP3) and the human-machine interface (WP4). These will start almost simultaneously by deriving the general requirements. A development phase will then follow resulting in an advanced, fixed-base simulator.

Verification: a full evaluation (WP5), supported by previous part-task evaluations, will check the performance of the fixed-based simulator against the established requirements. Technical and operational points of view will be addressed.

In parallel, a major point will be to disseminate the ODICIS results (WP6). Sharing and discussing project outputs with other aeronautical stakeholders will be of prime importance.

Expected Results

One of the key deliverables of the ODICIS project is the complete mock-up of a fixed-base aircraft simulator with a display covering the whole dashboard and interactive means, including tactile input. Such a new cockpit concept will provide advances in the domain of image blending, graphic computing architecture for avionic systems and human-machine interactions.

Based on the final evaluation report, recommendations will be provided for the development of a future system. An exploitation roadmap will be defined for technological readiness levels, resulting in an aeronautical product, which also has potential for the consumer and simulation markets.

The ODICIS project will pave the way for future aircraft cockpits by introducing a greater flexibility on the system architecture. From the marketing point of view, a single display is also a visible technological breakthrough bound to attract attention and sharpen the image of aircraft manufacturers.

Acronym:	ODICIS	
Name of proposal:	One DIsplay for a Cockpit Interactive Solution	
Grant Agreement:	233605	
Instrument:	CP – FP	
Total cost:	5 609 386 €	
EU contribution:	3 595 087 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.05.2009	
Ending date:	31.10.2011	
Duration:	30 months	
Technical domain:	Avionics, Human Factors and Airports	
Website:	http://https://www.odicis.org/	
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	Alitalia Compagnia Aerea Italiana S.p.A.	IT
	Optinvent	FR
	Interuniversitair Micro-Electronica Centrum VZW	BE
	Danmarks Tekniske Universitet	DK
	Università ta' Malta	MT
	Technological Educational Institute of Piraeus	GR

SUPRA
Simulation of UPset Recovery in Aviation

State of the Art - Background

Safety reviews list Loss of Control In-flight, LOC-I, as the leading cause of fatal accidents in transport aircraft. Between 1997-2006, LOC-I accounted for 87 accidents (2,573 fatalities) worldwide, 12 of them in EASA Member States. A large number of these accidents have been attributed to unsuccessful recovery from an 'upset', i.e. an aircraft inadvertently exceeding the flight parameters normally experienced in line operations (such as a roll angle of more than 45 degrees). Typically, a lack of awareness and experience by the crew allows the situation to become critical, resulting in loss of the aircraft. While these situations do not occur on a regular basis, their results are invariably catastrophic.

Aviation authorities recognise the clear need to educate pilots in upset recovery techniques. Performing such training in real aircraft would be expensive and unsafe. A cost-effective and safe alternative is to use a ground-based flight simulator, especially since commercial pilots already receive their recurrent training in a simulator. However, current flight simulators are considered inadequate for upset recovery training, since the aerodynamic models and equations of motion apply to the normal flight envelope, which is not representative of the extreme flight conditions associated with an upset.

Desdemona

Objectives

The global objective of SUPRA is to develop and validate a new flight simulation concept for teaching pilots to recover from a flight upset.

The technical objectives of SUPRA are:
- to perform actual flight tests to measure aircraft behaviour in upset conditions;
- to extend aerodynamic models beyond the standard flight envelope;
- to develop innovative motion-driving algorithms to provide motion feedback to the pilot representing in-flight upsets;
- to develop a Bayesian motion-perception model for objective optimisation of simulator motion.

The results of the project will become the basis for optimising standard training simulators for upset recovery training, as well as the development of specific flight simulators, capable of simulating exceptional flight conditions. The requirements will be laid down in a set of guidelines. SUPRA will contribute to ensuring that aviation safety remains at the current high standards or even improves, regardless of the growth in air transport.

The consortium will combine unique expertise and simulator facilities, such as the new motion platform Desdemona (see figure). With its gimballed cockpit and centrifuge capabilities, extreme attitudes and sustained G-loads can be simulated.

Description of Work

SUPRA is divided into seven technical work packages (WP).

WP1 obtains data from accident analyses, flight data recordings and flight tests.

WP2 extends the mathematical models of aircraft dynamics beyond the normal operational flight envelope to account for unsteady nonlinear aerodynamics in upset conditions.

WP3 consists of hardware modifications to the research simulators. A debriefing tool will be developed which allows for the evaluation of pilot performance in upset recovery training.

WP4 encompasses psychophysical experiments to build a knowledge base on visual-vestibular interactions. The experimental data will be input for the development of a new Bayesian perception model, showing how well certain simulator cues lead to the correct self-motion perception.

WP5 develops the special motion driving algorithms which accommodate the simulator motion envelope to the high accelerations and attitudes characteristic of upset situations. For hexapod simulators, existing motion driving algorithms will be optimised, and for the unconventional motion platforms, completely new motion driving algorithms will be developed.

WP6 integrates the extended aircraft models and motion-driving algorithms into the research simulators for the final validation of upset recovery simulation.

WP7 integrates the results to formulate guidelines for simulator-based upset recovery training.

Expected Results

The deliverables of the project are:
- a documented set of relevant flight upsets and required recovery techniques;
- an extended mathematical aerodynamic model;
- innovative motion driving technologies;
- guidelines to retrofit existing training simulators for simulation of (certain) flight upsets;
- guidelines to perform (certain) upset recoveries in dedicated motion simulators;
- Bayesian motion perception model.

The results of SUPRA will become the basis for optimising standard training simulators for upset recovery training, as well as the development of specific flight simulators, capable of simulating exceptional flight conditions. This way, SUPRA will contribute to further improving aviation safety, regardless of air transport growth.

Acronym:	SUPRA
Name of proposal:	Simulation of UPset Recovery in Aviation
Grant Agreement:	233543
Instrument:	CP – FP
Total cost:	4 928 779 €
EU contribution:	3 713 934 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.09.2009
Ending date:	31.08.2012
Duration:	36 months
Technical domain:	Avionics, Human Factors and Airports
Website:	http://www.supra.aero
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	AMST-Systemtechnik GmbH	AT
	Boeing Research and Technology Europe S.L.	ES
	Gromov flight research institute	RU
	Federal State Unitary Enterprise - The Central Aerohydrodynamic Institute named after Prof. N.E. Zhukovsky	RU
	Joint stock company Centre of Scientific and Technical Service «Dinamika»	RU
	De Montfort University	UK
	Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V.	DE

PICASSO
Improved Reliability Inspection of Aeronautic Structure through Simulation Supported POD

State of the Art - Background

With ageing engines and the expected increase of air traffic in the next 20 years, a central challenge in the aeronautical industry will concern the increase of efficiency in maintenance which still represents around 20% of an operator's indirect operating costs. This challenge is particularly important for metallic parts within the engine and aircraft industry. Maintenance is directly related to the concept of Probability of Detection (POD) curves which are obtained by expensive experimental campaigns.

Furthermore, the aeronautics regulations and expectations regarding safety are really increasing, imposing enhanced expectations on Probability of Detection (POD) sizing. In particular, new aeronautic regulations require appropriate damage tolerance assessments for critical parts (for example compressor and turbine disc), to address the potential for failure from material, manufacturing and service induced anomalies within the Approved Life of the part.

Within the PICASSO project, we propose to evaluate the concept of using Non Destructive Testing (NDT) low cost simulations to obtain POD curves.

Objectives

The aim of PICASSO is to build a new and original concept of «simulation supported POD curves based on NDT simulation in addition to existing experimental data base».

The main objectives of the PICASSO project are to increase the accuracy, and reduce the cost of, a Probability of Detection campaign with Non-Destructive Testing simulation techniques.

This will be achieved by:
- Completing experimental NDT inspections by simulated NDT inspections – suppressing the needs of manufacturing expensive samples with defects;
- More representative samples of the population for the POD campaign – enhancing the accuracy of the POD samples and increasing their numbers thanks to simulation techniques;
- Delta POD approach – suppressing the need of a new POD campaign for similar parts or inspection configurations.

The main impacts of the project will be:
- To improve the answer to FAA/EASA damage tolerance requirements with higher knowledge and accuracy on NDT inspection PODs;
- Savings in costs concerning aircraft maintenance and engine development.

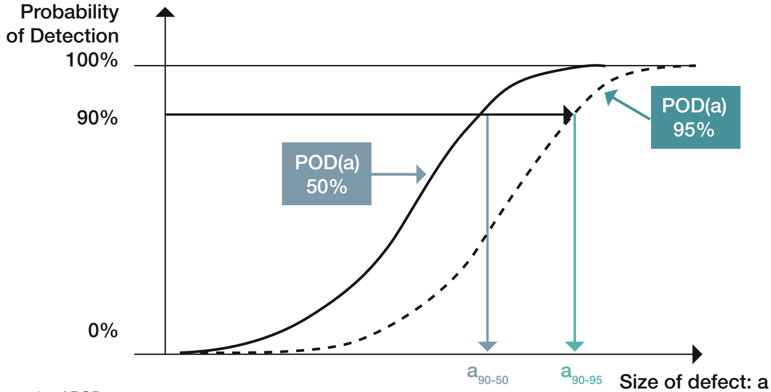
Description of Work

The project is divided into four technical Work Packages (WPs).

WP1 aims to procure the initial inputs of the project (material properties, defect description, data from equipment) and the validation cases to be used as experimental data for the comparison, with model-based POD calculations.

WP2 gathers the tasks concerning the modelling. NDT simulation software have to take into account the complexity of real situations: the complexity of parts, materials and defects, and the fluctuations coming from a large number of influential parameters.

In this WP2, the models will be highly improved by developers to achieve accurate and numerically efficient simulation tools, and



Example of POD curve

to be reliable enough for intensive use for POD calculations.

WP3 focuses on POD issues and deals with the introduction of simulated data in POD studies. The objective of WP3 is to develop a simulation supported POD methodology. Common methodologies and tools for low cost POD determination using a simulation supported strategy will be developped. Major expected results is the development of a prototype POD software platform.

WP4 is concerned with the assessement and validation of the new simulation supported POD methodology developed in WP3. It will be performed by the comparison between experimental and simulation of POD data.

Expected Results

The main result of the project will be the validation of the concept of 'simulation supported POD' by first realistic results, implementation and methodologies.

Through realistic industrial applications, design offices and maintenance departments will have at the end of the project a clear overview of the potential impacts.

Methodology recommendations obtained as a result of the project on simulation supported POD determination will enable to establish the basis and recommendations for a future European standard for qualification and reliability of inspection for the aircraft industry.

In this context, Aircraft European industry will increase its competitiveness and the aircraft safety level.

Its intensive use and the building of a future EU standard on simulation supported POD will be the next step towards the entry into service of such tools.

Acronym:	PICASSO	
Name of proposal:	Improved Reliability Inspection of Aeronautic Structure through Simulation Supported POD	
Grant Agreement:	234117	
Instrument:	CP – FP	
Total cost:	7 315 065 €	
EU contribution:	4 957 469 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.07.2009	
Ending date:	30.06.2012	
Duration:	36 months	
Technical domain:	Maintenance and Disposal	
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	Chalmers tekniska Högskola ab	SE
	European Aeronautic Défence and Space Company (EADS) France SAS	FR
	Hoch Technologie Systeme	DE
	Fraunhofer-Gesellschaft zur Förderung der Angewandten Forschung e.v	DE
	MTU Aero Engines GmbH	DE
	PHIMECA Engineering	FR
	Rolls Royce plc	UK
	TECHNIC-CONTROL Sp. z.o.o.	PL
	TURBOMECA SA	FR
	TWI LIMITED	UK
	Volvo Aero Corporation ab	SE

MISSA
More Integrated System Safety Assessment

Sate of the Art - Background

The increase of aerospace systems complexity has led to an increasing time-to-market for new technologies, increasing costs to demonstrate safety, a greater demand for skilled resources and a limitation on design iterations, which means there is less time to optimise designs that are compliant with safety targets.

The FP6 ISAAC Specific Targeted Research Project and the SPEEDS Integrated Project represent the main source of the current state of the art in the fields of functional, architectural and implementation level contract and model-based safety specification, automated logical and spatial reasoning about the safety of discrete and hybrid systems architectures, implementation and installation specification, and image processing.

MISSA will advance the state of the art by developing and combining the above technologies to develop a seamless argumentation framework for specifying, and substantiating aircraft systems functional safety specification, and will look to optimise systems installation by accounting for safety assessment influence on systems installation and finally providing means to audit the physical installation against the safety-driven installation requirements. MISSA deliverables will reduce the time to analyse aircraft systems specification and its installation definition, and will provide more time for system optimisation.

Objectives

The MISSA project has the following objectives:

- Develop an argumentation framework that is capable of linking every systems safety engineering activity that leads to an aircraft specification from Physical Testing Results, Design and Model Specification and Analysis through to In-Service Events Data;
- Develop the ability to carry out Installation Optimisation, driven by Safety Installation Requirements and some Performance Requirements;
- Develop the ability to check consistency of assumptions and specification 'laterally' between dependent systems within the aircraft level, systems architecture level and detailed systems implementation level, and 'vertically' including consistency between analysis results from the aircraft level, down through to the detailed systems implementation level;
- Devise a method for modelling the relevant aspects of specification at aircraft level, systems architecture and implementation level so that they can be analysed to demonstrate the adequacy of the relevant level of specification at addressing the airworthiness requirements;
- Develop the ability to include within the detailed systems implementation-level models, non-linear mathematical expressions to more accurately describe the behaviour of the systems;
- Develop the ability to abstract time in order to make time-dependent systems analysable with reasonable time and resources.

Description of Work

The work is divided into six technical work packages and two non-technical work packages (WP):

WP2: Clarify the detailed project requirements and train all the teams so they can work on the candidate modelling methods and analysis techniques. The resulting detailed requirements are used as key performance indicators to evaluate the project.

WP3: Focus on the optimisation of safety requirement allocation and installation at the aircraft level, mainly modelled thanks to formal requirement languages such as RAT and MathSAT.

WP4: Deal with the assessment of systems architecture by using mainly AltaRica models.

WP5: Handle the detailed design analysis by using mainly Simulink, Statemate and Scade models.

The correlation between consecutive levels is tackled by WPs 4 and 5.

WP6: Develop synthesis, argumentation and change-management methods and tools to support the justification of safety objectives.

WP7: Focus on platform evaluation. Several models are developed and used to test the platform, one of which is a leading case study that spans from aircraft down to detailed systems implementation level. Some models have sufficient detail to show what is needed to industrialise the tools.

WP8: Publicise the achieved objectives at industry working-group meetings and scientific conferences.

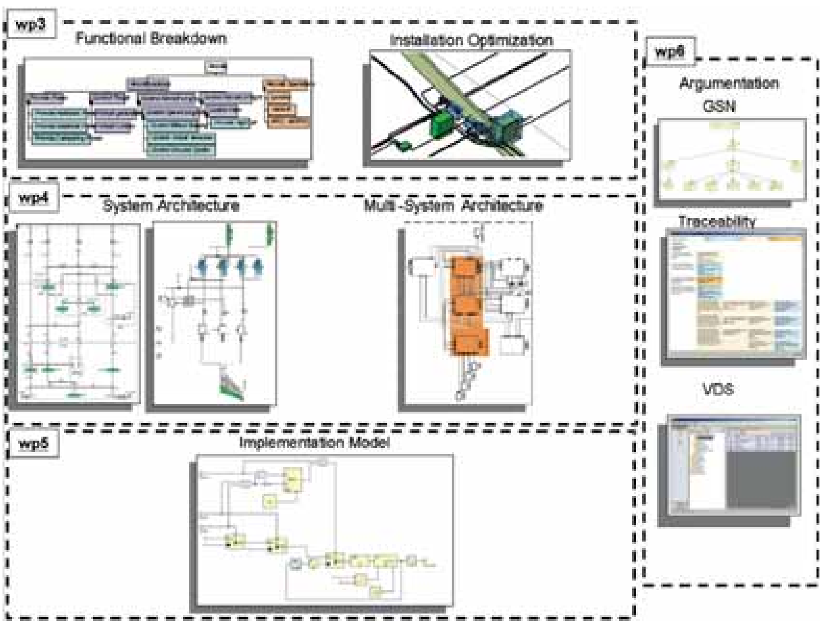
Expected Results

The aforementioned capabilities will lead to reducing the time taken to complete subsequent design iterations, offering either a reduction to the development costs, more time to have a greater level of performance and weight optimisation or an increase in the agility of design, and so will enable the design organisation to respond to changing market demand through the design life.

It will also improve the means to maintain and keep active the links between safety claims and the evidence used to substantiate it, by improving the maintenance of the complete chain of evidence.

It will provide one aspect of what is needed to produce affordable and better performing products that are better aligned to societal needs.

Some consortium members are active in the main industrial working groups that focus on aviation safety and participate in the day-to-day development of aerospace recommended practice. The methods developed



Scope and nature of models used in the model-based safety analysis framework within MISSA, along with the evaluation results, will be used to demonstrate the methods and potential gains they offer to the industry's working groups with the intention of gaining their support for the industrialisation of these methods.

The results from MISSA will improve the ability for industry to respond to market demand by making safety management more agile. Industrial organisations that implement this framework will be better placed to compete.

Acronym:	MISSA	
Name of proposal:	More Integrated System Safety Assessment	
Grant Agreement:	212088	
Instrument:	CP – FP	
Total cost:	5 900 216 €	
EU contribution:	3 999 105 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.04.2008	
Ending date:	31.03.2011	
Duration:	36 months	
Technical domain:	Design Tools and Production	
Website:	http://www.missa-fp7.eu	
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	Fondazione Bruno Kessler	IT
	Office National d'Études et Recherches Aérospatiales	FR
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	Prover Technology	SE
	Queen Mary and Westfield College, University of London	UK
	Thales Avionics SA	FR
	University of York	UK

ALEF

Aerodynamic Load Estimation at Extremes of the Flight Envelope

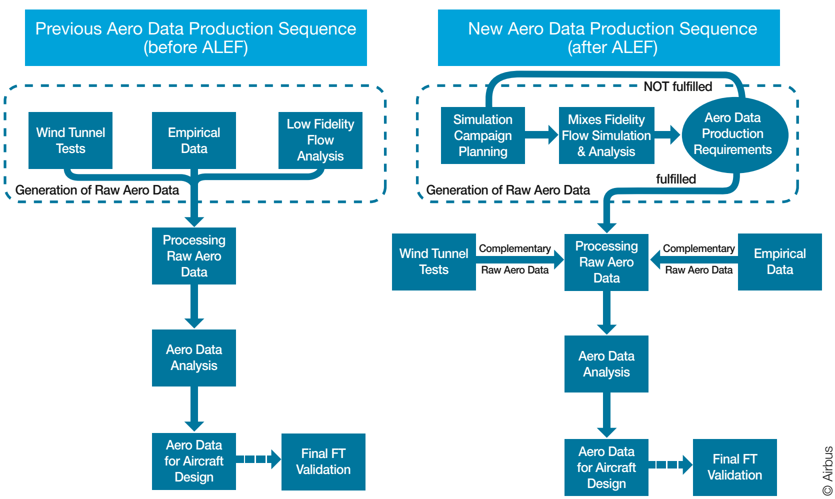
State of the Art - Background

Previously, aerodynamic aircraft data was primarily determined by using empirical data, analogies, and wind tunnel experiments. This data forms the basis for the structural dimensions of the vehicles and therefore influences their weight and fuel burning. More importantly, the layout of flight control systems and the design of control surfaces are also based on this aerodynamic data. In general, singular cases were used for limit load predictions. This approach yielded rather rough estimates of global loads over the entire flight envelope leading to serious safety issues. Finally, secure but heavy aircraft structures were designed.

Today, secure aircraft structures must be designed to be as lightweight as possible in order to come up with environmental friendly vehicles. This necessitates small or even zero margin safety risks, which in turn call for the precise prediction of aerodynamic data over the entire flight envelope, including fringe areas and beyond, as limiting cases can no longer be foreseen. In addition, more detailed information for aerodynamic data is needed for the better optimization of single components, as well as the overall aircraft. Competition in aeronautical industry also leads to quite significant reductions of design cycle times.

Over the last two decades «testing» has been increasingly complemented by tools for the numerical simulation of aerodynamics, steadily increasing their capabilities. These computational fluid dynamic (CFD) tools have now reached a sufficient level of maturity regarding the quality of their results for major parts of the 'inner area' of the flight envelope. This maturity is based on the experience gained by design simulations near the cruise point.

The challenge is now to introduce CFD as the major source for aerodynamic data prediction in the aircraft design process.



ALEF's impact on aero data production sequence (schematic)

However, numerical simulation techniques for aerodynamic applications have known deficits, specifically at the extremes of the flight envelope. Complex flow phenomena, in conjunction with high configuration complexity, makes high-fidelity simulation a challenging task.

As well as this, providing aero data based on high-fidelity simulation for any flow condition and requested configuration in suitable time scales overshoots current computational resources by far: from an actual aircraft development point of view, aero data production needs to cover all combinations of deviations in configuration (cruise/high lift, control surface deflections) and/or flow condition (M, α, β) finally leading to a list of multi-dimensional requirements.

Objectives

ALEF's objective is to enable the European aeronautical industry to create complete aerodynamic data sets of their aircraft based on certified numerical simulation approaches within the respective development processes. i.e. ALEF will kick-off a paradigm shift from greater confidence in experimentally-measured data to just as great confidence in computational results. Beyond the scope of ALEF this paradigm shift will essentially influence the overall aerodynamic development process.

The objective has three aspects:

- Comprehensiveness: the ability to predict aerodynamic forces, moments and their derivatives in time for any point of the flight regime;
- Quality: the accuracy of each flow simulation result used for prediction of aerodynamic data and to the coherence of aero data integrated over the complete flight envelope from tools of varying fidelity;
- Efficiency: the need to deliver aerodynamic data over the entire flight envelope for loads and handling qualities, as well as for performance within time frames dictated by multi-disciplinary industrial design processes at given costs and computational resources.

The certification of numerical simulation for aerodynamic data prediction is derived from the first two aspects of the objective. They ensure the trustworthiness and reliability of numerically predicted data over the entire flight envelope in industrial development frameworks.

Description of Work

The ALEF project is anchored in between two major work-packages which first (WP 1)

define the scope of aerodynamic loads estimation, the procedures necessary (Task 1.1) and the quality of the aerodynamic loads estimation requirements (Task 1.2). The other bridgehead is the assessment (WP 4) which checks on the demonstration (Task 4.1) of test cases and requirements defined and provided in WP 1 (Subtask 1.1.1), subject to quality and efficiency goals. The lessons are learned (Task 4.2) from demonstrations together with experience, expertise, tools and processes provided by steady and unsteady aero loads simulations (WP 2 and WP 3). They will provide insight into the state-of-the-art aerodynamic tools and processes suitable for load estimations, together with their potential and capabilities to be applied for realistic industrial applications on complex aircraft configurations and their components. The outcome will be a set of tools and processes rated with regard to their capabilities, their efficiency and needs of future developments.

Expected Results

The ultimate scope of the use of simulation tools in aero data generation is to cover all flight conditions and configurations by means of a numerical toolbox. This would ensure an up-to-date and fast estimation of the most recent status of aircraft with consistent data. Unsteady behaviours and flexibility could be incorporated in the standard aero data prediction process. ALEF will essentially contribute to a 70% wind tunnel testing cost reduction by 2020, which will cut the aerodynamic development effort by about 40%.

Acronym:	ALEF	
Name of proposal:	Aerodynamic Load Estimation at Extremes of the Flight Envelope	
Grant Agreement:	211785	
Instrument:	CP – FP	
Total cost:	5 503 297 €	
EU contribution:	3 390 000 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.05.2009	
Ending date:	30.04.2012	
Duration:	36 months	
Technical domain:	Flight Physics	
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	CIMNE - Centre Internacional de Mètodes Numèrics en Enginyeria	ES
	CIRA - Centro Italiano Ricerche Aerospaziali S.C.p.A.	IT
	Dassault Aviation SA	FR
	DLR - Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	EADS Deutschland GmbH	DE
	Eurocopter Deutschland GmbH	DE
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	KTH - Kungliga Tekniska Högskolan	SE
	NLR - Nationaal Lucht- en Ruimtevaartlaboratorium	NL
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	Piaggio Aero Industries S.p.A.	IT
	RUAG Aerospace	CH
	SAAB AKTIEBOLAG	SE

ADVITAC
ADVance Integrated Composite Tail Cone

State of the Art - Background

New requirements and ecological policies for greener aircraft have led the aeronautic industry to consider new approaches for aircraft development and manufacturing. The aircraft tail cone appears to be a strategic component for reducing aircraft noise, fuel consumption and nitrogen oxide emission, notably because of its integrated Auxiliary Power Unit (APU). The project's central focus is to design and manufacture a lightweight multilayer/multifunction and smart composite tail cone with no fasteners in a fully integrated structure, using a fully integrated and automated process, which results in significant cost savings.

In order to ensure a thinner, cheaper and safer system, new architecture, design concepts and manufacturing processes for the integrated tail cone should be investigated. The project brings together a consortium that has an overview of all the problems concerning tail cone structure and APU integration. Significant weight and cost savings are expected when the solutions to issues to be addressed by each of the partners have been consolidated in a design-to-cost approach.

Objectives

Today, lightweight structures are mandatory in order to significantly reduce CO_2

emissions of any aircraft, but unfortunately the production cost of low weight structures is higher than that of classical structures. To fulfil both society's needs and that of the European leadership, we propose the following detailed technical goals:
- Lowering production costs by 30% regarding the actual composite aero structure;
- Lowering weight by 10% regarding the actual composite aero structure;
- Specifying a new generation of composite architecture allowing an extensive function integration (acoustic, fireproof, electrical and strength);
- Significantly improving knowledge of interaction between innovative technologies allowing fully automated integrated processes, including automated dry perform;
- Trough Thickness Reinforcement and infusion process.

Description of Work

The ADVITAC project is divided into eight Work Packages (WPs).

WP1: Project management;

WP2: Integrated tail cone specifications: defining precisely the input data necessary to manage the technical issues ;

WP3: Composite structure design and architecture: defining a design and analysing the manufacturing process in order to identify real cost drivers;

WP4: Innovative process selection: selecting the best processes that are relevant to solving issues defined in the specification WP;

WP5: Manufacturing process enhancement: building on promising technologies, this WP will enhance the relevant processes from a cost and weight point of view;

WP6: Full-scale validation process: enabling the validation process to be applied to a full-scale tail cone demonstrator;

WP7: Full-scale experimental test: the effectiveness of the low weight and low-cost architecture will be demonstrated by different elements and detailed tests, such as fire and lightning tests;

WP8: Dissemination.

Expected Results

Automated and Integrated Processes, including automated fibre placement, TTR and infusion technology to the TRL 4/5 (reduction of assembly costs)leading to:

Fast and repeatable processing of dry reinforcement with AFP,

automated implementation of TTR, replacing the use of expensive titanium rivet and hand riveting processes, complete function integration by integrating parts with LRI applied to the latter fully integrated 3 dimensional reinforcement, and the implementation of innovative architecture of the Tailcone.

- Innovative solutions for the multi-material fibres placement process (carbon + optic fibres, carbon + metallic fibres);
- Innovative solutions for electrical continuity, thermal properties, and lightening to be used for multilayer composite;
- Specification and system for SHM sensor automated placement;
- Robust resin Infusion Process including control of nano particles repartitioning within the structure;
- Low cost infusion tools (mainly thanks to new solution for both thermal behaviour of the mould and better demoulding issues);
- System for low cost and automated dry stringer manufacture;
- Experimental measurement of nano particles effect on both electrical, mechanical and thermal behaviour of a composite structure;
- Verification on a scale one aircraft tail cone of industrial capabilities of innovative processes developed within ADVITAC;
- Calculation software for aero and vibro acoustic issues, innovative because taking into account composite properties.

Acronym:	ADVITAC	
Name of proposal:	ADVance Integrated Composite Tail Cone	
Grant Agreement:	234290	
Instrument:	CP – FP	
Total cost:	5 895 306 €	
EU contribution:	3 999 137 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	28.05.2009	
Ending date:	28.11.2009	
Duration:	42 months	
Technical domain:	Aerostructures and Materials	
Website:	http://www.advitac.eu	
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	Cranfield University	UK
	Coriolis Composites SAS	FR
	Free Field Technologies SA	BE
	Empresa Brasileira de Aeronáutica SA	BR
	RECOMET IMPEX SRL	RO

IMac-Pro

Industrialisation of Manufacturing Technologies for Composite Profiles for Aerospace Applications

State of the Art - Background

Today, most of the profiles used for the structure of an aircraft and for stiffening the skins on the wings and fuselage are made of aluminium, even partly of titanium. In modern aircraft design these materials are increasingly substituted by carbon fibre reinforced plastics (CFRPs). CFRPs have a very high potential for lightweight design by offering excellent specific stiffness and strength. They also allow an optimised design regarding geometry, local thicknesses and local fibre direction.

The market for cost-effective manufacturing of CFRP profiles is expected to grow significantly in the future, due to a rapidly growing aircraft market and the demand for lightweight designs based on CFRPs, which improve the ecological compatibility of planes and helicopters, and reduce aircraft production and development costs.

CFRP parts already in use are mostly produced using pre-impregnated (prepreg) technology. Automated production of prepreg parts is currently limited to two-dimensional geometries with moderate curvature. Complex shapes still need extensive manual work with hand-lay-up of the material, layer by layer, and a manual vacuum bagging. Resin curing in the autoclave is also a very expensive step of prepreg production.

IMac-Pro will focus on ‘textile preforming’ in combination with ‘out-of-autoclave curing’, which would provide promising alternatives to prepreg.

Objectives

The technological objective of IMac-Pro is the development of a complete integrated process chain for the cost-effective serial production of optimised CFRP stiffener profiles (e.g. frames, stringers, struts, floor beams, drive shafts, etc.) for all kinds of aircraft (passenger and freighter planes, helicopters) based on textile technologies in combination with advanced injection and curing technologies.

Depending on the geometrical requirements and the loads, the targeted profiles might be straight with a constant cross section (e.g. fuselage stringers), straight with a varying cross section (e.g. wing spars) or complex curved (e.g. fuselage frames).

In IMac-Pro, net-shaped textile preforming techniques with a high potential for automation and cost saving will be the baseline for the production of the profiles, with the following challenging goals to reach:
- a weight saving of at least 20% compared to aluminium design;
- a weight saving of up to 5% compared to prepreg design for curved profiles;
- a cost saving of more than 45% compared to prepreg design for complex profiles.

Description of Work

The project addresses different types of aircraft stiffener profiles. The common characteristics of these parts are an enormous length in comparison to the dimensions of the cross section. They can be divided into two main categories due to the significant impact on the manufacturing technology necessary for the production:

1. Massive profiles like floor beams and frames with edge dimensions in the range of 50 to 400 mm and wall thicknesses from 0.5 to 8 mm. These profile types have the additional challenge that their cross section shape and their wall thicknesses may change along the profile continuously or periodically.

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Manufacturing of the Carbon Fibre Preform for a Curved Profile by Braiding

2. Stringer profiles with relative small cross section dimensions in the range of 50 mm, no changing of the cross section, but partly single or double curved and of even greater length (up to 30 metres).

For the massive profiles the braiding technology is the baseline for preform production. Profile type 2 will be addressed by continuous forming (similar to pultrusion) of textile semi products and by fibre patch preforming (FPP).

Different techniques of curing will be investigated: RTM with adaptable elements to compensate for the settling (thickness reduction) of the preform, continuous injection and microwave heating.

Expected Results

The expected results of IMac-Pro comprise mostly of machine prototypes, devices and measurement systems, which will be adapted to already existing equipment:

- a circular braider at Kümpers will be equipped with the 0° and 90° lay-up devices;
- a circular braider from USTUTT, which can be opened, will be used to address the braiding of closed frames;
- a laboratory stringer preform machine at SECAR, which will be combined with FPP lay-up units;
- a microwave oven at DLR which will be used for the fast stringer curing.

Using the developed machines and tools, three demonstrator structures are planned:

- a stiffened panel with four pre-cured stringers on a prepreg skin;
- a stiffened panel with four stringer preforms and textile skin cured at the same time;
- a cargo floor unit, consisting of a curved frame profile, a straight crossbeam and z-struts.

A consequent application of the project results will lead to a significant weight saving of the whole airframe and by this to an improvement of environmental compatibility without loss of performance. At the same time, a significant reduction in aircraft acquisition costs can be expected. The main cost-cutting issues compared to prepreg are: lower basic material costs, reduced waste due to net shaping, a high degree of automation for complex shapes, and the potential for cheaper tools and non-autoclave curing.

Acronym:	IMac-Pro
Name of proposal:	Industrialisation of Manufacturing Technologies for Composite Profiles for Aerospace Applications
Grant Agreement:	212014
Instrument:	CP – FP
Total cost:	7 341 660 €
EU contribution:	4 998 870 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.07.2008
Ending date:	31.12.2011
Duration:	42 months
Technical domain:	Aerostructures and Materials

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	SGL Kümpers GmbH & Co. KG	DE
	University of Stuttgart - Institute of Aircraft Design	DE
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	Dassault Aviation SA	FR
	Société Anonyme Belge de Constructions Aéronautiques	BE
	Centre de Recherche en Aéronautique ASBL	BE
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	SECAR Technology GmbH	AT
	Westcam Fertigungstechnik GmbH	AT
	Hellenic Aerospace Industry SA	GR
	LTSM-Upatras	GR
	University of Patras	GR
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	Israel Aerospace Industries Ltd	IL
	Aeronautical Research and Test Institute of the Czech Republic	CZ
	Alenia Aeronautica S.p.A.	IT

LAYSA
Multifunctional Layers for Safer Aircraft Composite Structures

State of the Art - Background

The use of composite materials in the aeronautics industry has constantly increased over the last 35 years, due mainly to their high level specific strength and stiffness combined with the possibility of designing complex geometry components that are more aerodynamically efficient than metals.

But due to the organic nature of polymeric matrix components, composite materials are electrically and thermally bad conductors and tend to burn easily, emitting toxic gases and smoke. For this reason, they require affordable, effective and certifiable protection systems against atmospheric hazards such as icing and erosion, as well as fire, not only for preventing accidents but also for surviving them. Moreover, improved field inspection techniques for continuous assessment of their structural health are required due to their increased use.

The incorporation of ice/fire protection and structural health monitoring systems on composite structures result in adding an additional weight penalty and complexity during the component manufacturing and posterior maintenance, and may even go against the structural integrity of the component in some cases.

Objectives

The main objective of LAYSA is to develop a multifunctional layer with thermal and electrical conductivity, improved fire performances and sensing capabilities to be incorporated in aircraft composite structures for ice and fire protection, as well as health monitoring.

The scientific objectives of the project are:
- Design and manufacture a novel layer concept with multifunctionality based on nanomaterials;
- Develop electrical/thermal conductivity capable of distributing the necessary heat on a composite surface to prevent ice formation on its surface in rough fly conditions or to remove the already existing one. With respect to current electrothermal system it is estimated that a weight reduction of 99% and a power consumption reduction of 50% can be achieved;
- Reduce flammability;
- Use electrical conductivity variation measures to sense temperature and stress;
- Integrate, model and validate a multifunctional system in novel structural composite materials.

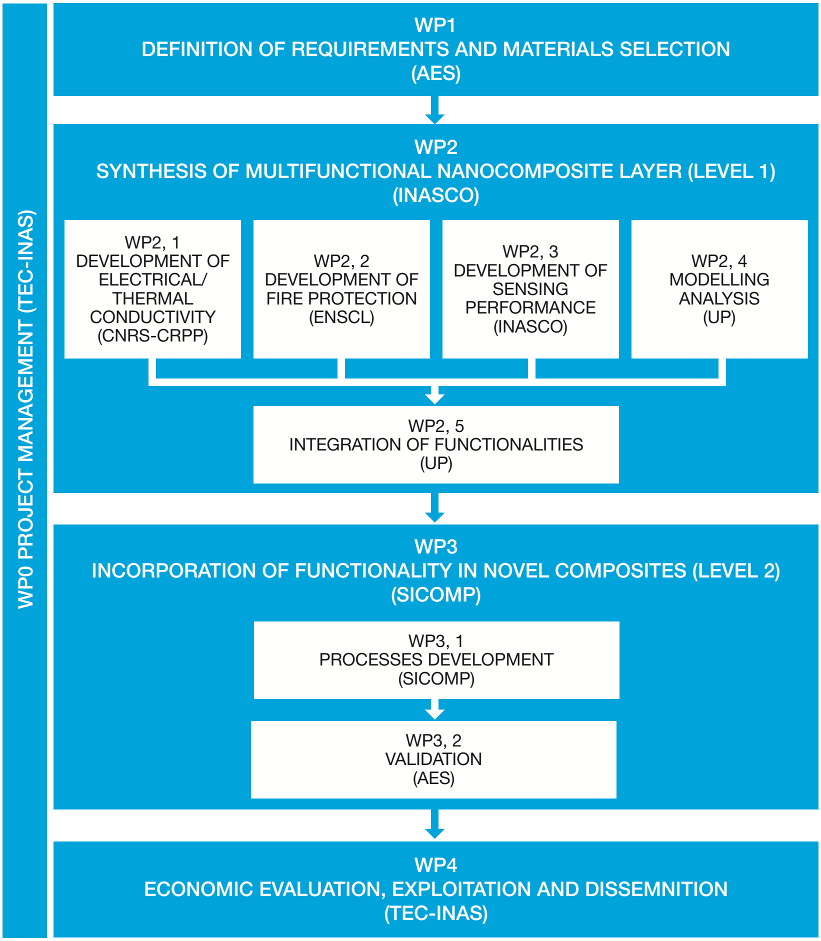
The technological objectives are:
- Couple the conductivity characteristics of the composite with ice/fire protection and health monitoring systems;
- Develop modelling tools to facilitate the analysis and design of multifunctional layers;
- Manufacture and validate composite components with ice/fire protection and sensing capabilities for real-time temperature and damage assessment.

Description of Work

The project work packages (WP) are:

WP1: Specification of aircraft composite structures in order to determine the base materials to be used during the project. Specification of structural and functional requirements of ice/fire protection and sensor systems of aircraft composite structures. Several nanomaterials will be considered including different carbon nanotubes, layered silicates (MMT) or other similar metal nanotubes – and also the possibility of combining nanomaterials.

WP2: Development of nanocomposite with triple functionality (electrical /thermal conductivity, fire resistance and sensing capability). The functionalities will be studied separately, focusing on pre-treatment, dispersion, adhe-



LAYSA workpackages

sion and orientation (randomly or aligned) of nanomaterials into resin for the required functionality.

A model will be derived to show how each of the possible nanofillers will interact with each other and with the available epoxy matrix in order to produce nanocomposites of predictable electrical, thermal, sensing properties and fire protection.

WP3: Integration of the nanocomposite in the traditional composite manufacturing process. Several layer alternatives will be considered, selected, optimised and incorporated in the manufacturing process of the novel composite.

WP4: Economic evaluation, exploitation and dissemination. Steps for certifying technology will also be explored.

Expected Results

Concentrating solely on structural mass reduction does not lead to further lowering of equipment mass because the structure typically represents as little as 10-15% of the total mass.

The integration of the three functions (ice/fire protection and health monitoring) with nanomaterial technologies opens the door to high performance, environmentally friendly and safer aircraft operation by better exploiting available multifunctionality potentials derived from their exceptional properties, in terms of thermal and electrical conductivity and sensing capacity.

LAYSA outputs are expected to have competitive and societal impacts such as savings in the manufacturing process and fuel consumption, increasing the European market share and the opportunities for employment of highly skilled professionals.

Acronym:	LAYSA	
Name of proposal:	Multifunctional Layers for Safer Aircraft Composite Structures	
Grant Agreement:	213267	
Instrument:	CP – FP	
Total cost:	4 347 840 €	
EU contribution:	3 007 603 €	
Call:	FP7-AAT-2007-RTD-1	
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Ending date:	31.08.2011	
Duration:	36 months	
Technical domain:	Aerostructures and Materials	
Website:	http://www.laysa.eu	
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	University of Cranfield	UK
	Integrated Aerospace Sciences Corporation	GR
	Université de Pau et des Pays de L'Adour	FR
	Advanced Composite Group	UK
	Huntsman	CH
	Aries Complex	ES
	Aernnova	ES

MAAXIMUS

More Affordable Aircraft through eXtended, Intergrated and Mature nUmerical Sizing

State of the Art - Background

Composite solutions can deliver lighter structures with less maintenance. They provide greater stiffness and strength to density ratios than metallic ones, allow the designing of more integrated structures with fewer fasteners, are less prone to progressive damage under in-service fatigue loads with current design rules and are also less sensitive to corrosion.

Composites represent 26% of the Airbus A380 structural weight and up to 50% is anticipated for the Boeing 787 and the Airbus A350 XWB. Nevertheless, increasing the percentage of composites in the airframe structure is not sufficient to achieve lighter and more cost efficient airframes: composite areas can be further optimised in terms of cost and performance, and various knock-on effects of a 'more composite' aircraft should also be considered:
- the substitution of the assembly of many small composite parts by a large part provides additional weight reduction;
- the final assembly line process must be adapted to composite properties (lack of ductility, stiffness);
- if the appropriate level of confidence and cycle time was available, simulation-based design would provide a faster and less expensive path to find the optimal structure than the current development process which relies on physical tests;
- more conductive composites are necessary to avoid additional weight for system protection.

Objectives

The aim is to demonstrate the fast development and 'right first time' validation of a highly optimised composite airframe. This will be achieved through coordinated developments on:
- a physical platform, to develop and validate the appropriate composite technologies for low-weight aircraft;
- a virtual structure development platform, to identify the best solutions faster and validate them earlier.

The objectives regarding the highly optimised composite airframe are to:
- enable a high production rate: 50% reduction of the assembly time of the fuselage section;
- reduce the manufacturing and assembly recurring costs by 10% (compared to the ALCAS FP6 project equivalent reference) as a result of more integrated structures;
- reduce the structural weight by 10%, compared to the best available solutions on similar fuselage sections (F7X, A320 and TANGO FP6 Project fuselage).

Regarding faster development, the aim is to:
- reduce the current development timeframe of aircraft composite structures from preliminary design up to full-scale test by 20% (ALCAS reference), and by 10% of the corresponding non-recurring cost.

Regarding the 'right first time' structure, the aims are to:
- additionally reduce the airframe development costs by 5% compared with the equivalent development steps in an industrial context;
- avoid late and costly changes due to unexpected test results.

Description of Work

Based on a set of airframe requirements, MAAXIMUS will design, analyse, manufacture, assemble, control and test a full-scale barrel, made of two fuselage sections. This breakdown by skill discipline is a direct correspondence with the current industrial approach for airframe development.

However, to achieve the different project objectives, the two-section barrel development cannot be launched from scratch. Many improvements need to be achieved first and can be categorised in the following themes:
- Advances in composite technology;
- Virtual aircraft engineering and manufacturing;
- Generic numerical technologies for optimisation and analysis;
- IT framework development, for a successful multi-skill integration of new methods into a coherent working environment.

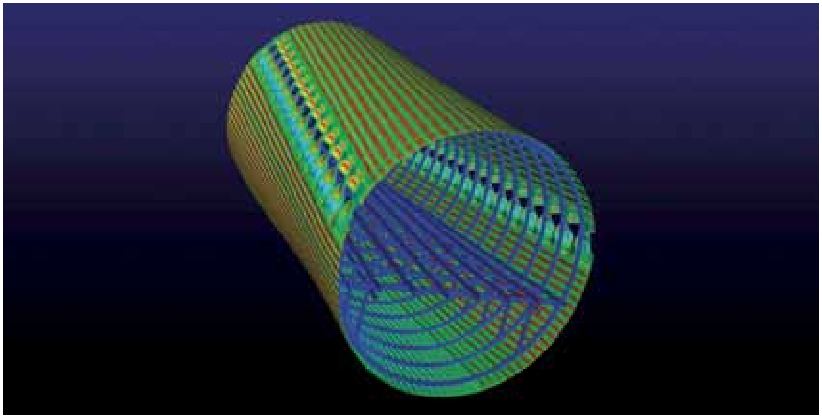
Advances in composite technology will be demonstrated by the design, sizing, manufacturing, control and testing up to failure of the full-scale composite barrel, demonstrating the expected accuracy and confidence of the virtual platform.

The overall MAAXIMUS strategy is to address simultaneously the two dimensions of the development:
- 'airframe development' skill view: Sub-project view. The different sub-projects will contain all the project work packages
- 'capability development' view: 'Hub view'. This will give a transverse vision on the project and create the connection between the sub-projects.

Expected Results

The main results of the project will be:
- a set of physical tests at coupon, structural detail and panel level;
- a generic composite barrel section manufactured and tested under quasi-static load;
- a set of advanced optimisation and analysis methods integrated in a demonstrator framework.

Virtual testing will be a major asset to freeze a trouble–free design earlier than can be done today. More mature aircraft will be provided for entry into service, with fewer Service Bulletins or post-entry into service modifications. This will be a key asset for airliner satisfaction.



Development and validation of new standards in high fidelity modeling, optimisation, analysis and certification of composite aircraft structure.

Acronym:	MAAXIMUS	
Name of proposal:	More Affordable Aircraft through eXtended, Intergrated and Mature nUmerical Sizing	
Grant Agreement:	213371	
Instrument:	CP – IP	
Total cost:	67 140 538 €	
EU contribution:	40 199 771 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.04.2008	
Ending date:	31.03.2013	
Duration:	60 months	
Technical domain:	Aerostructures and Materials	
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	Airbus UK Ltd	UK
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	ARTTIC	FR
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	Centro Italiano Ricerche Aerospaziali SCPA	IT
	Constructions Industrielles de la Méditerranée	FR
	Dassault Systèmes SA	FR
	Dassault Aviation SA	FR
	Centre d’Essais Aéronautique de Toulouse	FR
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	EADS Deutschland GmbH (MAS and IW)	DE
	European Aeronautic Defence and Space Company France SAS	FR
	ESI Group SA	FR
	Eurocopter Deutschland GmbH	DE
	Fischer Advanced Composite Components AG	AT

Fundación de la Ingeniera Civil de Galicia	ES
Fundación Fatronik	ES
Fundación Imdea Materiales	ES
IMA Materialforschung und Anwendungstechnik GmbH	DE
Imperial College of Science, Technology and Medicine	UK
Integrated Aerospace Sciences Corporation O.E	GR
Universität Stuttgart	DE
Institut National des Sciences Appliquées de Lyon	FR
Instituto Superior Tecnico	PT
iSIGHT Software SARL	FR
Israel Aerospace Industries Ltd	IL
National Institute of Aviation Technologies	RU
Latécoère	FR
Gottfried Wilhelm Leibniz Universität Hannover	DE
LETOV LETECKA VYROBA S.R.O.	CZ
LMS International	BE
Ecole Normale Supérieure de Cachan	FR
MSC Software Ltd	UK
Office National d'Études et de Recherche Aérospatiales	FR
Politecnico di Milano	IT
QinetiQ Ltd	UK
Rheinisch-Westfaelische Technische Hochschule Aachen	DE
SAMTECH SA	BE
Short Brothers plc	UK
Swerea SICOMP AB	SE
Sogeti High Tech (Cap Gemini)	FR
Sonaca SA	BE
Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
Eidgenössische Technische Hochschule Zürich	CH
Technische Universität Carolo-wilhelmina zu Braunschweig	DE
Technische Universität Hamburg Harburg	DE
Technische Universiteit Eindhoven	NL
Technology Partners Foundation	PL
Swedish Defence Research Agency	SE
Tusas Aerospace Industries Inc.	TR
University of Limerick	IE
University of Patras	GR

CREAM
Innovative Technological Platform for Compact and Reliable Electronic integrated in Actuators and Motors

State of the Art - Background

The actual political, environmental and economic trends applied to air transport point to future moves to the All Electric Aircraft (AEA). The goal of this concept is to eliminate as many hydraulic power sources and complicated circuits of high-pressure hydraulic lines as possible. The engine, which is currently required to produce thrusts, pneumatic power, hydraulic power and electrical power, must be redesigned and optimised to produce thrust and predominantly electric power.

Today, it is clear that reliable electric actuators are one of the technical bottlenecks for achieving this ambitious technological vision of AEAs. The goal of power by wire (PBW) is to significantly reduce or eliminate altogether the hydraulic connection and its associated risks by providing electrical power straight to the actuators. However, the maturity of PBW technology is lagging behind. In fact, the real challenge for the implementation of the PBW aircraft is the development of compact, reliable, electrically-powered actuators to replace the conventional hydraulic systems, thereby allowing the replacement of all electrical hydrostatic actuators by Electro-Mechanical Actuators - EMA (flight control actuators, braking system, landing gear actuators, propulsion inverters, various pumps, and various auxiliary actuators).

Objectives

The CREAM project objective is to reach new high performance and reliability capabilities of Electro-Mechanical Actuators (EMA) in harsh thermal environmental conditions ready to use in all-electric aircraft.

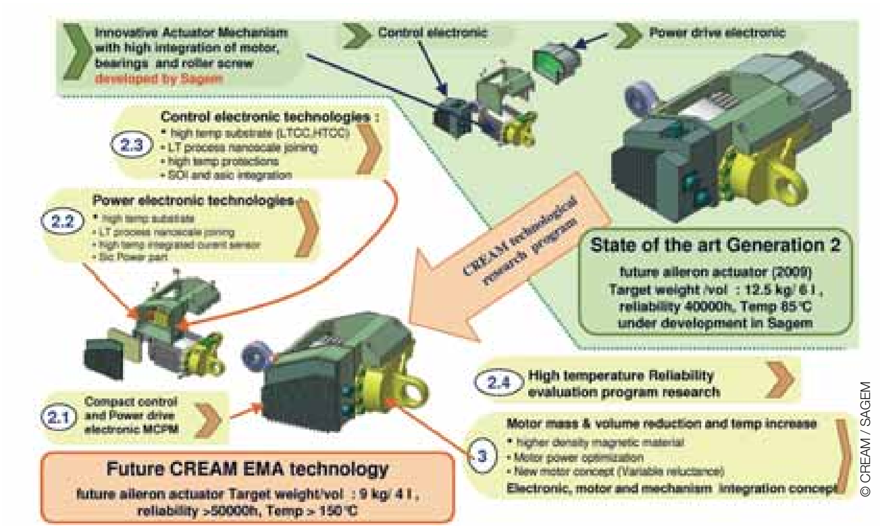
For this global objective, it will develop an advanced, smart, miniaturised and reliable electronic technological platform integrating new compact technologies, advanced components and assembly methods able to substantially improve the drive and control electronic modules and the EMA motors in order to:

- Provide high power density and compact characteristics of electronics modules integrated in actuators or motors (reduction by a factor of 2 of the electronic volume and mass);
- Provide advanced new concept of thermal management of the electronic platform allowing higher performances and reliability;
- Provide high temperature and compact motors for actuators (reduction of 30% of the motor volume and mass);
- Integrate the new electronic and motor platform in actuator housing and a very severe thermal environment (above 200°C) providing performing thermal management;
- Provide validation of aeronautic reliability in high temperature at least at the same level than existing hydraulic systems (50 000 hours), and even better (100 000 hours) with health monitoring functionality.

Description of Work

CREAM proposes an ambitious technological research program allowing the development and validation of a number of various emerging sub-components, packaging and motor technologies and to integrate them to a high performance smart electronic and motor technological platform destined to electric actuator preparation. The project is divided into 4 Work Packages (WPs).

WP1, Specifications, is oriented to the better understanding of the harsh environment and the complex validation plan to ensure the



CREAM EMA Innovation : Applied to Flight control actuator

best implementation of the new actuator in aircrafts.

WP2, Multi-Chip Power Module (MCPM) Design, is the core development of the CREAM project and will lead to the creation of the new electronic part of the actuator. This workpackage is divided in to 4 sub-workpackages.

WP2.1 refers to the technical coordination of this activity and all developments of the MCPM global packaging (electronic interface, global packaging and integration between modules).

WP2.2 refers to the development of a new power module for the actuator including power component interfaces with the control module and the compact high temperature power packaging.

WP2.3 will develop another electronic module dedicated to the control of the actuator for high temperature applications.

WP2.4 deals with the reliability of the electronic devices developed, including all assembly technologies and reliability of the modules integration.

WP3, Actuator Global Integration, is dedicated to the development of a new motor for this generation of actuators. New technologies, as new magnetic materials or new motor control method, will be evaluated to improve the actuator.

WP4, Technological platform validation, aims at validating the new actuator to perform the Technological Readiness Level expected.

Expected Results

The following technological outputs of the CREAM project will lead to further economic impacts:

- Reliable 'application-ready' high-temperature electronic modules: establishment of European know-how in the field of high-temperature electronics;
- Successful development of high thermal conductive materials with high thermal stability: such materials are of interest in many areas where reliable cooling is an issue;
- A new technology and design for measuring current in harsh environment, reusable in various sectors;
- High temperature and compact motor controller for applications in valves and pumps;
- Reliable EMA actuators in hard thermal environment providing reduced operational cost for maintenance.

Immediate benefits derived from the wider application of electrical power and electronics in actuation include higher performances and reliability, benefits of overall weight reduction, easier maintainability, reducing operating costs (including reduced fuel burn) and enhanced safety.

CREAM is able to establish the credibility of electric actuation as a primary reliable method for aircraft actuators including flight critical control surfaces, by integrating innovative concepts and sub-systems and reliability testing methods.

Acronym:	CREAM	
Name of proposal:	Innovative Technological Platform for Compact and Reliable Electronic integrated in Actuators and Motors	
Grant Agreement:	234119	
Instrument:	CP – FP	
Total cost:	6 127 734 €	
EU contribution:	4 199 478 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.09.2009	
Ending date:	31.08.2012	
Duration:	36 months	
Technical domain:	Systems and Equipment	
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	Liaison Electro-Mécanique SA	CH
	CISSOID S.A.	BE
	Fraunhofer Institute of Integrated Systems and Device Technology	DE
	Technological Educational institute of Piraeus	GR
	Naturen Industrial, Informatics and Trading Ltd.	HU
	Joint Stock Company United Aircraft Corporation	RU
	Rotech Engineering LTD	GR
	Alma Consulting Group S.A.S.	FR

DAPHNE

Developing Aircraft Photonic Networks

State of the Art - Background

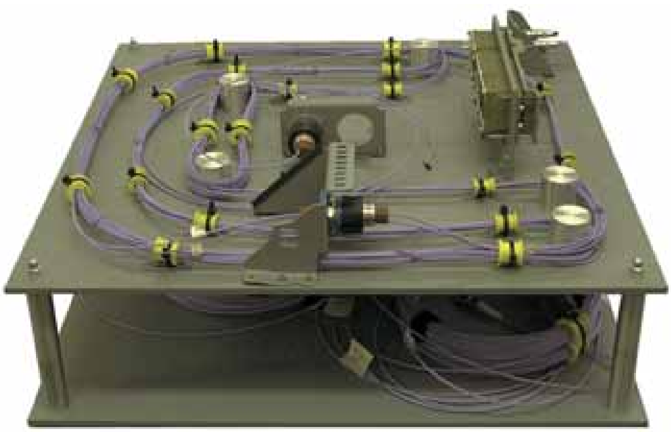
Modern aircraft are considered to be a paradigm of technological achievement. In practice, the long design time associated with the development of new aircraft means that systems employed on a new airframe are often several years behind the true state of the art. This is particularly true of rapidly evolving technologies such as computer hardware or communication systems. This technology lag is further compounded by stringent safety and certification requirements which favour an adaptation of existing system solutions rather than a step change in technology.

The dramatic advance in the use of fibre optics in terrestrial communication and datacom systems in the last 20 years has resulted in networks which outperform even the latest aircraft equivalents by orders of magnitude in terms of speed, channel count, modularity, flexibility and packaging miniaturisation.

The primary objective of DAPHNE is to enable the exploitation of key terrestrial optical networking technology, with its associated performance advantages, in future European aircraft and systems. The project will adopt key components and network technology from commercial markets, and develop and validate future aircraft networks to take European aircraft systems capability well beyond the current state of the art and make them suitable as a platform for future development.

Objectives

Aircraft data networks have increased dramatically in complexity and functionality throughout the history of powered flight. Modern networks support a large number of nodes with a wide range of span lengths, bandwidths and protocols. Existing systems, based on copper conductors, have become more complex, larger, heavier and more expensive, and this trend is set to continue. A coordinated step change to fibre-optic technology would reduce size, weight and cost, and improve the modularity, flexibility and scalability of the network. Moreover, fibre optics brings other implicit advantages including EMC immunity and improved security.



The boom in photonic technologies for terrestrial telecoms markets has provided a rich source of techniques and components, which may be adapted for aerospace environments. However, research and development work is required to bring the advantages of photonic networks to aircraft systems.

The DAPHNE consortium has identified cabin systems as the most immediate application area for implementing photonic networks. Here the need for high flexibility, re-configurability, high bandwidths (driven primarily by information-to-the-seat), large number of nodes, and the increased use of composite fuselage structures mean that the technology and business case for photonic networks is compelling.

Description of Work

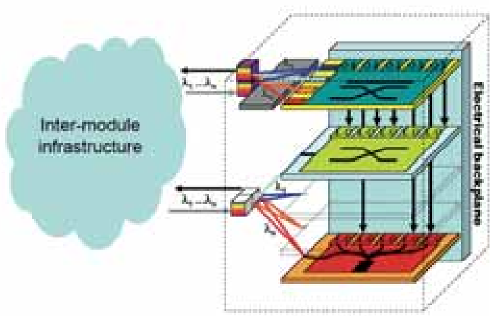
The DAPHNE work plan is split into key tasks as follows:

- Existing and future aircraft network requirements will be studied to establish the frame of reference for the project.
- System integration concepts will be developed and architectures analysed and modelled, considering aircraft-level communications as a whole, with appropriate network layouts for generic airframes. Network modelling will assess the performance of the integrated systems and model practical network performance.
- Network hardware will be developed, prototype components and harnesses will be built and tested. Network modules will be constructed, and mock-up aircraft equipment prepared for integration.
- Components and modules will be integrated into realistic aircraft network systems. The prototype modules will be integrated into aircraft network mock-ups to represent different aircraft types and system applications.
- Extensive system testing will validate the compatibility of individual components and systems, including quantified data transmission across the integrated network physical layer(s) and critical system safety testing.
- Dissemination and standardisation of the results is essential to ensure widespread uptake of the project results. DAPHNE will disseminate the project aims and results to the aircraft industry, as well as actively pursue the standardisation of the technology developments.

Expected Results

The key outputs from the project include:

- Quantitative network analysis and modelling of the physical layer to optimise the efficiency of the networks in terms of physical characteristics, optical performance and network functionality as well as reliability, availability and maintainability.
- Active and passive components optimised for aircraft environments. The problems of encapsulation and in-harness mounting, maintenance and repair considerations will be addressed, including the self-testing of active components and EMC/lightning survivability.
- Aircraft electronic LRU housings, designed to take into account the small footprint of photonics devices, component mounting and the effect on the environment into which they will be installed
- Physical environmental testing will capture commonly recognised fault-causing mechanisms based on real observed instances from current generation fibre-optic installations on fixed and rotary wing airframes.



Acronym:	DAPHNE	
Name of proposal:	Developing Aircraft Photonic Networks	
Grant Agreement:	233709	
Instrument:	CP – FP	
Total cost:	6 730 852 €	
EU contribution:	3 956 791 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.09.2009	
Ending date:	31.08.2012	
Duration:	36 months	
Technical domain:	Systems and Equipment	
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	Westland Helicopters Ltd	UK
	Galileo Avionica S.p.A.	IT
	Gooch & Housego (Torquay) Ltd	UK
	D-Lightsys S.A.S.	FR
	W.L. Gore and Associates GmbH	DE
	SQS Vláknova Aptika AS	CZ
	Instituto de Engenharia de Sistemas e Computadores do Porto	PT
	Technische Universität Ilmenau	DE
	Technical University of Denmark	DK
	Skysoft Portugal, Software e Tecnologias de Informação, S. A.	PT

SANDRA
Seamless Aeronautical Networking through integration of Data links, Radios and Antennas

State of the Art - Background

Air traffic in Europe is expected to double by 2025 according to the Eurocontrol's last forecast, with an average growth of 2.7%-3.7% per year. On a worldwide basis, the number of passengers is expected to grow by 4.5% per year over the same timeframe. Future passenger and freight fleets will bring better efficiency and improved environmental performance, and will allow people all around the world to benefit from the essential connections that only air transport can deliver. In this context, an integrated aircraft communication system is of paramount importance to improve efficiency and cost-effectiveness by ensuring a high degree of flexibility, scalability, modularity and reconfigurability.

Objectives

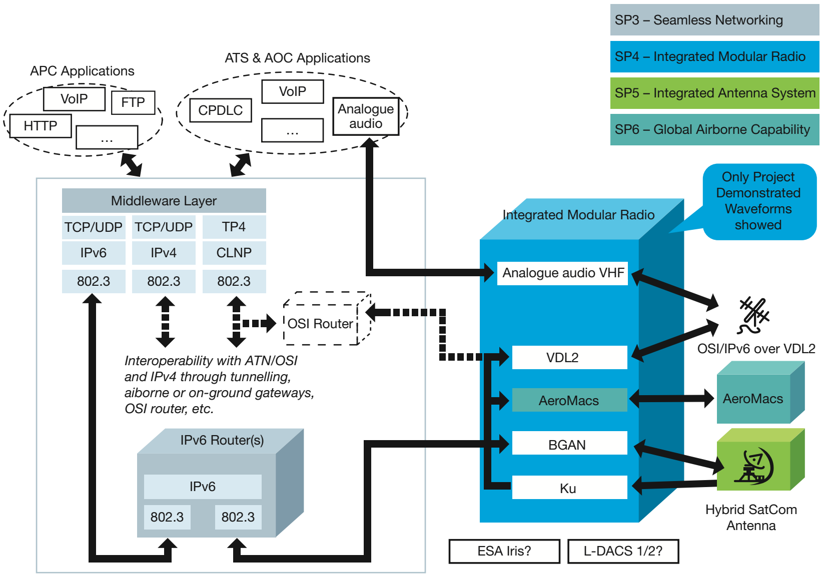
SANDRA will develop and validate an architecture based on the innovative concept that the normal state of operation for the aircraft shall be to have multiple data or voice links simultaneously active. These links will be available based on the geographical location and on the particular subset of communication systems deployed on board, which may vary from aircraft to aircraft. No single service provider exists for all link types on a worldwide basis, thus on a typical flight around the globe the aircraft may utilize several link types provided by different providers to implement a large variety of services.

Following the SANDRA vision, data communication and digital voice links between the aircraft and ground stations or service providers will be shared between the various applicative domains through a fully IP-based network. So all links will carry IP packets, and the avionic radios' structure and functions will be developed to better handle IP packet-based communications. In addition in the SANDRA radio system each single radio element could be independently reconfigured to operate a specific radio link as required. This will reduce the number of radio sets carried considerably, and the number of types of radio will be reduced to just the one reconfigurable type, simplifying spares and maintenance operations.

Description of Work

The SANDRA project will design, implement and validate through in-flight trials an integrated aeronautical communications system based on an open architecture, a common set of interfaces and well-proven industry standards. Integration will be addressed at four different levels, namely:

- integration at service level, supporting a full range of services such as airline operations, cabin crew operations, in-flight and on-ground passenger services, airport operations, security services and air traffic management-related operations through a Service Oriented architectural approach;
- integration at network level having an IPv6 aeronautical network as final unification point, but addressing interoperability with network technologies such as ACARS and ATN/OSI, to ensure a realistic transition from the current procedures to the new system
- integration of several existing radio technologies into an Integrated Modular Radio (IMR) platform, allowing to dramatically reduce the size, weight, and cost in avionics with respect to current radio systems implemented as standalone equipments. The modular approach will additionally ensure the possibility to dynamically reconfigure each radio element to operate a specific type of radio link;
- integration at antenna and RF level by means of a very low profile satellite antenna



SANDRA Architectural Sketch

prototype allowing the provision of reliable, low maintenance, broadband connectivity, especially meant for bandwidth demanding passenger and cabin applications;
- WiMAX adaptation for integrated multi-domain airport connectivity.

Expected Results

The integration of different service domains with very heterogeneous requirements through a cost-effective and flexible avionic architecture is one of the main challenges addressed by SANDRA. In this light, the SANDRA communication system will represent a key enabler for the global provision of distributed services for Common Decision Making based on the System Wide Information Management concept, and for meeting the high market demand for broadband passenger and enhanced cabin communication services.

Last but not least, the SANDRA concept is completely in line with SESAR activities and future plans for the deployment of European Air Traffic Management modernisation programme as well as with the final conclusions and recommendations of Eurocontrol/FAA Future Communications Study. In particular, SANDRA addresses many of the enablers identified by SESAR for the medium and long term implementation packages, although the proposed integrated approach for the global provision of distributed services covers a broader set of applications and service domains.

Acronym:	SANDRA
Name of proposal:	Seamless Aeronautical Networking through integration of Data links, Radios and Antennas
Grant Agreement:	233679
Instrument:	CP – IP
Total cost:	23 988 398 €
EU contribution:	15 620 824 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.10.2009
Ending date:	30.09.2013
Duration:	48 months
Technical domain:	Systems and Equipment

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THALES Avionics SA	FR
Thales Research & Technology (UK) Ltd	UK
Airtel ATN Ltd.	IE
ACREO AB	SE
Alenia Aeronautica S.p.A.	IT
ALTYS Technologies S.A.R.L.	FR
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European Aeronautic Defence and Space Company EADS France	FR
GateHouse A/S	DK
IMST GmbH	DE
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Institut National de Recherche en Informatique et Automatique	FR
LioniX BV	NL

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TriaGnoSys GmbH	DE
University of Twente	NL
University of Pisa - Department of Information Engineering	IT
Paris Lodron Universität Salzburg	AT
Ernst & Young	IT

TAUPE
Transmission in Aircraft on Unique Path wirEs

State of the Art - Background

This project aims at simplifying the electrical architectures of the aircraft and reducing the length and mass of the cables installed by introducing PowerLine Communication (PLC) or Power over Data (PoD) technologies inside the aircraft. Both technologies aim at supplying power and data on the same cable.

Objectives

The main objective is to provide a fully optimised avionic architecture for power and data transmission (mixing aircraft power and communication networks) that will demonstrate, on System Integration Benches (SIB), the feasibility of transmitting power and data on unique path wires.

The TAUPE avionic architecture will provide the same required functionalities as the current applications without jeopardising the overall safety and without adding complexity to the system design.

From the resulting TAUPE fully optimised avionic architectures, which mix electrical and communication networks, the project will also deliver specifications for harness wiring and network equipments, and requirements for systems qualification that will allow easy and secured power and data transmission on unique path wires.

TAUPE is targeting Technological Readiness Level (TRL) 4: component and breadboard validation in a laboratory environment, where the basic technological components (optimised Chipsets, adapted repeater, customised modems, wiring network and specific bridges) are integrated in SIBs to demonstrate that the components and the breadboard are working together for specific reference applications.

Description of Work

The approach is to respond to the following three challenges:
- aircraft environment;
- functional and safety requirements;
- transmission.

The proof of concept will be carried out on two reference applications which are representative of the different transmission configurations:

1. the Cockpit Display System (CDS), from Thales Avionics, an avionic application considered as safety critical for future aircraft;
2. the Cabin Lighting System (CLS), from Diehl Aerospace, a core application targeting high-speed transmission for future aircraft.

Two complementary technologies will be implemented:
- the Power over Data (PoD) technology;
- the Power Line Communication (PLC) technology.

These technologies have proven their efficiency and reliability in the transmission of power and data on the same cable for surface transport and domestic applications.

Two SIBs will be used for validation of the electrical power quality, communication signal and functional communication (protocols):
- the Cabin Mock-Up (provided by EADS Deutschland);
- the Copper Bird (provided by Hispano-Suiza).

Expected Results

The TAUPE results will show:

- a systems weight reduction with a ratio of between 2 and 4 for the same functionalities (300 kg approx. saved on the A320), and an impact on fuel consumption and CO_2 and NO_x emissions with around 180 tonnes of fuel saved per day for the current A320 fleet;
- a simplification of the cabling maintenance (only one harness to maintain) resulting in an impact on security, cost and time with 20% of maintenance time saved (and a 40% reduction in maintenance costs) on the A320;
- a simplification of the cabling system with 50% less cables deployed compared to the reference applications, resulting in an impact on space allocation for cabling, cost, complexity and a reduction of delay in assembly lines;
- a cost-effective retrofit which will allow current airline fleets to implement new functionalities easily, thus saving 30% of retrofit time for the A320 (60% of retrofit costs saved).

To guarantee the full exploitation of results, the TAUPE assessment and validation will take into consideration the following:

- safety (design robustness able to meet certification requirements);
- industrialisation and the related costs;
- portability to other applications;
- a contribution to the definition of electric and telecommunication standards.

Acronym:	TAUPE
Name of proposal:	Transmission in Aircraft on Unique Path wirEs
Grant Agreement:	213645
Instrument:	CP – FP
Total cost:	5 665 170 €
EU contribution:	3 630 186 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.09.2008
Ending date:	31.08.2011
Duration:	36 months
Technical domain:	Systems and Equipment
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Partners:	Airbus France SAS	FR
	ARTTIC	FR
	Ascom (Schweiz) AG	CH
	Diehl Aerospace GmbH	DE
	Diseño de Sistemas en Silicio S.A.	ES
	EADS Deutschland GmbH	DE
	EKIS Romania SRL	RO
	Ecole Polytechnique Fédérale de Lausanne	CH
	Haute Ecole d'Ingénierie et de Gestion de Vaud	CH
	Hispano-Suiza SA	FR
	Hortec BV	NL
	Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	Office National d'Études et de Recherche Aérospatiales	FR
	Thales Avionics SA	FR
	Université des Sciences et Technologies de Lille - IEMN Groupe TELICE	FR
	University of Science of Central Switzerland, Lucerne School of Engineering and Architecture	CH

ACCENT
Adaptive Control of Manufacturing Processes for a New Generation of Jet Engine Components

State of the Art - Background

The manufacture of safety-critical rotating components in modern aero engines is by nature very conservative. To achieve the required engine performance, thermal and mechanical stresses are pushed to the maximum, which in turn leaves the choice of materials with exotic super alloys. These materials are classed as difficult to machine under normal circumstances, but when added to the changes in mechanical properties, machining processes can never be fully optimised. Stringent legislative controls are placed on safety critical component manufacture to ensure that parts entering service will function correctly and safely to a declared service life, and in declaring the service life for such a part, the machinability issues stated above have to be taken into consideration. Hence manufacturing process parameters are often reduced or tools are changed early to ensure part surface integrity. The industry method adopted is to then 'freeze' the process following process qualification, first article inspection, and successful part validation via laboratory examination and testing. Once frozen, no changes to process parameters are permitted without time-consuming and costly re-validation. Validation of new manufacturing methods (or even an adaptation of an existing method) can easily exceed a timeframe of two to four years.

Objectives

ACCENT will allow the European aero-engine manufacturers to improve their competitiveness by applying adaptive control techniques to the manufacture of their components. Being able to adapt the machining process to the constantly changing tool and component conditions whilst operating in a multi-dimensional 'approved process window', processes will be optimised to the prevailing conditions and no longer 'frozen'. Benefits will be seen in terms of reduced part manufacturing process time, more consistent part quality in terms of geometry, surface and sub-surface properties, tool usage optimisation, the elimination of costly part re-validation due to small process changes, and the possibility to improve component design due to optimised machined surfaces. Anticipated cost savings could be 40%.

Description of Work

The project is divided into five work packages (WP).

WP1: project management.

WP2: ensures that a standard procedure is generated to define multi-dimensional parameter windows for the machining process and material combinations. The outcome will be a specification which defines how a machining process has to be established and controlled in order to satisfy a defined surface integrity level.

WP3: is focused on developing the Standard Procedure for Adaptive Control. The work package will deliver an understanding of how to use process monitoring systems in a closed-loop adaptive control system that keeps the process within a defined process window.

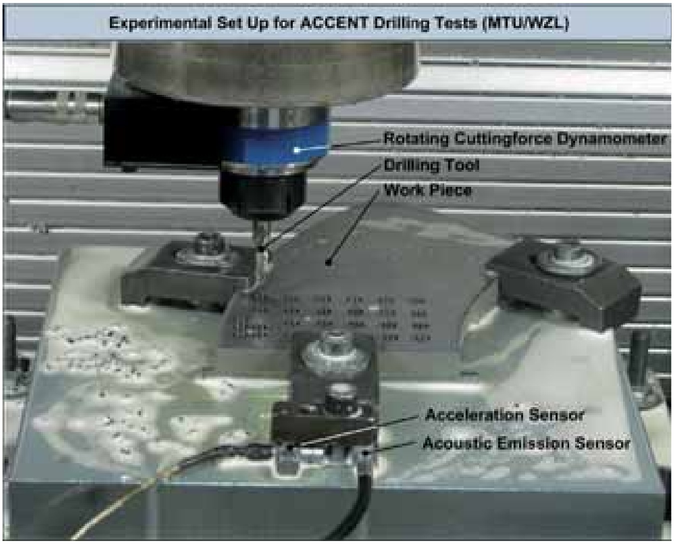
WP4: will bring together those elements that have a direct effect on the component performance in terms of life and fitness for purpose. The interaction between the surface integrity generated as a result of the machining process parameters, cutting tool and machine tool condition, material characteristics, etc. will be investigated and understood.

WP5: exploitation and dissemination.

The knowledge gained here will allow the design function to understand the effect of machining processes on part quality and subsequent component service, and thus allow the component design to be optimised. With the new validation procedure, new demands will be placed on storage and retrieval of related data.

Expected Results

For the manufacture of critical aero-engine components, ACCENT will develop a standard procedure for defining process parameter windows and develop methods whereby components manufactured within these process parameter windows are validated to meet the demands of design and surface integrity requirements. It will provide a new manufacturing methodology that will allow significant reduction in recurring validation costs and develop a novel standard procedure for adaptive control based on process monitoring techniques. It will take account of factors responsible for producing variable part quality and provide aero-engine manufacturers with a methodology that can be adapted to individual company procedures, thus allowing the design and manufacture of critical components to be optimised. As the majority of Europe's aero-engine companies are project partners, increased contacts will lead to new collaboration opportunities and consolidation of the aero-engine sector in Europe. ACCENT will involve world-leading experts from both universities and companies in Europe, thus helping to increase the synergy between academia and industry, and help to secure a supply of highly skilled young aero-engine engineers in Europe.



Acronym:	ACCENT	
Name of proposal:	Adaptive Control of Manufacturing Processes for a New Generation of Jet Engine Components	
Grant Agreement:	213855	
Instrument:	CP – FP	
Total cost:	8 196 673 €	
EU contribution:	5 374 684 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.07.2008	
Ending date:	30.06.2011	
Duration:	36 months	
Technical domain:	Design Tools and Production	
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	Snecma	FR
	Volvo Aero Corporation	SE
	Industria de Turbo Propulsores, S.A.	ES
	Turbomeca	FR
	L'Ecole Nationale d'Ingénieurs de Tarbes	FR
	Société d'Études et de Recherches de l'ENSAM	FR
	Technical University of Kosice	SK
	Mondragon Goi Eskola Politeknikoa S. Coop.	ES
	Advanced Prototype Research	IT
	University of Naples	IT

ADMAP-GAS

Unconventional (Advanced) Manufacturing Processes for Gas-engine turbine components

State of the Art - Background

Due to a high increase in market demand for gas turbines in the aircraft industry, efficient manufacturing processes for turbine components are necessary. The need for individual and adapted product solutions calls for efficient, reliable and additional flexible manufacturing technologies. Today, the high temperature nickel/titanium alloy gas turbine rotors are produced by assembling disks and blades. Fir tree profiles connect both elements, resulting in a closed-form and space-saving assembly of the parts.

Broaching fir tree profiles is a very critical process during the manufacture of gas turbine parts. Although very high metal-removal rates in combination with high surface qualities and accuracies can be achieved, the broaching process wears tools, resulting in additional high maintenance costs. The time-consuming regrinding operations of the broaching tools also prevent continuous production. Furthermore, the broaching process is very inflexible regarding a change in the work-piece geometry.

New and promising alternative processes would be able to substitute this critical broaching process.

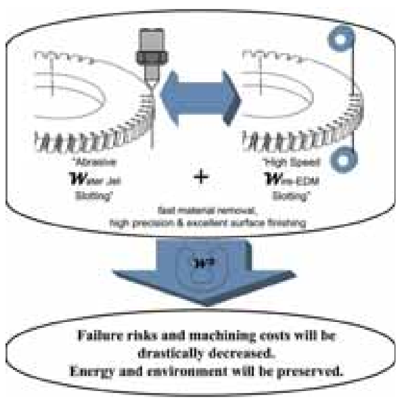
Objectives

The objective is to substitute the critical broaching process of fir tree structures in gas turbine blades and disks by the alternative processes of Water Jet Cutting (WJC) and High Speed Wire Electro Discharge Machining (High Speed Wire-EDM).

New developments and adaptations in generator technology and process control will allow a much higher cutting rate during Wire-EDM in combination with an almost damage-free rim zone. This High Speed Wire-EDM and Abrasive Water Jet Machining (AWJM) process will economically produce fir tree profiles for blades and disks in titanium- and nickel-based super alloys. These characteristics result in lower production costs and higher process reliability.

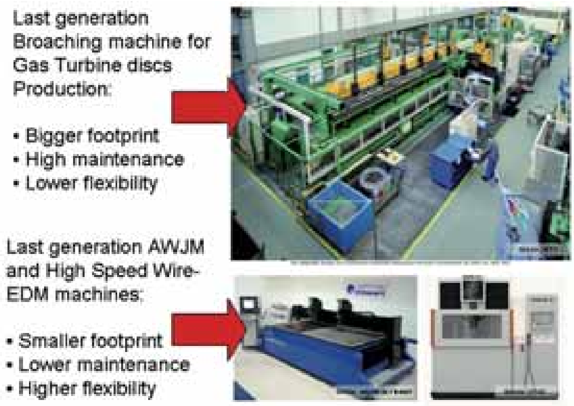
With proper data management that will be developed during this project, the machines can be programmed for different geometries by taking advantage of their CNC flexibility, using knowledge-based manufacturing technologies in which the properties of both processes can be used for the efficient, cheaper and environmentally safe production of gas turbine components.

The advantages of these investigations will be:
- lower tool manufacturing costs;
- lower maintenance costs due to less tool wear;
- a continuous production process;



Concept of ADMAP-Gas

Comparison between broaching and Wire-EDM + Water Jet



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- flexibility and efficiency when the work-piece geometry has to be changed;
- less machining space required;
- easily corrected process inaccuracies.

Description of Work

There are three main technical work packages (WP).

WP1 is mainly focused on the development of the Wire-EDM process to prove that it is able to produce fir tree structures with high profitability and precision. A faster cutting rate can be achieved with new generator technology, new wires, new dielectrics and flushing optimisation. This increased cutting rate will be tested for fir tree slotting and rough machining blisk structures. To generate a minimised heat-affected zone the process has to be run with low discharge energies. The used dielectric will also have an influence so different dielectrics and additives will be developed.

WP2 will focus on the water-jet machining process in order to evaluate the capability of substituting the broaching. This will be achieved through improved process control and tighter tolerances, via the development of new abrasives and carrier materials, and through a closed-loop control of the process allowing features and pockets to be created.

WP4 covers the development of the integrated process and data management system. Here the communication between different development steps will be realised in order to improve the efficiency of CAD/CAM data integration into the two main machining technologies described above.

Expected Results

The major deliverables of the project are:
- the development of modified machine tools and components, new wires, improved dielectrics and additives to optimise the process;
- the creation of new nozzles and machine set-ups and control algorithms for AWJM technologies;
- a comparison of AWJM with broaching and rough machining of blisks;
- an evaluation of both technologies and intelligent process combinations in comparison to existing process chains for manufacturing fire tree profiles;
- to test, demonstrate and verify the new integrated processes for manufacturing real gas engine components.

Acronym:	ADMAP-GAS
Name of proposal:	Unconventional (Advanced) Manufacturing Processes for Gas-engine turbine components
Grant Agreement:	234325
Instrument:	CP – FP
Total cost:	4 322 905 €
EU contribution:	2 883 657 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.08.0009
Duration:	36 months
Technical domain:	Design Tools and Production

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	AMRC (Manufacturing) Ltd	UK
	University of Sheffield	UK

COALESCE2

Cost Efficient Advanced Leading Edge Structure 2

State of the Art - Background

The European Aerospace industry has developed significantly over the past 30 years, with many of its businesses established and recognised worldwide as technical leaders in aerospace engineering and manufacturing. To maintain this position the industry has to continue to develop its technical know-how. The COALESCE2 Project is an industrial collaboration study of new technology and design integration applied to aircraft fixed leading edge structure. A typical short range aircraft will be used as the platform for the studies because this type of product cost efficiency has a much greater significance for both airline and aircraft manufacturers. The predominant research activity will be to explore how the application of newly matured material and process technologies can be used to create new innovative, leading design solutions that offer simplified manufacturing and assembly routes and allow easy access to systems installations housed within the structure. There is also a growing interest in exploring other flight control mechanisms, not just those most common today, to understand whether they would better enable step change in aircraft performance and cost targets to be met. COALESCE2 is incorporating this possibility in its studies through development of structural design concepts that would support alternative mechanisms.

Objectives

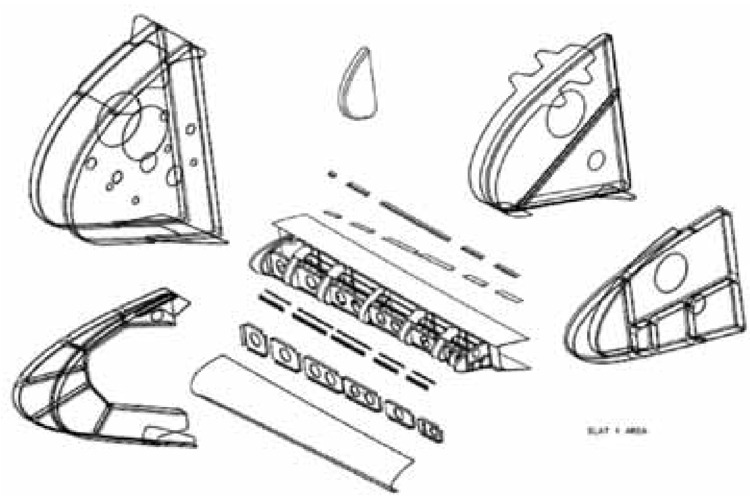
The primary aims are:
- To determine ways of achieving fixed, leading structural design that is over 30% more cost efficient than the highly fabricated structure that has been standard on aircraft for over 30 years;
- To examine and develop technology and integrated design options suitable for conventional and less conventional flight control mechanisms and show how they compare in enabling achievement of the challenging cost target;
- To demonstrate, through simulation, both the manufacturing/assembly process and the structural performance, showing the developed design and technology solutions meeting defined critical criteria. These will include the ability to both house, and have good access, to systems installations.

Description of Work

The project is subdivided into five operational working packages. WP1 will define the geometrical framework and minimum structural performance that must be reached by the concept developments and provide a definition of the criteria by which the technologies and design concepts will be evaluated. A cost assessment methodology will also be defined, to ensure a common approach is used throughout the project. In WP2 today's state-of-the-art leading edge structure will be reviewed and typical features will be selected for development. Manufacturing and assembly process studies will be carried out, including tooling lay-outs, and application to concepts will be evaluated. New materials and manufacturing process combinations will be studied. Executing mechanical tests will validate the performance of the structural details and joint assemblies. WP3 and WP4 will create innovative, low cost designs for a typical leading edge. The designs will be based on technology developed in WP2 and will be checked with reference to the criteria as created in WP1. WP3 will focus on configurations for a wing with a forward moving slat system and WP4 on alternative moveable configurations such as, for example, droop nose or Krueger flap. Tooling, manufacturing and assembly issues will be investigated to evaluate selected concepts and the associated production costs. WP5 will assess and evaluate the concept solutions from WP's 3 & 4 on the requirements specified in WP1 and determine the 'best' concepts to meet those requirements.

Expected Results

The metallic and composite technology developments performed and integrated into design solutions are not generic developments but are directed towards meeting the specified requirements that the primary European aircraft producers need to ensure future competitive products. Through these technological development activities, the partners will gain valuable knowledge about how the different technology options measure up against today's state-of-the-art options, understanding their relative strengths and weaknesses and how best to exploit them to create innovative, high-performing design solutions for fixed leading edge structures. This knowledge will be relevant not just to this project but may prove valuable in application to other Aerospace component developments. As most of the Partners have strong interests in the design and manufacture of aircraft components, this offers the potential for much wider exploitation opportunity beyond fixed leading edge structure.



One Part of Leading Edge area to be developed

Acronym:	COALESCE2
Name of proposal:	Cost Efficient Advanced Leading Edge Structure 2
Grant Agreement:	233766
Instrument:	CP – FP
Total cost:	4 797 477 €
EU contribution:	2 828 378 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.04.2009
Ending date:	31.03.2012
Duration:	36 months
Technical domain:	Design Tools and Production

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	Sonaca SA	BE
	Stork Fokker AESP B.V.	NL
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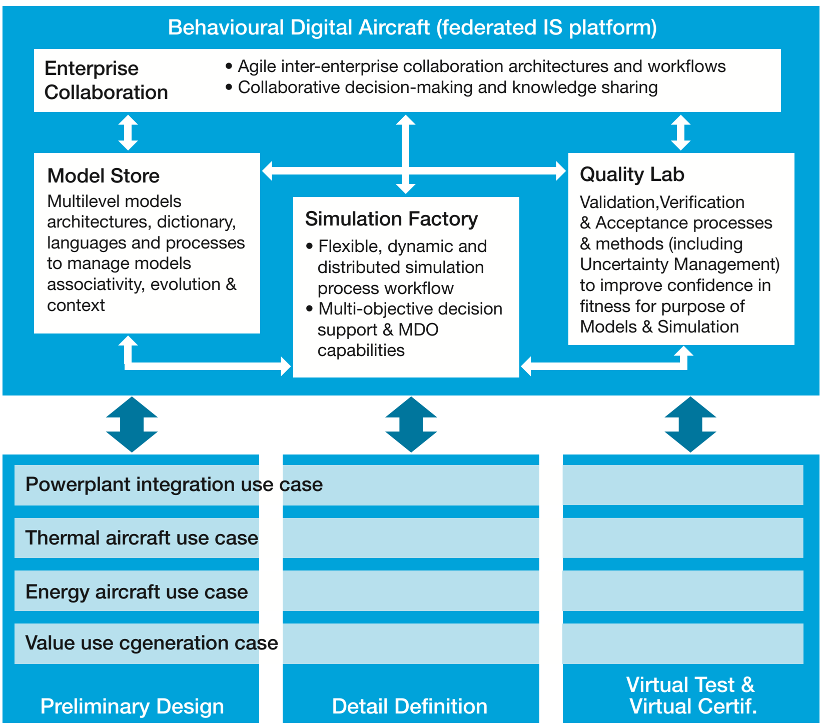
CRESCENDO

Collaborative and Robust Engineering using Simulation Capability Enabling Next Design Optimisation

State of the Art - Background

In today's context of strong competitiveness, European aircraft, engine and equipment manufacturers are facing greater challenges than ever before. The market demands that more complex products be developed with shorter lead times and more cost effectiveness, while using evolving business models involving multiple partners. Compared to past methods of development, an order of magnitude of complexity has been reached which cannot be tackled only by improving existing practices. The modelling, simulation and virtuality to be developed in next research programmes address the following benefits:

- Improving maturity at Entry Into Service by simulating the business process in the early phases in order to limit surprises such as necessary reworks and delays and, in the



development phase, to allow faster integration of functional evolution and faster and less expensive 'make and test';
- Improving engineering efficiency and agility through the capacity to reconfigure and redefine products with a high level of functional complexity on the spot according to customer requirements;
- Better translation of customer expectations through upstream assessment of technical feasibility using a simulation approach; explicitly link customer needs and technical requirements; take into account market evolution, changing requirements from the client regarding cost, size, user services or airport constraints.

Objectives

CRESCENDO will develop the foundations for the Behavioural Digital Aircraft (BDA), taking experience and results from VIVACE, integrating these into a federative system and building the BDA on top of them. The BDA is the missing capability which will enable the use of simulation throughout the development life cycle at aircraft level and within the entire supply chain. It will describe and host the set of simulation models and processes enabling its users to link, federate, couple and interact with different models with seamless interoperatibility, hierarchical, cross-functional and contextual associativity. The main components of the BDA are: the Model Store, the Simulation Factory, the Quality Laboratory, and the Enterprise Collaboration Capabilities. It will be validated through four use cases and 20 test cases concerning 'Power Plant Integration', 'Energy Aircraft', 'Thermal Aircraft' and 'Value Generation'. The validation will consider design problems and viewpoints during the preliminary design, detailed design, test and certification phases of a generic aircraft product life-cycle. The BDA will become the new backbone for the simulation world, just as the Digital Mock-up (DMU) is today for the Product Life-cycle Management (PLM) world. CRESCENDO brings together 59 partners from industry, research institutes, universities and technology providers.

Description of Work

The technical work plan is broken down into five sub-projects:
- SP1 - Overall Technical Management and Integration ensures the technical coherency and convergence towards the High Level Objectives and provides the rythm of the project. It is the 'architect and integrator', since it ensures the consistency between the business aspects, participates in the validation plan, and is responsible for the Mastered BDA (MBDA) which comprises the BDA system. This is populated (or instantiated) with the complete range of models and simulations that represent the behavioural, functional and operational aspects of the whole aircraft and constituent systems.
- SP2, SP3 and SP4 - Preliminary Design, Detailed Definition, and Virtual Testing & Virtual Certification - each cover the specific phases of a typical product design cycle, from preliminary design to entry into service. Their roles are to define the context and develop the models, simulations and processes needed by the test cases, when they do not already exist. They define the requirements for the SP5 capabilities with respect to their test cases and more common requirements seen within their SPs. These will be used to validate the MBDA.
- SP5 - BDA Enabling Capabilities develops all the capabilities required to build the BDA. The perimeter extends from generic services to the implementation of a demonstration platform for the test cases.

The work implementation builds on an iterative process: Year 1 - Proof of Concept, Year 2 - Prototype, Year 3 - Validation. Within each iteration phase, a sequence of six basic steps is performed to complete the loop of requirements definition, development and validation to the required completion and maturity.

Expected Results

The CRESCENDO project addresses the Vision 2020 objectives for the aeronautical industry's Strategic Research Agenda.

CRESCENDO will contribute to achieving a 10% reduction of development lifecycle duration and cost, 50% reduction in rework, and finally, 20% reduction in the cost of physical tests.

It will deliver the BDA a new development paradigm to support the design of a complete virtual aircraft up to certification. This is considered a challenging area for research and innovation for the next decade. Hence, the CRESCENDO results will provide the aeronautics supply chain with the means to realistically manage and mature the virtual product in the extended/virtual enterprise with all of the requested functionality and components in each phase of the product engineering life cycle. CRESCENDO will make its approach available to the aeronautics supply chain via existing networks, information dissemination, training and technology transfer actions.

Acronym:	CRESCENDO	
Name of proposal:	Collaborative and Robust Engineering using Simulation Capability Enabling Next Design Optimisation	
Grant Agreement:	234344	
Instrument:	CP – IP	
Total cost:	55 294 805 €	
EU contribution:	32 483 499 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.05.2009	
Ending date:	30.04.2012	
Duration:	36 months	
Technical domain:	Design Tools and Production	
Website:	http://www.crescendo-fp7.eu	
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	Aircelle S.A.	FR
	ALENIA Aeronautica S.p.A.	IT
	ALTRAN Technologies SA	FR
	ANSYS France SAS	FR
	ARTTIC	FR

Associazione Esoce Net	IT
AVIO S.p.A.	IT
Brandenburgische Technische Universitat Cottbus	DE
CERFACS	FR
Centre Internacional de Mètodes Numèrics en Enginyeria	ES
Cranfield University	UK
Dassault Systemes SA	FR
Deutsches Zentrum fuer Luft- und Raumfahrt e.V.	DE
Empresarios Agrupados Internacional S.A.	ES
Eurocopter SAS	FR
EADS France SAS	FR
Eurostep AB	SE
FLUOREM	FR
Free Field Technologies SA	BE
Fujitsu Systems (Europe) Ltd	UK
INSA Toulouse	FR
International Research Institute for Advanced Systems	RU
INTESPACE	FR
iSIGHT Software SARL	FR
Israel Aerospace Industries	IL
Linköpings Universitet	SE
LMS Imagine SA	FR
Luleå Tekniska Universitet	SE
MSC Software GmbH	DE
MTU Aero Engines GmbH	DE
National Technical University of Athens	GR
Office National d'Études et de Recherches Aérospatiales	FR
PARAGON LTD	GR
Politecnico di Torino	IT
Pyramis	FR
Queen's University Belfast	UK
Rolls-Royce Deutschland Ltd & Co KG	DE
Rolls-Royce plc	UK
SAAB Aktiebolag	SE
SAMTECH s.a.	BE
Università del Salento	IT
Short Brothers Plc	UK
Siemens Product Lifecycle Management Software (FR) SAS	FR
Snecma	FR
University of Southampton	UK

Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
Thales Avionics SA	FR
Transcendata Europe Ltd	UK
Turbomeca SA	FR
UNINOVA - Instituto de Desenvolvimento de Novas Tecnologias.	PT
The Chancellor, Masters and Scholars of the University of Cambridge	UK
University of Limerick	IE
VINCI Consulting	FR
Volvo Aero Corporation	SE

EXTICE
EXTreme ICing Environment

State of the Art - Background

Recent aircraft incidents and accidents have highlighted the existence of icing cloud characteristics beyond the actual certification envelope currently defined by the JAR/FAR Appendix C, which accounts for an icing envelope characterised by water droplet diameters up to 50 µm (so-called cloud droplets). The main concern is the presence of super-cooled large droplets (SLD) such as freezing drizzle, in the range of 40-400 µm, or freezing rain, with droplet diameters beyond 400 µm. The presence of SLD was also confirmed in Europe by the European funded project EURICE. The main results raised within the EURICE project was that, while the existence of SLD has been proved, means of compliance and engineering tools to accurately simulate these conditions are lacking and existing measures must be improved and/or new techniques developed.

International airworthiness authorities, namely the Federal Aviation Administration (FAA), Transport Canada (TC), and the European Aviation Safety Agency (EASA) are intending to jointly develop and issue updated regulations for certification in SLD: 'Appendix X'.

If implemented, the proposed new rules will require aircraft manufacturers to demonstrate that their product can safely operate in SLD environments. To do so, they will be requested to demonstrate that specific capabilities comply with the new regulation.

Objectives

At the present time, certification authorities rely primarily on flight-test data for icing certification. Unfortunately flight tests in icing conditions are costly and difficult to achieve. If standard icing conditions are not easy to meet during an icing flight campaign, flight tests in extreme icing conditions, such as Super Cooled Droplet (SLD) conditions are still more troublesome. Advantages over the present situation could be achieved by performing part of the certification process through a combination of wind-tunnel testing and numerical simulation; however these approaches must be proven reliable and trustworthy. Indeed, to cover the SLD envelope, there exists a need to extend and improve existing wind-tunnel techniques and numerical simulation tools.

The objectives of this proposal are twofold:
- to reduce aircraft development cost by improving tools and methods for aircraft design and certification in an icing environment;
- to improve safety by providing more reliable icing simulation tools.

Description of Work

Compliance has typically involved actual flights into natural icing conditions, as well as the use of engineering simulations of the natural environment provided by experimental means, icing tunnels and tankers, and analytical methods, namely ice prediction computer codes.

In an effort to improve the reliability of simulations and to prove their accuracy, the methodology chosen here is one integrating basic experiments, wind-tunnel testing and flight testing.

The basic experiments are planned to improve the knowledge of SLD physics. Results from these experiments can be used to define a single SLD droplet basic mathematical model that can be implemented in ice accretion numerical simulation tools. Icing wind-tunnel tests on 'industrial components', such as a wing or an airfoil, will be necessary since they will be used both to validate and to improve numerical tools by identifying the best approach to be used for ice accretion simulation.

Finally, within the EXTICE project, it is planned to compare ice accretion obtained in an icing wind-tunnel test to icing accumulated on a specific test article installed on an aircraft flying in icing conditions. The comparison will be performed by using the same numerical code for the simulation of icing wind-tunnel tests and of in-flight icing, and performing a critical review of all the obtained results.

Expected Results

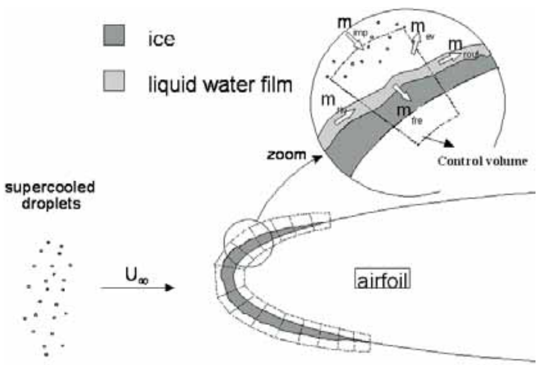
The expected top-level results will be a fundamental knowledge of the SLD ice accretion environment analysis and the development of European theoretical and experimental capabilities, the so-called engineering tools, to model accurately the SLD encounter effect on aircraft in order to comply with the new icing certification rules. At the same time a deeper knowledge of SLD impact on aircraft will be obtained and countermeasures from SLD conditions will be investigated.

Therefore the EXTICE project will contribute to AAT.2007.4.1.1 Design Systems and Tools by improving tools for aircraft design since the improved icing simulation tools developed within the EXTICE project will allow for a more effective design process by reducing required wind-tunnel and flight-test costs. The results will also have an impact on AAT.2007.3.3.2 System and Equipment as knowledge of accumulated ice shapes within the flight envelope will be increased and reliable tools for ice shape simulation will be developed within the EXTICE project.

Concluding the EXTICE project will allow:

a) a decrease in time and costs for aircraft design and certification;

b) an increase in aircraft safety by providing industries with more reliable icing simulation tools.



Acronym:	EXTICE
Name of proposal:	EXTreme ICing Environment
Grant Agreement:	211927
Instrument:	CP – FP
Total cost:	4 258 307 €
EU contribution:	3 000 000 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.06.2008
Ending date:	31.05.2011
Duration:	36 months
Technical domain:	Design Tools and Production
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	Cranfield University	UK
	Dassault Aviation SA	FR
	Technische Universität Darmstadt	DE
	Instituto Nacional De Tecnica Aeroespacial	ES
	Office National d'Études et de Recherches Aérospatiales	FR
	Piaggio Aero IndustriesI S.p.A.	IT
	Universita Degli Studi di Napoli Federico II	IT
	Universiteit Twente	NL
	Airbus España S.L.	ES
	Eurocopter SAS	FR

FFAST
Future Fast Aeroelastic Simulation Technologies

State of the Art - Background

Unsteady load calculations play an important role in the design and development of an aircraft, and have an impact upon the concept and detailed structural design, aerodynamic characteristics, weight, flight control system, performance, etc. They determine the most extreme stress levels and estimate fatigue damage and damage tolerance for a particular design. For this purpose, loads cases due to gusts and manoeuvres are applied to detailed structural models during the design phase.

The flight conditions and manoeuvres, which provide the largest aircraft loads, are not known a priori. Therefore, the aerodynamic and inertial forces are calculated at a large number of conditions to estimate the maximum loads that the aircraft will experience.

Wing configurations at different flight conditions

These analyses have to be repeated for every update of the aircraft structure. For modern civil aircraft, each of these loads calculation cycles requires more than 6 weeks. This, together with the multiple times this calculation procedure needs to take place, has a detrimental effect on cost and time to market. The number of critical loads cases raises two main points.

First, the replacement of the current low fidelity models with more accurate simulations is attractive because of the reduced tunnel testing costs and the decreased risk of design modification in the later phases, however the overall cost of the loads process must not increase.

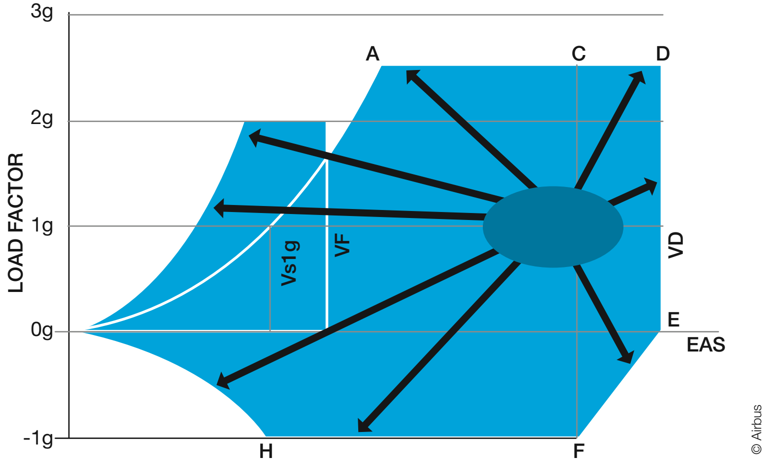
Secondly, the new aircraft that will be vital to meet 2020 performance targets is likely to possess critical loads cases very different from those found on conventional aircraft. Engineering experience, that is currently used to reduce the number of critical loads cases without compromising air safety, cannot be extended to novel configurations.

Objectives

To solve the requirements of faster turnaround time and increased accuracy in the loads process, FFAST will develop, implement and assess a range of numerical simulation technologies to accelerate the aircraft loads process.

FFAST will focus on three areas of research that have been identified as offering major reductions in the total analysis cost/time:

- Faster identification of critical loads cases: the minimization of the number of requested aeroelastic analyses to some key-points by formalising the process and reducing dependency on engineering judgement; this will allow non-conventional configurations to be evaluated at lower risk;



Expanding high fidelity modelling from cruise to critical loads cases

- The extraction of aerodynamic and aeroelastic reduced order models (ROMs), suitable for loads analysis, from complex full order models. Such models reproduce the dominant characteristics of higher fidelity models, but at a much reduced cost;

- Reduced order model acceleration of full-order models: full order simulations are currently too expensive for routine use, but reduced order models offer cost savings through convergence acceleration.

Success in each research theme may make a considerable individual contribution to the reduction of loads analysis cost. Improvements are multiplicative and the step change in analysis costs will only come about if there are simultaneous improvements in each of the three identified areas.

Description of Work

The work naturally splits into critical load identification, aerodynamic reduced order modelling, aeroelastic reduced order modelling and validation & assessment. The full benefit of improvements in each of these areas, to deliver a significant impact on future aircraft design, will only be achieved if they are fully integrated. The main subdivisions of the work are the development and assessment of the following:

- Methods for reducing the number of analyses needed to identify the critical loads cases for conventional aircraft;
- Methods for making critical load identification applicable to non-conventional aircraft;
- Aerodynamic reduced order modelling techniques at a single flight point;
- Hybrid aerodynamic reduced order modelling/full order modelling techniques;
- Strategies for global reduced order models for across-the-envelope simulation;
- Hybrid aeroelastic reduced order modelling/full order modelling techniques;
- Construction of reduced order models from a unified non-linear aeroelastic system;
- Global aeroelastic reduced order models for use in early design phase.

The final stage of the project will involve the validation and assessment of candidate technologies.

Expected Results

FFAST is an upstream university led project, and, as a result, the main outputs will be:
- new knowledge in the form of novel numerical simulation technologies and innovative approaches to the loads process;
- early release software;
- a solution database for unsteady loads cases, and

- recommendations in the form of written reports on a range of candidate technologies, that will guide future research investment.

The FFAST project will contribute to improving European industrial competitiveness by developing capabilities to design an aircraft concept that will have significantly lower fuel burn levels than today's best standards. Lowering aircraft fuel burn will result in reductions in CO_2 emissions that will go a significant way to meeting the ACARE 2020 vision targets. In order to meet these targets the aircraft design process must evolve rapidly to allow a number of concepts to be retained and assessed from top level definition through to high levels of maturity whilst also reducing lead times. New tools and technologies are required to enable this. In this context, FFAST will provide the foundation for a new approach in the key area of rapid critical load analysis, across a range of granularity and fidelity.

Acronym:	FFAST	
Name of proposal:	Future Fast Aeroelastic Simulation Technologies	
Grant Agreement:	233665	
Instrument:	CP – FP	
Total cost:	3 711 290 €	
EU contribution:	2 735 511 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.01.2010	
Ending date:	31.12.2012	
Duration:	36 months	
Technical domain:	Design Tools and Production	
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FLEXA
Advanced Flexible Automation Cell

State of the Art - Background

European industry is constantly under pressure to meet requirements on cost efficiency in competitiveness with the global manufacturing industry. The requirements on development in production are also from demands on new product introduction, new materials used and new regulations on environmental effects, dependent on production. At the same time, it is a fact that the products produced in the aeronautical industry are products produced with relatively low volume, which will be in operation for 30 years, some times even longer, before they go out of service. This puts strong emphasis on the equipment specification when doing new investment in the production units. The main task in this project is to create a balanced production unit that is able to deliver a multi-generation, multi-size and multi-product flow of components in the same production facility, using and prioritising between the same physical machines.

In the automotive sector automation technology has been developed for a long time. It is the intention of this project to utilise the state-of-the-art technology developed in the automotive area and to improve the aspect of flexibility, low volume, multi-product and quality assurance aspects.

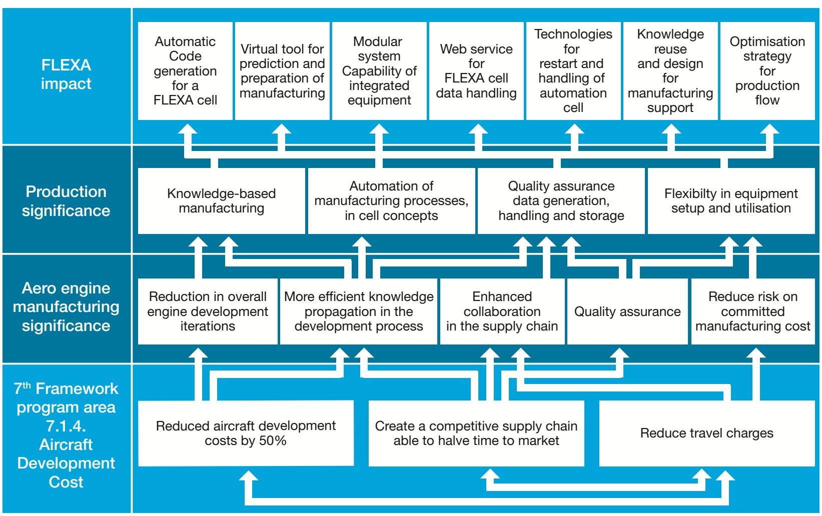
Objectives

The aim of the project is to integrate and improve knowledge from selected areas of manufacturing that will help to build the next generation platform for advanced flexible automation cells.

The FLEXA project is set up to meet one common main objective which is defined as:

To create the tools, methods and technologies needed to define, prepare and validate an automated flexible cell that can manufacture a generic process chain allowing for safe human interaction and deliver quality assured parts for the European aerospace industry.

FLEXA contribution to FP7 AREA: Aircraft Development Cost



The FLEXA project is defined with the intention of being independent of specific solutions available, but at the same time able to integrate state-of-the-art solutions into the infrastructure used at the industrial sites.

The specific technical objectives are:
- Develop flexible automation technology based on aero industry requirements;
- Integrate key manufacturing processes in automation concept;
- Develop virtual tools supporting cell preparation, operation and restart;
- Develop knowledge engineering tools supporting automated manufacturing;
- Integrate manufacturing knowledge in design activities;
- Develop intelligent data communication protocol for manufacturing;
- Develop a quality assurance strategy that meets aerospace requirements.

Description of Work

The project is divided into five technical work packages (WP):

WP1: The main objective of WP1 is to define the requirements of a flexible automated cell for the aero engine manufacturing industry. The work described within this WP will provide the definition and background for the other WPs.

WP2: The main objective here is to develop a novel and flexible reconfigurable hardware and software environment capable of supporting the automated processing and assembly of aero engine components.

WP3: The main objective of WP3 is to apply high-level description tools for automated cells, e.g. for welding and machining. This implies increased use of virtual manufacturing in the aerospace sector. The task therefore includes specific application-related demands to be interfaced to generic automation tools. The task develops a simulation-based environment to be able to simulate and verify a whole automated cell.

WP4: The main objective here is to verify and validate cell configurations and capability as an integrated solution of tools and methods developed in the project.

WP5: The main objective is to define, develop and deliver methods and tools that allow proactive handling of fatal behaviour of an automated cell, including preparation, human-machine interaction, training and data communication to cell main control for quality assurance and safe operation.

Expected Results

The project has 113 deliverables that will be produced during a four-year period, which are evenly split over the different work packages. The most important deliverables are:
- D1.25 Handbook for cell definition and best practice document;
- D3.24 Handbook for OLP (off-line programming) and QA (quality assurance);
- D4.25 Handbook of cell operation.

The project is expected to deliver both a direct and indirect impact on the goal of halving the time-to-market. In direct response this will be driven from the aero engine manufacturing industry group through implementation of knowledge in both ongoing production as well as in development programmes for the future. Indirectly, the impact of research publications, reports and the update of teaching materials for engineering education will provide the basis for knowledge implementation over a wide field, while also improving European industry competitiveness in general terms.

Acronym:	FLEXA	
Name of proposal:	Advanced Flexible Automation Cell	
Grant Agreement:	213734	
Instrument:	CP – FP	
Total cost:	8 196 673 €	
EU contribution:	5 374 684 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.06.2008	
Ending date:	31.05.2012	
Duration:	48 months	
Technical domain:	Design Tools and Production	
Website:	http://www.flexa-fp7.eu/	
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	MTU Aero Engines GmbH	DE
	BCT Steuerungs- und DV-Systeme GmbH	DE
	Skytek Ltd	IE
	Rolls Royce plc	UK
	University of Nottingham	UK
	Wytwornia Sprzetu Komunikacyjnego PZL - Rzeszow SA	PL
	Universita di Pisa	IT
	Zenon S.A. Robotics and Informatics	GR
	University of Sheffield	UK

INFUCOMP

Simulation Based Solutions for Industrial Manufacture of Large Infusion Composite Parts

State of the Art - Background

These days, advanced composites use either layers of plies impregnated with resin (prepregs) to form a laminate, or Liquid Composites Moulding (e.g. RTM) of dry textiles. Prepreg composites give superior mechanical properties due to toughened resins and high fibre content, but suffer from high material costs, limited shapeability, complex, expensive and time consuming manufacturing, as well as limited material shelf life. Infusion technologies can overcome these limitations, but are not fully industrialised and rely on costly prototype testing due to the lack of simulation tools. Current infusion simulation technologies are approximate and really only suited to small scale components based on adaptations of Resin Transfer Moulding simulation, they are not suited to large scale aerospace composites.

The INFUCOMP project will develop the simulation chain from preform design to manufacture (infusion), process/part optimisation, and final part defects/mechanical performance prediction. The project covers all popular Liquid Resin Infusion (LRI) methods currently used in the Aerospace industry. The proposed technologies will allow the economical manufacture of high performance, integrated, large scale composite structures, therefore contributing positively to their increased use. Benefits include lower cost, improved performance, greater payloads and fuel/emissions reductions.

Objectives

Project aims will be achieved through the 9 Work Packages (WPs):

WP1Project management, dissemination and exploitation.

WP2 Fabric deformation characterisation: Mechanical fabric testing will determine data for fabric deformation laws to be implemented in to the FE draping software.

WP3Viscosity and permeability characterisation: Resin viscosity testing on selected resins will enable new hydraulic and air permeability models to be developed and implemented in the LRI software.

WP4Preform tooling and assembly simulation: Important fabric deformations are imposed during preformance. Techniques to model this process step will be developed.

WP5Infusion simulation developments: Numerous new developments specific to thick, large scale, aerospace composites structures will be developed and validated.

WP6Cost analysis and cost optimisation: The various LRI manufacturing routes have different cost benefits: each will be investigated and cost models developed.

WP7Post-infusion defects prediction: Final part performance including residual stresses, distortions and void content will be studied experimentally and numerically.

WP8Process optimisation: Optimisation techniques (evolutionary/genetic) and sensitivity studies will be used to optimise the LRI manufacturing process.

WP9Industrial validation: Four diverse, industrially relevant LRI aircraft sub-structures will be investigated to critically evaluate and validate the new CAE tools.

Description of Work

Work package interaction(s):

1. WPs 2 and 3 perform fabric deformation and resin viscosity/permeability measure-

ments respectively. There is some interaction in these two WPs - deformed fabrics from WP2 will be used for permeability testing in WP3.

2. The mechanical data obtained from WP2 and WP3 is directly used to develop new fabric deformation models at the macro- and meso- scales (WP2) and for new permeability models for deformed fabrics (WP3), both of which are implemented into the new software.
3. WP4, WP6, WP7 and WP8 all develop necessary associated simulation technologies. In each case the developments are undertaken and then used for collaborative and validation studies with the end-users.
4. Final validation of the CAE tools and procedures is undertaken in WP9.

The testing work is largely undertaken in the first half of the project with measurement being immediately used to develop the new/improved numerical models. Most software developments are undertaken in two to three years, so that validation work can be performed as soon as possible. This is considered essential so that important feedback is available for possible improvements to the CAE tools.

The validation studies will focus on draping and preforming in year 2, and then move to infusion work in year 3 and mechanical performance/defects prediction in year 4.

Expected Results

INFUCOMP will build on existing simulation softwares to provide a full solution chain for LRI composites. The simulation tools will allow the CAE design of alternative manufacturing routes and enable cost effective, efficient LRI composite structures to be designed and manufactured. Specific developments include:

1. Improved drape simulation software for accurate knowledge of the deformed fabric architecture;
2. New modelling methods based on further development of the WiseTex software for fabric deformation and permeability prediction;
3. New methods to predict preform assembly and obtain initial infusion conditions;
4. Contributions to test standards include fabric deformation, resin viscosity and permeability testing;
5. Numerous enhancements to state-of-the-art resin infusion simulation are planned giving a simulation accuracy of 90%, allowing large scale 3D structures to be analysed;
6. Cost analyses developments will be integrated to the new development tools;
7. Chaining of the simulation stages and optimisation work will allow process optimisation and positively control final part mechanical performance;
8. For the first time simulation tools will be used throughout the full design process in a range of industrially relevant LRI structures.

Acronym:	INFUCOMP
Name of proposal:	Simulation Based Solutions for Industrial Manufacture of Large Infusion Composite Parts
Grant Agreement:	233926
Instrument:	CP – FP
Total cost:	5 157 994 €
EU contribution:	3 299 123 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.11.2009
Ending date:	31.10.2013
Duration:	48 months
Technical domain:	Design Tools and Production
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	Hexcel Reinforcements SAS	FR
	Katholieke Universiteit Leuven	BE
	University Of Patras	EL
	Swerea SICOMP AB	SE
	Short Brothers PLC	UK
	Israel Aerospace Industries Ltd.	IL
	INASCO - INtegrated Aerospace Sciences Corporation o.e.	EL
	Universität Stuttgart	DE
	Piaggio Aero Industries S.P.A.	IT

gIFEM
Generic Linking of Finite Element based Models

State of the Art - Background

Engineers need to conduct large-scale computational analysis of, for example, entire aircraft structures. One issue that arises during the modelling of such structures is the need to conduct a unified analysis of an assembly of individual structural models that are coupled and were developed independently. Typically, these individual models were created by different engineers at different geographical locations using different software, or they can be present due to local analysis of complex physical behaviour.

As a result these individual models are likely to be incompatible with interfaces. Therefore, it is very difficult to combine them for a unified analysis of the entire assembly. Global-Local Finite Element (FE) methods enable the joining of independently modelled substructures. In addition, these methods allow for a hierarchy of mesh refinements on components and the use of complex finite elements within generic finite element meshes.

Objectives

The strategic project objectives are to reduce aircraft development costs, reduce lead times, and establish a more competitive supply chain. This can be achieved by enabling companies within the aeronautical supply chain to seamlessly couple their analysis capabilities by solving analysis model interfacing. This advanced interfacing will enable companies in the supply chain to cooperate in new profitable ways providing a combination of adaptive accuracy, ease of use and tailored intellectual property protection.

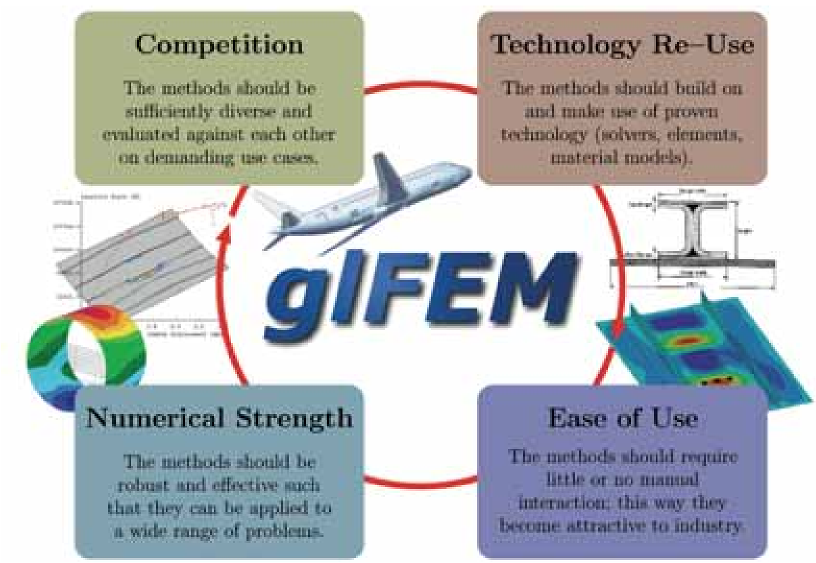

Figure 1 Focus areas of the gIFEM project.

The operational project goal is to derive innovative methods to couple finite element-based structural analysis models of different origin and modelling fidelity. Applying the coupling methods has to be generic, i.e. it comprises different local phenomena (e.g. multi-scale progressive damage), analysis capabilities (e.g. strength, stability), scales (entire aircraft versus detailed components), materials (composites, metals), and demands on accuracy and efficiency. Additionally, the coupling procedure is to be automatic, i.e. local models are automatically created and analysed where necessary, and the local-global coupling is automatically integrated within the (iterative) global FE analysis.

Subsequent to the development, the coupling approaches considered in this study will be applied to several use cases that are considered representative for industry. The goal is to find the best approach among the ones considered and to verify utilization by porting the best approach to a commercial driven code. The goals of this research are summarized in the Figure below.

Description of Work

The work plan is divided into one management and six technical work packages (WP).

WP0 is comprised of all activities related to the project and WPs coordination.

WP1 specifies the detailed functionalities that are required to meet the project objectives. In addition, the level of required accuracy and the metrics to assess project performance will be established.

WP2 explores the theory on coupling approaches, assesses and improves the theory to meet the project objectives.

WP3 implements coupling approaches within existing software environments. The code language will depend on project requirements stated in WP1. The class implementation will be ‘generic’, so that it will be easy to integrate with existing software code.

WP4 conducts benchmarks of software implementation. In addition, mathematical algorithms that are used within the research are validated.

WP5 benchmarks newly developed code via pre-determined test cases. In addition, these benchmarks show that the industrial need is properly addressed. The code is validated by comparing commercial driven code and research driven code.

WP6 is concerned with writing and publishing a book. This book will cover all the theory and results related to the coupling approaches studied for this project.

Expected Results

The research conducted in this study will provide companies within the aeronautical supply chain with advanced methods and computational tools to seamlessly couple their analysis capabilities via accurate analysis model interfacing. More specifically, the deliverables provide automatic coupling of finite element based structural analysis models of different origin and modeling fidelity where no interaction during initial model creation is present.

The developed theory will be implemented into commercial finite element code. In addition, benchmark problems are defined and means to execute and verify the developed approaches will be documented. Via publications at conferences and in scientific journals the developed theory and results will be made publicly available. In addition, a book will be published covering the research conducted and the results obtained during this study.

In the context of virtual testing, glFEM will expand the multi-scale coupling capabilities. Interaction of different models on different length scales will be clearly defined enabling an automatic coupling between local and global FE analyses. This automatic coupling includes iterative processes, forward/backward interactions as well as automatic generation of local models. The local models involve local effects that influence the global structural behavior (e.g. skin-stringer debonding or local material damage).

In summary, the novel contribution of glFEM is an explicit investigation and establishment of innovative and reliable coupling approaches, which are automatic, iterative, generically applicable and not limited to a one-shot or one-way solution.

Acronym:	glFEM	
Name of proposal:	Generic Linking of Finite Element based Models	
Grant Agreement:	234147	
Instrument:	CP – FP	
Total cost:	3 815 545 €	
EU contribution:	2 839 910 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.09.2009	
Ending date:	31.08.2012	
Duration:	36 months	
Technical domain:	Design Tools and Production	
Website:	http://www.nlr.nl	
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	Centro Italiano Ricerche Aerospaziali SCPA	IT
	Seconda Università degli Studi di Napoli	IT

AISHA II
Aircraft Integrated Structural Health Assessment II

State of the Art - Background

Today's aircraft inspection procedures are excellent, but too expensive and not appropriate for all situations. A cheaper alternative for damage detection is offered by 'structural health monitoring'(SHM). With such SHM systems, a permanent sensor network, comparable to the nervous system in a human body, is placed at crucial structural components of an aircraft. In this project, guided ultrasonic waves (Lamb waves) are used to detect different kinds of defects.

However, this apparently easy solution requires a quite complex research and implementation effort using well-coordinated collaborations of many disciplines and expertise in Europe. The European Research Area establishes the ideal platform for such a collaborative undertaking, and the considerable financial risks can be reduced by a substantial amount by appropriate funding from dedicated European research programmes.

During the last few years, a number of SHM solutions have been presented at laboratory scale, and even partially implemented in real aircraft parts. There is thus, in principle, enough experimental evidence that such systems are able to deliver all the required information. However, the final implementation is still in an early phase and is partially hindered by a number of obstacles (technical immaturity, lack of acceptance by end-users, etc.).

Objectives

It will not be possible within this project to present a large-scale integrated technical solution to overcome all the challenges related to structural health monitoring. However, the following strategies have been chosen to put the operating systems into practice.

It appears that the best strategy to overcome the above-mentioned obstacles is to develop a SHM system for selected, isolated problems which can easily be followed and validated by conventional methods. If this technique appears to be trustworthy, a broader field of application will be created.

AISHA II therefore intends to focus on hot-spot monitoring instead of large-area screening. From operational experiences it is known that defects usually occur at well-defined locations. There are thus isolated problems in maintenance where a simple SHM can give reasonable added value, without screening the whole aircraft.

Description of Work

This project will use a limited number of carefully selected ultrasonic Lamb wave modes in the detection process. Lamb mode selection, both active and passive, is, however, not an easy process. As one of the main innovative aspects, the principle of controlled Lamb wave selection will be used as the basis of an aircraft health monitoring system, both for active and passive Lamb wave testing. In practice, this will mean that the amount and type of Lamb wave modes to be used in the monitoring process will depend on the type of material and damage to be detected and will thus have to be controllable by the user. Other NDT technologies will also be applied, such as electrochemical monitoring and eddy current.

Other work includes:
- opening the initial phase with the establishment of detailed specification sheets where the different demands on damage detection are clearly defined. The respective full-scale part will be studied by the assigned NDT groups, the different aspects of feasibility explored and the final plan for SHM implementation developed;
- implementing the selected SHM systems will be carried out in close collaboration with

all partners. Using the transducer, hardware and software required, the approved concepts will be implemented following the detailed road map defined in the design phase;
- an extended test programme will be run to check all operational aspects.

Expected Results

The expected progress that the proposed project will bring with respect to the state of the art will be the following:

- A selection of very specific aircraft components (representing isolated 'hot spots') in collaboration with the aircraft operators and aircraft manufacturers. The expected cost savings from using SHM must be considerable;
- A systematic research on durable sensor connections ensured by collaborating with a specified research institute;
- If proved useful, the introduction of the pseudo-defect technique for automated validation. This enables a dramatic enhancement in the efficiency of the validation tests leading to a fine-tuning of data analysis techniques;
- The application of combined sensor groups (ultrasonic sensor + parametric sensors for temperature and strain), electrochemical monitoring and thermography. These techniques are beyond the application of ultrasonic Lamb waves, but they help to facilitate the interpretation of signal-damage relationships.

© Consortium AISHA II (Helge Pfeiffer)

AISHA II - Sensor network

Acronym:	AISHA II
Name of proposal:	Aircraft Integrated Structural Health Assessment II
Grant Agreement:	212912
Instrument:	CP – FP
Total cost:	5 694 302 €
EU contribution:	4 133 731 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.05.2008
Ending date:	30.04.2011
Duration:	36 months
Technical domain:	Maintenance and Disposal
Website:	http://sirius.mtm.kuleuven.be/AISHA-II
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	Eurocopter SAS	FR
	Rigas Technical University	LV
	Fundación Centro de Tecnologías Aeronáuticas	ES
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	ASCO Industries N.V.	BE
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	Universidad Del País Vasco / Euskal Herriko Unibertsitatea	ES
	Vrije Universiteit Brussel	BE
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FANTOM

Full-Field Advanced Non-Destructive Technique for Online Thermo-Mechanical Measurement on Aeronautical Structures

State of the Art - Background

Non-destructive testing (NDT) techniques allow for the detection of flaws in materials and structures or the measurement of behaviour of such components under given stress. These techniques are widely used in various applications such as development, production and maintenance.

Optical full-field NDT techniques are gaining in interest since there is no contact and they allow for observing a complete image, which is a faster process than the single-point measurement with scanning.

The best-known and used optical NDT technique in aeronautics is thermography.

Thermography, or thermal imaging, is a type of infrared imaging. Thermographic cameras detect radiation in the infrared range of the electromagnetic spectrum at approximately between 0.9 and 14 m. In NDT applications, like the assessment of materials, thermography can show differential thermal behaviours of defects located under their surface when the materials are illuminated by an infrared lamp which creates heat transfer through it.

The other range of optical NDT techniques is holographic techniques which allow full-field observation of micrometric deformations of objects undergoing stress. Different techniques exist, the best known being shearography, which is increasingly applied for flaw detection in aeronautical composites.

Objectives

Both thermography and holography have advantages and disadvantages. The main drawback of holography is its sensitivity to on-site perturbation, mainly due to the use of visible lasers with a short wavelength.

The FANTOM project proposes the development of an advanced NDT technique which combines thermography and holography/shearography. The development is based on a holography/shearography sensor with a usual optical set-up, but instead of working with lasers at visible light wavelengths, it will work in the spectral range of thermographic cameras, say at long-wave infrared-light wavelengths. This has the advantage of greatly reducing the sensitivity to external perturbation, while increasing the measurement range of the technique.

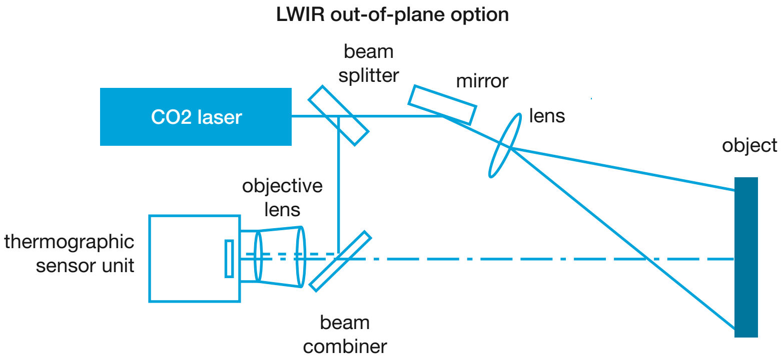
Additionally, the fact that the imaging system of holography in infrared is a thermographic camera allows one to envisage simultaneous capture of thermal and holographic information. This will lead to a unique sensor which will allow a substantial gain in inspection time compared to the situation where two such separate sensors are used.

Description of Work

There are three main innovations.

The first is the study and development of different holographic techniques in the long-wave infrared. Critical segments such as the infrared sensor will be improved in order to match specific requirements of holographic techniques. The techniques envisaged are electronic speckle-pattern interferometry, digital holography and shearography.

The second is the study of the decoupling between the holographic and thermographic information which will be captured simultaneously. This is required since it is not known



Principle of the ESPI out-of-plane option to be studied within FANTOM

how the use of lasers (necessary for holography) affects the thermal signature of the object.

Thirdly, based on the laboratory studies, a prototype will be built with improved segments and, after being validated in known study cases, will be validated in Airbus facilities (or other potential end-users).

Expected Results

The expected results are:

- Specifying the new technique based on state-of-the-art and end-user requirements;
- Conceptual designs of the instrument, including selection of critical components;
- Development studies of different holographic techniques, of improved optical segments and thermographic image sensors and camera modules;
- Study of thermal and holographic signatures decoupling;
- Development and certification of representative samples for lab evaluation;
- Build the prototype and carry out the evaluation in the lab with certified samples;
- Validating the prototype in structural testing at an Airbus plant (or other end-users).

Acronym:	FANTOM
Name of proposal:	Full-Field Advanced Non-Destructive Technique for Online Thermo-Mechanical Measurement on Aeronautical Structures
Grant Agreement:	213457
Instrument:	CP – FP
Total cost:	2 210 740 €
EU contribution:	1 700 080 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.12.2008
Ending date:	30.11.2011
Duration:	36 months
Technical domain:	Maintenance and Disposal
Website:	http://www.fantom-ndt.eu
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	Infratec	DE

IAPETUS

Innovative Repair of Aerospace Structures with Curing Optimisation and Life-cycle Monitoring Abilities

State of the Art - Background

The availability of efficient and cost-effective technologies to repair and extend the life of ageing airframes is becoming a critical requirement in most countries around the world. New aircraft incorporate new materials, processes and structural concepts which will shape the requirements for state-of-the-art repair techniques in the near future.

Bonded composite patches are ideal for aircraft structural repair as they offer enhanced specific properties, case-tailored performance and excellent corrosion resistance. Bonding also eliminates stress concentrations induced from mechanical fastening of metal sheets, seals the interface and reduces the risk of fretting fatigue between the patch and the component.

Adhesively bonded fibre composite patches still pose significant challenges, particularly when used to repair primary structures. With respect to the repair material system, existing composite material systems may be tailored to comply with the repair requirements. However, the introduction of novel material configurations is a challenge. Regarding the application of the composite patch repair, the aircraft industry is in dire need of reliable and cost-efficient in-the-field repair technologies that will facilitate patch application and will reduce depot service time for aircraft, contributing to a reduction of the overall operational cost.

Objectives

The main aim is to develop novel repair technologies and materials for metallic and composite aircrafts. This will be achieved with the use of novel hybrid composite systems, which offer the multi-functionality that will lead to the development of innovative repair technologies and life-cycle health monitoring capabilities, together with the enhancement of repair efficiency.

The scientific and technical objectives are to:

- address the problem of bonding composite patch repairs to ageing aluminium and new composite aero-structures by investigating new easy-to-apply heating-up concepts, either by direct resistance heating, using the conductive composite patch as a heating element, or by introducing induction heating technologies;
- develop innovative Carbon Nano Tubes (CNT)-doped conductive composite fibre patches which offer improved mechanical performance and provide built-in sensing capabilities;
- develop innovative conductive and non-conductive laminating resins and adhesives for achieving increased peeling and sheer strength of the patch/structure bond;
- develop a curing monitoring system compatible with the proposed processes and materials, which will be integrated within the composite patch and provide curing state data and thus a mean for optimal curing;
- demonstrate the developed materials and repair processes at coupon and component level.

Description of Work

The project has been organised into three technical sub-projects (SPs).

SP1: Developing the two novel curing methodologies (direct resistance and induction heating) and patch material improvement through the use of CNT additives. Solutions for galvanic corrosion will also be investigated and a curing monitoring system suitable for composite repairs and adapted to CNT-doped materials will be implemented. The proposed curing methodologies will be evaluated in terms of curing efficiency and patch bonding integrity.

SP2: Demonstrating the applicability of the smart patch concept based on the approach of electrical resistance measurements. The electrical resistance mapping performance for the detection of various types of damage in repaired aero-structures will be critically evaluated against typical ultrasonic inspection. A second Non Destructive Technique – flash thermography – will also be adopted.

SP3: Providing the framework to integrate the technologies of innovative curing, curing control and monitoring and the smart patch technologies. The technology integration will be made in small-scale components and validated through appropriate testing (quasi-static and dynamic/fatigue loading conditions). Then the integrated system will be validated in a suitable aeronautical structure. The envisaged construction will consist of thin (skin) and thick (web) components.

Expected Results

The major expected results of the project:

- Optimal CNT processing for the achievement of dispersion in the matrix, conductive properties of the adhesive layers and minimisation of galvanic effects in the case of aluminium substrate repair;
- The design and implementation of novel curing approaches based on the conductive properties of the materials using induction and resistance heating;
- The implementation and validation of novel offline and online sensing methodologies based on the two dimensional and through thickness mapping of the changes in the CNT conductive network that mirror the damaged system;
- The integration of the innovative curing system with the smart-patch sensing abilities and validation at coupon level and large-scale applications;
- A list of recommendations for the industrialisation of the technology and for securing the developed repair system within the existing repair standards.

Acronym:	IAPETUS
Name of proposal:	Innovative Repair of Aerospace Structures with Curing Optimisation and Life-cycle Monitoring Abilities
Grant Agreement:	234333
Instrument:	CP – FP
Total cost:	3 531 391 €
EU contribution:	2 339 595 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.06.2009
Ending date:	31.05.2012
Duration:	36 months
Technical domain:	Maintenance and Disposal
Website:	http://www.iapetus.eu
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	University of Patras	GR
	INASCO - INtegrated Aerospace Sciences COrporation O.E.	GR
	Integrated Aerospace Sciences Corporation	GR
	Daher Aerospace SAS	FR
	GMI Aero SAS	FR
	University of Sheffield	UK
	Hellenic Aerospace Industry SA	GR
	University of Ioannina	GR
	PANEPISTIMIO IOANNINON	GR

TRIADE

Development of Technology Building Blocks for Structural Health-Monitoring Sensing Devices in Aeronautics

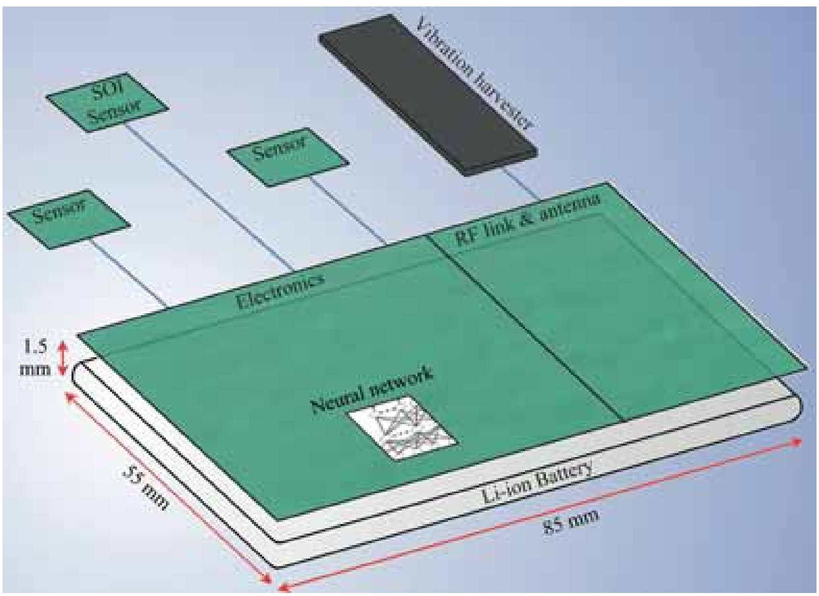
State of the Art - Background

In TRIADE, industrial specifications will require a Health and Usage Monitoring System (HUMS) performing Structural Health Monitoring (SHM) functions during flights which must exhibit a very high level of autonomy. The power consumption will be minimised to achieve the best use of the energy obtained from the battery and energy-harvesting units, which will be subjected to very stringent space limits.

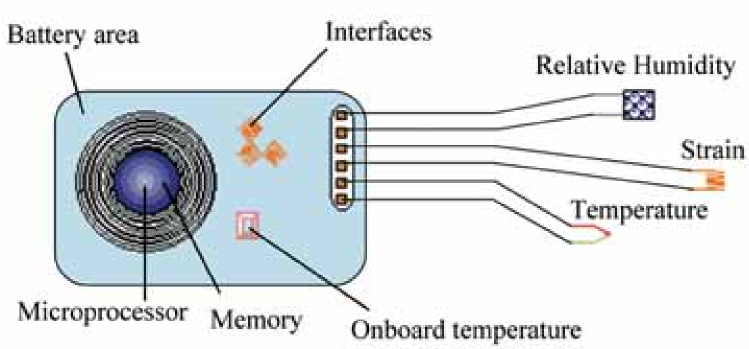
Within TRIADE, the following applications will be considered:

- To explore the 'out-of-flight domain' conditions and/or to monitor the integrity and health of parts and structures, which have been repaired in the field;
- To monitor critical parts made out of composites in helicopters;
- To increase the efficiency of aircraft maintenance.

The inspection of completed or ongoing EU projects shows that these goals cannot be achieved in aeronautics today with the non-intrusiveness, autonomy, size and cost requirements.



TRIADE smart tag - building block overview



TRIADE smart tag principle

The following technical outputs differentiate TRIADE from other EU projects, particularly the ADVICE project:

- The energy harvesting proposed uses seismic mass and electromagnetic conversion;
- Energy storage using rechargeable devices;
- Fully depleted Silicon on Insulator (SOI) CMOS technology targeted for Ultra Low Power (ULP) functions, sensors and interfaces.

Breakthrough solutions will also have to be developed to bring embedded neural network intelligence.

Objectives

The overall TRIADE objective is to contribute towards solving application issues by providing technology building blocks and fully integrated prototypes to achieve power generation, power conservation and embedded powerful intelligence – data processing/storage and energy management for structural health-monitoring sensing devices in aeronautical applications.

TRIADE will be assessed when compared to the following measurable goals:

- Implement an architecture where energy management will bridge the gap that exists today between a need of 250 mAh in most modern comparable products to less than 30 mAh available power in most modern harvesting and storage solutions;
- Include a neural tool and data processing in the prototype, which will fulfil the power consumption requirements;
- Validate the robustness of the solution to an aeronautic environment.

Technical development will result in a disposable smart tag that includes a battery, an antenna, an RF inductive coupling link, a memory, an energy-harvesting part, a power management circuit and a microprocessor. Remote sensors will be connected to the tag: a humidity sensor, one or two XY strain gauges, an acceleration sensor, and ULP temperature and pressure sensors. This tag will be stuck in the last layer of the composite (with a lifetime of at least ten years), or on the structure (lifetime of six months to one year).

Description of Work

The project is divided into six technical work packages (WP).

WP1 is essentially concerned with HUMS environmental and functional requirements, overall architecture and interfaces with low power in mind.

WP2 will deal with peripheral components. In particular, this WP will be concerned with the adaptation of peripheral components to the aeronautics requirements: energy-harvesting sources and batteries. Several interfaces will be implemented: RF link, microprocessor, power interface between energy source and batteries, remote sensors implemented with low power solutions.

WP3 will be aimed at upgrading and establishing the SOI CMOS/MEMS platform for embedded electronics and sensors. Selected critical functions will be developed with ULP concepts.

WP4 will focus on studying the embodiment of the electronics, how it adapts to processes and process temperature, environmental and service life. Simulations for structural integrity assessment will be performed and transferred for use in WP6.

WP5 consists of neural network computation. It will focus on developing a software-computing tool, compatible with previous requirements and choices.

WP6 is concerned with the development of a prototype to be put on a small technological specimen containing fasteners: stuck on the specimen, the prototype will be tested with an environmental cycle defined by the end-users.

Expected Results

The major deliverable of the project will be the HUMS smart tag device that could be stuck on the structure or in the last layer of the composite of an aircraft in order to record the external parameters, e.g. temperature, pressure, moisture and vibrations. The smart tag will respect the compatibility with the manufacturing processes and service life. It will be the size of a credit card so as to be easily used in the aeronautics domain and allows for further monitoring applications. Several other technological results with breakthrough building blocks will be issued from this smart tag:

- A battery optimised for aeronautic embedded devices;
- Harvester devices using vibration and electromagnetic coupling;
- A neural network for smart-record triggering and damage assessment;
- SOI-based ultra-low power components.

The expected impact of TRIADE is its contribution to reducing aircraft operating costs by 50%, through a reduction in maintenance/inspection and other direct operating costs by 2020. Before TRIADE, smart maintenance systems were not embeddable on board aircraft; after TRIADE, smart systems will be embeddable. Before TRIADE, smart maintenance systems consumed 250 mAh and lasted a few hours when continuously powered; after TRIADE, they consume 30 mAh and may be used intermittently for ten years.

Acronym:	TRIADE
Name of proposal:	Development of Technology Building Blocks for Structural Health-Monitoring Sensing Devices In Aeronautics
Grant Agreement:	212859
Instrument:	CP – FP
Total cost:	6 130 570 €
EU contribution:	4 170 769 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	17.12.2008
Ending date:	16.12.2011
Duration:	36 months
Technical domain:	Maintenance and Disposal
Website:	http://triade.wscrp.fr
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	Commissariat Energie Atomique - CEA	FR
	Eurocopter SAS	FR
	Goodrich Actuation Systems SAS	FR
	Hellenic Aerospace Industry SA	GR
	University of Southampton	UK
	Instytut Technologii Elektronowej	PL
	KT-Systems GmbH	DE
	Memsfield	FR
	Wytwornia Sprzetu Komunikacyjnego ‘PZL-Swidnik’ SA	PL
	ROVI-TECH S.A.	BE
	Université Catholique de Louvain	BE
	EADS Deutschland GmbH	DE

FLY-BAG

Blastworthy Textile-Based Luggage Containers for Aviation Safety

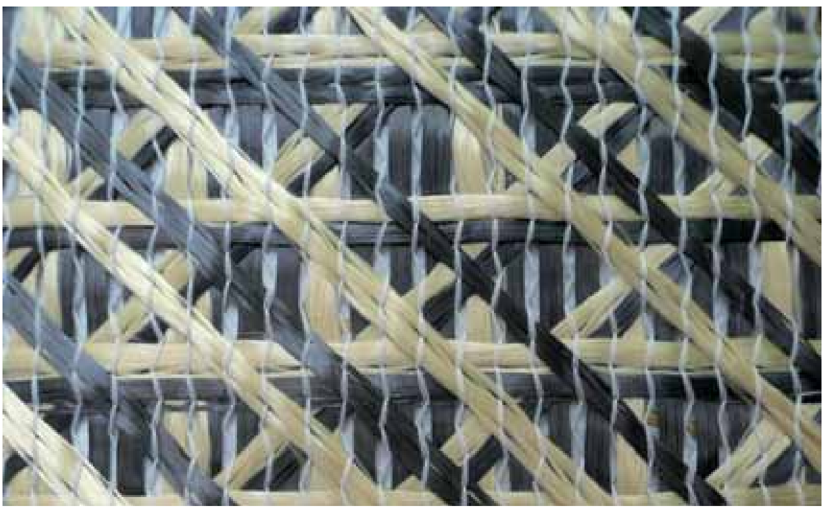
State of the Art - Background

The rise in worldwide terrorism requires that measures be taken to strengthen aircraft against catastrophic in-flight failure due to terrorist bombings. Since the crashes of Air India Flight 182 (1985, 329 casualties) and Pan Am Flight 103 (1988, 270 casualties), both of which exploded due to bombs concealed within the passengers' baggage, much effort has been carried out by governments and international bodies to prevent further such disasters; nevertheless, the risk that a small quantity of an explosive, below the threshold of the detection instruments, could go undetected is not negligible. The introduction of countermeasures to reduce the effects of onboard explosions has to be considered. Hardened luggage containers (HULD) have been developed for the latter scope, but their shortcomings, the biggest being their high weight and cost, have prevented their wide utilisation and market acceptance; moreover, they are not available for most narrow-body aircrafts. The issue of containing explosions aboard narrow-body aircrafts has yet to be resolved.

Objectives

FLY-BAG aims at designing and realising a blast-worthy textile-based luggage container to protect aircrafts from explosions caused by bombs concealed inside checked-in luggage. Combining textile fibres and composite materials allows the container to achieve a high flexibility and reconfigurability, a low weight and high resistance to explosions; moreover, this concept applies to both wide- and narrow-body aircraft and can be further customised for practically any application and configuration.

Flexible, lightweight textile structures will be designed to resist explosions by control-



Multi-axial blastworthy textile structure

Bulk luggage in aircraft hold

led expansion and mitigation of the shock waves, while at the same time retaining hard-luggage fragment projectiles and preventing them from hitting the aircraft fuselage at high speed. A multi-layer structure will be developed to absorb the large dynamic loads of the explosion and the large deformation related to the gas expansion. The idea is to use a textile structure made of ballistic yarns as an internal high-strength layer to stop the ejected debris, coupled with an external layer which could deform in a controlled way during the explosion, in a way similar to car airbags, mitigating the blast pressure. The combination of different innovative textile materials shall allow achieving a great blast resistance while retaining an acceptably low weight.

Description of Work

In order to grant the project the maximum effectiveness, the functional requirements for the development of a novel safety device for the containment of the luggage in the cargo compartment are defined to meet the needs of real-life working conditions; this is assured by the presence of an airline as an end-user within the consortium. The design and fabrication activities are supported by intensive sessions of small-scale tests of the composite and textile materials subjected to different loading conditions to measure their blast, ballistic and flame performance, and Finite Element Model simulations of the dynamic behaviour of the luggage container under blast. The prototyping phase comprises a first stage of separate fabrication and testing of all the different elements of the system (i.e. textile components, composite elements, belts, internal and external connections, opening systems) followed by the assembly of a full-scale prototype of the container structure, tailored for the luggage compartment of a narrow-body aircraft. At the end of the project, full-scale validation will be achieved through full-scale blast testing of the textile container prototype placed in a mock-up simulating the basic aircraft structure (e.g., airframe, stringers, skin panels, wall liners and floor beams) of the cargo hold.

Expected Results

A short-term impact will already occur in the final part of the project, as it will lead to the demonstration of the performance of the novel device within the consortium providing valuable results to the members. The direct involvement of end-users within the project activities will give them the opportunity to further improve their visibility as companies at the forefront of passenger security. Furthermore this project contributes to increased international co-operation, especially in the delicate field of aviation safety research.

A medium-term impact of the project will be the fulfilment of the urgent but yet unsolved need to protect in an efficient and cost-effective way narrow-body aircrafts from the risk of explosions in the cargo area. The outcome of the project will be used to stimulate the organisations in charge of the security of the air transport system to accept the new system and to start the required procedure for its standardisation and general acceptance, opening an opportunity for a huge potential market.

In the long term, this novel concept can be used in other industrial sectors, especially within transport (e.g. railways, maritime) and therefore it will provide an excellent opportunity for benchmarking and comparing different safety measures. Moreover, it could lead to the optimisation of safety/security of the transport industry as a whole.

Acronym:	FLY-BAG	
Name of proposal:	Blastworthy Textile-Based Luggage Containers for Aviation Safety	
Grant Agreement:	213577	
Instrument:	CP – FP	
Total cost:	3 057 444 €	
EU contribution:	2 180 792 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.12.2008	
Ending date:	30.11.2010	
Duration:	24 months	
Technical domain:	Aerostructures and Materials	
Website:	http://www.fly-bag.net	
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	Centro di Progettazione, Design e Tecnologie dei Materiali	IT
	Hoffmann Air Cargo Equipment GmbH	DE
	Meridiana S.p.A.	IT
	Danmarks Tekniske Universitet	DK
	APC Composit AB	SE

HIRF SE
HIRF Synthetic Environment research programme

State of the Art - Background

The definition of HIRF (high intensity radiated field) denotes a concern with external electromagnetic (EM) radiation that affects an air vehicle's electrical and electronic systems. HIRF radiation sources potentially interfering with the safety of flight are mainly identified as EM sources external to the air vehicle, i.e. licensed emitters that intentionally generate man-made EM signals within the frequency range of 10 kHz and 40 GHz.

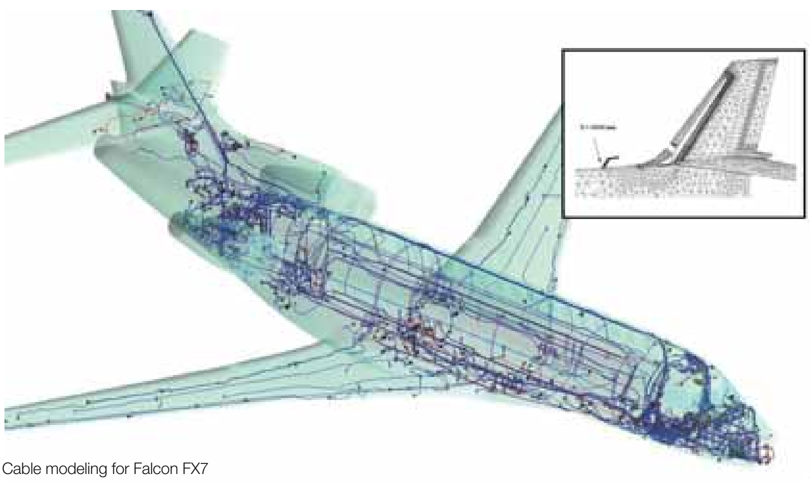
Knowledge of HIRF falls into the following main categories:
- HIRF electromagnetic (EM) environment;
- HIRF requirements;
- Design, protection methods and verification via analysis and testing required by the HIRF certification process.

Problems are usually only discovered at the end of the certification process, i.e. when the final verification, including HIRF testing, at air vehicle level is performed; it is only at this stage that some non-compliance in the project can be found. The modification or redesign process to satisfy HIRF requirements has considerable impact in terms of time (time to market) and costs. Moreover, with the traditional approach, sub-systems will be often unnecessarily over-engineered, with corresponding cost implications. Another critical area for the aeronautics industry is related to the modifications that can be introduced on an air vehicle during its operational life.

Objectives

HIRF Synthetic Environment's main objectives are:
- Develop fully validated and integrated solutions to model, simulate and test air vehicles for EM aspects during the whole life cycle;
- Build (from past and current methods) an integrated approach with an open and evolutionary architecture.

The first objective of the HIRF SE project addresses the drawbacks of the actual



Cable modeling for Falcon FX7

© Alenia Aeronautica

Alenia Aeronautica's Sky-y (UAV) ready for EMC testing inside Anechoic Chamber

design, which consists of the certification and modification approaches, assisted by EM computational techniques.

The second objective addresses the compilation of all available numerical simulation competences. Many stand-alone expert tools are supposed to work together in order to solve these problems. The HIRF SE proposes to overcome this difficulty with an innovative and systematic solution based on a high level of software integration on a computer based framework which offers an open and evolutionary architecture.

HIRF SE will also meet the objective of reducing the delivery timescales of future air vehicles and systems, of decreasing the time required for physical testing, and possible redesign and re-testing. Developing virtual models and validating virtual testing are key issues to reduce the number of development tests required to achieve the air vehicles certification and to obtain improved results.

Description of Work

In order to achieve the HIRF SE objectives, the partners have defined a work plan with nine work packages (WP):
- WP0: Project management
- WP1: Synthetic environment requirements
- WP2: Synthetic environment framework definition
- WP3: Synthetic environment modules modelling
- WP4: Synthetic environment integration/implementation
- WP5: Synthetic environment modules simulation
- WP6: Synthetic environment modules validation
- WP7: Synthetic environment final assessment
- WP8: Dissemination, exploitation and training

Each WP itself is divided into several tasks, split either per successive stages of realisation for common activities or per domain-specific activities.

To ensure the quality and completeness of the HIRF SE framework development, a set of documents will be produced during the project and they ensure that development conforms to the highest standards of software.

Expected Results

The expected results can be summarised as follow:

- Capability to deal with the increased use of composite materials and structures by the airframe industry. The HIRF SE framework will include the most advanced computational models for the numerical simulation of the EM characteristics and performance of composite materials;
- Capability to deal with the complete internal and external electromagnetic environment (present and foreseen). The HIRF SE tool will be able to simulate a widespread typology and number of EM (internal and external) interference sources;
- Develop and issue a work of excellence on EM modelling by gathering a large team of scientists, academic and industrial engineers, co-operating to build a reference tool of their own;
- A developed methodology/tool, well recognised inside the civil aviation community, in accordance with certification bodies.

Acronym:	HIRF SE	
Name of proposal:	HIRF Synthetic Environment research programme	
Grant Agreement:	205294	
Instrument:	CP – IP	
Total cost:	26 497 703 €	
EU contribution:	17 799 956 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.12.2008	
Ending date:	30.11.2012	
Duration:	48 months	
Technical domain:	Systems and Equipment	
Website:	http://www.hirf-se.eu/hirf/	
Coordinator:	Dr. Donatella Invernizzi	
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	AxesSim SAS	FR
	Università di Roma	IT

Dassault Aviation SA	FR
University of York	UK
Alenia Aermacchi	IT
Agusta Westland	IT
BAe Systems Ltd	UK
Brno University of Technology	CZ
Centre Internacional de Metodes Numerics a l'Enginyer	ES
CST Gesellschaft für Computer-Simulationstechnik GmbH	DE
Eurocopter Deutschland GmbH	DE
EMCCons DR. RASEK	DE
EADS Construcciones Aeronáuticas	ES
Evektor Spol s r.o.	CZ
Swedish Defence Research Agency	SE
Galileo Avionica	IT
Hispano – Suiza	FR
Institute of Communication and Computer Systems	GR
Ingegneria dei Sistemi S.p.A. - Italia	IT
National Institute for Aerospace Technology	ES
Istituto Superiore Mario Boella sulle Tecnologie dell'Informazione e delle Telecomunicazioni	IT
National Aerospace Laboratory	NL
Oktal – Synthetic Environment	FR
Piaggio Aero Industries S.p.A	IT
Politecnico di Torino	IT
Polskie Zakłady Lotnicze Sp.z o.o.	PL
QWED Sp.z.o.o.	PL
Rzeszow University of Technology	PL
SPIRIT S.A.	GR
Thales Avionics SA	FR
Thales Systèmes Aéroportés	FR
Thales Communications SA	FR
Technische Universität Hamburg-Harburg	DE
University of Twente	NL
University of Granada	ES
University of Malta	MT
Universitat Politecnica de Catalunya	ES
University of Nottingham	UK
Ingegneria dei Sistemi (UK) Ltd	UK
Advanced Microwave Systems Ltd	GR

BEMOSA
Behavioral Modeling for Security in Airports

State of the Art - Background

Providing the fundamental human resource tools involved in crisis management that will form the basis for an integrated training program dealing with airport security requires gaining a more definitive understanding of the social dynamics involved in the decision making process among all the airport stakeholders. This means being prepared beforehand, during and after an actual crisis. In order to lay the groundwork for such an endeavour we must build up a portfolio of empirical evidence that is derived from actual behavioural patterns involved in decisions relating to airport security.

It requires focusing on a number of groups of actors that are part of the airport organization including the passengers. It is clear that there is interdependence among all the actors in an airport organizational environment that encompasses those directly, and indirectly, involved.

Objectives

Ground Breaking Scientific Advancement - Advancing the state-of-the art in behavioural modeling through:
- Direct, multi-faceted observations of group behaviour in airports;
- Developing a dynamic and realistic model of social behaviour during security threats in airports;
- Development and integration of advanced software simulations that help to capture and predict social behaviour in stressful emergencies.

Training Modules and Packages - Developing innovative world-wide airport staff training programmes that:
- Provide breakthrough progress in real-world crisis handling and hazard reduction;
- Reduce some of the most well-known effects of stress and time pressure on human behaviour;
- Create training modules and training packages that can be readily applied across cultural and organizational boundaries.

Meeting the two above-mentioned objectives will have the following impact on the European air transport system:
- Increased safety and security through enhanced training;
- Improved capability to correctly detect potential hazards;
- Increased efficiency of air transport;
- Reduction of false alarms.

Description of Work

A work plan has been designed, which foresees 8 Work Packages (WP) and accommodates for the interaction between the WPs. Each WP Leader has a set of tasks that covers all the work within that package. Partners who participate in these tasks are allocated the resources that will facilitate a successful, timely completion of the tasks. Most of the WPs are active only partially throughout the entire project, as some of the results obtained by a certain WP may provide the input for a consequent WP.

The WPs have been divided into three building blocks:

Block 1: Preparatory Research.
- WP1: Developing an initial simulation working model of social decision-making chains;
- WP2: Designing the Initial Survey for the study of airports;
- WP3: Studying Airports;
- An exploratory ethnographic study of the major airport security agents;
- Generating a longitudinal survey of a cohort of key security decision-makers;

Block 2: Application Development.
- WP4: Utilize the continuous survey output for data analysis and validation;
- WP5: Iteration & simulations of the behavioural science model;
- WP6: Designing training modules and packages.

Block 3: Other activities.
- WP7: Dissemination and Exploitation;
- WP8: Project Management.

Expected Results

The research will improve people's capability to correctly detect potential hazards and reduce false alarms. Such improvements will surely have an impact on hazard/hostile actions' prevention. BEMOSA will contribute to make airports 'learning organizations', meaning that the developed models/training procedures improve the way in which airports learn from experience, revising and updating their safety and security skills and procedures.

The emphasis of the project will be on emergency and disaster behavior of individuals, groups and organizations associated with air travel. Investigating generic decision making factors affecting preparedness, emergency and security resolution behavior will be emphasized. These results will form the benchmark for developing a behavioural model for resolving crises, and will be the basis of training simulations. Such behavioural findings are applicable to a varied set of circumstances that, given cultural sensitivities, are applicable to alternative scenario modelling that aids training and operational protocols for such types of crises resolution. As a result, BEMOSA will allow airport management and other related stakeholders to make evidence-based policy decisions in upgrading security and safety for passengers as well as making their own security systems more effective.

Acronym:	BEMOSA	
Name of proposal:	Behavioral Modeling for Security in Airports	
Grant Agreement:	234049	
Instrument:	CP – FP	
Total cost:	4 215 906 €	
EU contribution:	3 399 934 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.09.2009	
Ending date:	31.08.2012	
Duration:	36 months	
Technical domain:	Avionics, Human Factors and Airports	
Coordinator:	Prof. Alan Kirschenbaum	
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	Helios Technology Ltd	UK
	Technische Universiteit Delft	NL
	Avitronics Research	IE
	Università degli Studi di Modena e Reggio Emilia	IT
	Letiste Brno A.S. - AIRPORT BRNO (BRQ)	CZ
	Fundación CARTIF	ES

ATOM

Airport detection and Tracking Of dangerous Materials by passive and active sensors arrays

Sate of the Art - Background

Events such as 11 September 2001, the hijacking of Air France flight 8969 (1994) and many others in recent years repeatedly bring the problem of air transport security to the fore. This has always been a priority for the EU aviation industry, since airports represent a natural target for terrorist acts. Nevertheless, airport security measures have not always been effective and there are many past tragedies which were the result of people carrying explosive materials or weapons inside airports. Today, travellers are only quickly screened by walk-through metal detectors before entering the secure area, while X-ray machines are used for screening both hand and checked luggage.

Objectives

The overall objective of ATOM is to design and develop an innovative detection and surveillance system that integrates active and passive radar sensors, which is able to enhance the security level in the airport areas by detecting hidden hazardous materials/tools and tracking people carrying these materials, without interfering with normal airport operations. While directly enhancing the airport security, the ATOM system will also indirectly contribute to protecting aircraft from terrorist or other criminal acts.

The ATOM system will be a non-intrusive but pervasive security system. Its pervasiveness derives from the capability of the ATOM sub-systems to monitor wide airport areas and detect many kinds of hidden hazardous objects.

The technical approach to be followed foresees two separate and integrated controls: one at the terminal accesses equipped with innovative active devices, which are able to detect and identify dangerous concealed tools; the other, in the airport halls before the gate area, will be equipped with new passive RF sensors which are able to track suspicious people/containers.

The integrated controls information will be managed securely within the airport information networks thus minimising the risk to other people inside the terminal area.

Description of Work

The development of the advanced surveillance system will integrate an innovative detection system with a new tracking system.

Imaging sensor at 15 35 GHz frequency.

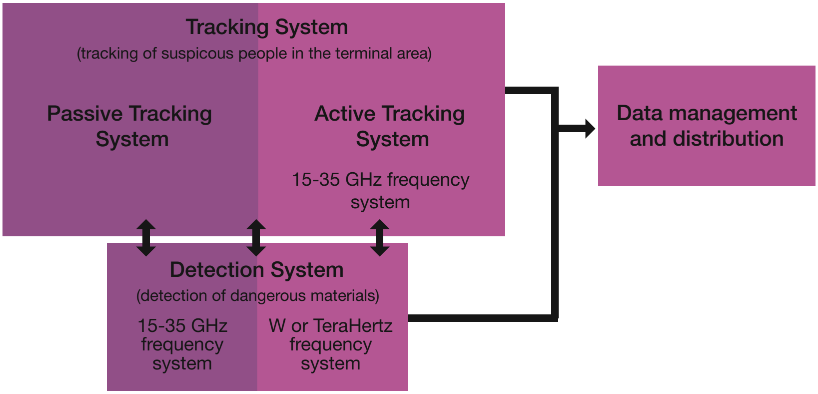
An active distributed Radio Frequency (RF) sensor system able to detect and track suspicious people concealing dangerous tools will be developed. It will consist of several active radar nodes in order to increase accuracy and performance. The processing techniques, including advanced tracking algorithms, will be designed and simulated in a realistic environment to support the performance analysis.

Imaging sensor at 75-110 GHz or THz frequency.

The objective is to detect, by multiple miniature 94-GHz/220-GHz radar sensors with subsequent Synthetic Aperture Radar (SAR) image generation, dangerous objects such as metallic weapons hidden under clothes, to localise and then identify them using 3-D reconstruction.

Passive tracking system.

The development of a new passive radar sensor for the surveillance of the indoor public airport area, based on the best available



Main blocks of the atom system

electromagnetic source, will be analysed; the detection and localisation of designated human beings will be achieved by suitable signal processing techniques, and a multiple networked system approach will be evaluated.

Data management and data distribution.

A tracking filter, exploiting data from different sensors, will be developed in order to improve the accuracy.

Expected Results

The ATOM system, by developing an innovative and non-intrusive surveillance system, will enhance the security level in the terminal areas of airports by:

- preventing any hostile action and so protecting travellers and personnel from injury, loss, damage or disruption due to the effects of terrorism;
- ensuring enhanced security in air transport;
- developing a system which complements other security systems already in use in airports;
- the application of a wide range of concepts, innovative solutions and technologies which are able to improve security aspects in airports;
- securing and further developing the competitiveness attained by European industries in the global market;
- guaranteeing security by preventing acts of unlawful interference.

Acronym:	ATOM	
Name of proposal:	Airport detection and Tracking Of dangerous Materials by passive and active sensors arrays	
Grant Agreement:	234014	
Instrument:	CP – FP	
Total cost:	5 237 895 €	
EU contribution:	3 478 545 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.07.2009	
Ending date:	30.06.2012	
Duration:	36 months	
Technical domain:	Avionics, Human Factors and Airports	
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SAFAR

Small Aircraft Future Avionics ARchitecture

State of the Art - Background

Today, individual transport is mainly achieved by automotive vehicles. Due to the anticipated saturation of road traffic and longer transport distances in the extended European Union, the increasing demand for individual transport cannot be satisfied by road traffic alone. Consequently, a proper balance of individual transport by road, rail and air should be found.

Small aircraft can be a useful mean of personal transportation, particularly for people living in remote regions or requiring fast transportation from A to B.

A significant growth potential for the Low Capacity Air Transportation (LCAT) market is expected, arising from highly efficient, highly reliable LCAT aircraft which should achieve point-to-point on-demand traffic at speeds that are three or four times faster than road speeds and approximately twice as fast as using scheduled air transport traffic between major airport hubs.

SAFAR's future avionics architecture will be an avionics platform allowing the realisation of such highly efficient small aircraft with improved handling qualities and safety. The high aircraft efficiency will also lead to more affordable aircraft in terms of life-cycle cost.

Objectives

Within SAFAR, an avionics architecture for future small aircraft (safe, cost-efficient, extendable and scalable) will be designed, developed and validated. This will be the basis for a future low capacity air transportation system on which further advanced functionalities can be built.

The baseline of the SAFAR architecture will be an advanced safety-critical, fault tolerant, fly-by-wire platform applicable to LCAT aircraft. The platform will comprise computing resources, a human-machine interface, a mainly satellite-based fault tolerant attitude/navigation system and a safety-critical electric power supply with all-electric actuators. In order to keep the handling characteristics of the aircraft straightforward and to avoid any pilot training, the fly-by-wire platform must maintain the same handling characteristics and flight protection features, even in cases of platform failures. Significant functional degradations in the handling characteristics, such as degradation to 'direct law', are not acceptable. This requires an all time/full performance/full authority fly-by-wire platform without any mechanical backup.

The overall work on SAFAR is driven by the long-term prospect of small aircraft in air transportation: how they will be embedded in future air traffic control and management, and which technologies will be available to guarantee their efficient and safe operations.

Description of Work

A comprehensive analysis of missions for small aircraft, requested functionality, availability of technologies, system concepts and a clear characterisation of society-induced aspects such as individual mobility, environmental conditions, noise pollution, and high-level safety requirements will directly lead to systems and operation requirements for small aircraft.

Based on these requirements, the work then focuses on the avionics fundamentals for small aircraft performing the task-concept definition – design and prototyping, and validation and certification. First a comprehensive blueprint of future avionics of small aircraft will be drawn up. Logically, the design and prototyping of a failure-redundant fly-by-wire platform and the corresponding sensor package for navigation and communication will follow. Appropriate control laws will be developed via test flights with a validation aircraft

(V-plane) and incorporated in the flight control system on the top of the fly-by-wire platform. All components will be integrated in a test rig and their functional behaviour tested. The relevant hardware and software will be tested on a 6-DOF simulator, then integrated in the V-plane and tested on the ground. Finally in-flight validation of the SAFAR avionics in terms of handling quality, control characteristics and automatic reconfiguration in case of failures will be performed.

Expected Results

Beyond the current research objectives it is the intention of SAFAR to provide a generic, enhanced and proven avionics architecture to the aeronautics community with a high degree of re-use of generic hardware and software components. This will allow future implementation of further advanced functionalities to small aircraft, such as automatic take-off and landing or automatic go-home and auto-land functionalities in case of emergency. Advanced ATC and even ATM will be supported by way of maximum onboard automatism. Four-dimensional flight vectoring as a result of the onboard ATM/FM shall be executed automatically.

Due to safety levels ranging between 1/1 million up to 1/1 billion and the low-cost approach, the SAFAR avionics architecture could be a first choice for the avionics of future aerial robotic platforms.

Acronym:	SAFAR	
Name of proposal:	Small Aircraft Future Avionics ARchitecture	
Grant Agreement:	213374	
Instrument:	CP – FP	
Total cost:	7 318 272 €	
EU contribution:	4 700 000 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.04.2008	
Ending date:	31.03.2011	
Duration:	36 months	
Technical domain:	Avionics, Human Factors and Airports	
Website:	http://www.fp7-safar.de	
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	Honeywell International	CZ
	Septentrio	BE
	Universität Stuttgart	DE

ALFA-BIRD
Alternative Fuels and Biofuels for Aircraft Development

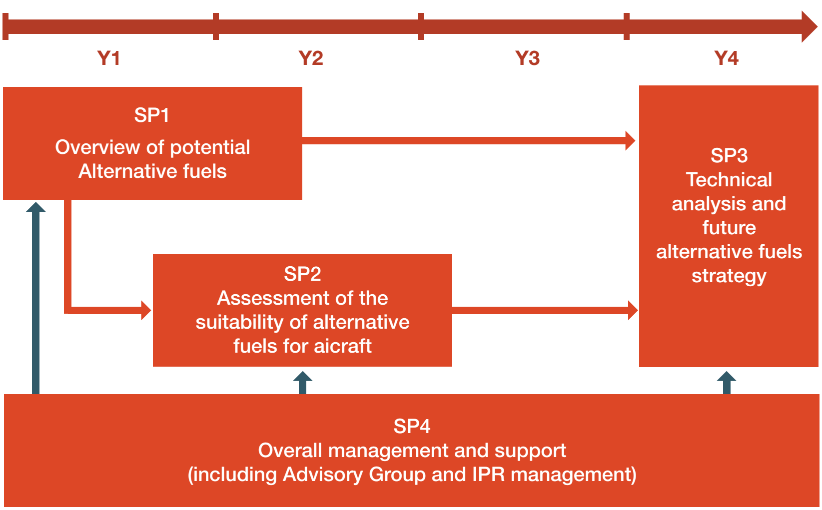
State of the Art - Background

ALFA-BIRD aims to develop the use of alternative fuels in aeronautics. In a context where the price of oil is increasing and with the impact of fossil fuels on climate change, the sustainable growth of the civil aviation is conditioned by respecting the environment. In this context, using biofuels and alternative fuels in aeronautics is a great challenge, due to very strict operational constraints (e.g. flying in very cold conditions) and the long lifetime of current civil aircraft (almost 50 years).

Objectives

The main objective of ALFA-BIRD is to develop the use of alternative fuels in aeronautics with a long-term perspective, to help improve each country's energy independence, help lessening global-warming effects, and to help soften the economic uncertainty of crude oil peaking. ALFA-BIRD will investigate new approaches and new alternative fuels to power aircraft with the possibility of revisiting the fuel specifications and reconsidering the whole aircraft system.

In operational terms, ALFA-BIRD addresses the following objectives:
- To identify and evaluate possible alternative fuels to petroleum kerosene, considering the whole aircraft system;
- To assess the adequacy of a selection of up to five alternative fuels with aircraft requirements based on a series of tests and experiments;
- To evaluate the environmental and economical performance of selected alternative fuels;
- To establish an industrial use of the 'best' alternative fuels.



Overview of the sub-projects

Description of Work

The project is organised into three technical sub-projects (SP):

SP1: Overview of potential alternative fuels.

To provide a complete analysis of the development of new alternative fuels and biofuels for the aircraft industry.

SP2: Suitability of alternative fuels to the aircraft requirements.

To assess the suitability of three to five alternative fuels with respect to aircraft requirements.

SP3: Technical analysis and future alternative fuels strategy.

To provide a strategy and implementation plan for alternative fuels in the aircraft industry based on the results of SP1 and SP2, as well as an environmental and economical assessment.

Expected Results

The main innovative deliverables will be:

1. New alternative fuels for aircraft;

a) Short term: Blend of kerosene and biofuel (treated plant oil)

b) Long term:
- New molecules: fatty acids produced by fermentation processes will enlarge the availability of candidates to be used as fuel for aircraft.
- Definition of best formulations thanks to the knowledge gained during the experimental study of the characteristics and properties of alternative fuels.

2. Redefine the requirements of jet fuels to optimise the supply chain (including production), the use and the operability of alternative fuels.

3. Long-term strategy and implementation plan for the use of alternative fuels for aircraft (this is a key deliverable for the project).

4. New methodology and corresponding tools for eco-efficiency assessment taking into account the whole life-cycle analysis.

Acronym:	ALFA-BIRD
Name of proposal:	Alternative Fuels and Biofuels for Aircraft Development
Grant Agreement:	213266
Instrument:	CP – FP
Total cost:	9 700 000 €
EU contribution:	6 800 000 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.07.2008
Ending date:	31.05.2012
Duration:	48 months
Technical domain:	Propulsion
Website:	http://www.alfabird.eu-vri.eu
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Institut Français du Pétrole	FR
Lesaffre International SARL	FR
MTU Aero Engines GmbH	DE
Office National d'Études et de Recherche Aérospatiales	FR
Rolls Royce plc	UK
Sasol Technology (Pty) Ltd	ZA
Shell Aviation Ltd	UK
Snecma SA	FR
University of Sheffield	UK
Universität Karlsruhe (Technische Hochschule)	DE
Technische Universität Graz	AT
The Governing Council of the University of Toronto	CA

FAST20XX

Future High-Altitude High-Speed Transport 20XX

State of the Art - Background

Worldwide activities are going on to develop suborbital human transportation, allowing a new private industry to emerge. The vast majority of these activities is taking place in the United States of America.

Most feasible and advanced, as well as sufficiently funded, are the activities by Scaled Composites in the USA with Virgin Galactic as airline operator ordering five SS2 (SpaceShipTwo) aircraft, and two WK2 (White Knight 2), as launching carrier aircraft. The hybrid rocket-propelled SS2 concept relies on an all carbon-based design. WK2 is in the process of being commissioned, while the space ship itself will have its first flights next year. SS2 takes six passengers to suborbital altitudes and has two pilots.

In contrast to the air launch concept, XCOR's suborbital two-seated liquid-rocket propelled space vehicle Lynx Mark I starts horizontally from the ground. The version Mark I will climb to altitudes of up to about 60 kilometres, and is planned to have its first suborbital test flights in 2010.

A third potential commercial suborbital flight vehicle is the vertically starting and landing liquid rocket-propelled New Shepherd concept of Blue Origin, based on the previous DC-X Delta Clipper. The anticipated number of passengers is three. The last test flights took place in 2007.

The aim in all these cases is a short vertical ride without large down-range capability. Europe has not really started activities in the field of suborbital transport. Technologically

ALPHA, hybrid propelled vehicle launched at high altitude for short-range flights (here: one of several launch options).

however, European engineers are in the position to develop novel suborbital transportation means as well.

In the USA the governmental authority FAA has helped the emerging private industries by providing licences to build a number of spaceports across the American continent and by alleviating the rules for selling suborbital flights to humans. In this respect, Europe is very behind. Corresponding activities will also result in new safety and liability agreements, and in the definition of enabling insurance rules.

Objectives

The general objectives of the present project are to:
- evaluate two novel concepts for high-altitude high-speed transportation,
- identify the prerequisites for the commercial operation of high-altitude, high-speed transport, and
- identify critical technologies.

The scientific and technological objectives for the envisaged concepts are:
- Hybrid propulsion;
- Flight experimentation;
- Innovative, high-performance cooling techniques;
- Separation techniques;
- Flow control in supersonic/hypersonic boundary layers;
- Guidance Navigation and Control (GNC) techniques;
- Safety analysis.

Description of Work

The present project pursues technical transport and operational development activities using the air launch of a suborbital space vehicle as a first step towards the development of more challenging longer-distance, point-to-point transportation. The guidelines are suborbital low-energy and high-energy transportation with the concepts ALPHA and SpaceLiner.

The project enables to consider all major technological aspects leading to representative tests as well as technical validation of technologies, tools or know-how required for the realisation of the major vehicle concepts, as well as pro-actively preparing the legal and operational basis for suborbital flight operation:

a. preliminary system design, analysis and performance evaluation for the vehicle concepts ALPHA and SpaceLiner,

b. critical assessment/comparison with developments in ATLLAS and LAPCAT,

c. development/evaluation of hybrid propulsion technologies with consideration of issues of noise and benign propellants,

SpaceLiner, two-stage all rocket propelled vehicle launched vertically from ground for ultra-fast long-range flights.

d. autonomous GNC with health monitoring and adaptation to vehicle performance degradation,

e. novel cooling techniques for wing leading edges, stagnation points and any other locations with very high heat loads,

f. computational and experimental simulation methods for separation phenomena and for the determination of dynamic loads in critical stability regimes,

g. on-ground and national/European/international guidelines for suborbital flight operations

h. aerodynamic/aero-thermodynamic know-how for mastering ascent and safe re-entry of a suborbital flight,

i. novel laminar flow control techniques for hypersonic flow striving for a strong reduction of viscous drag and surface heating while improving aerodynamic efficiency,

j. guidelines for ensuring safety for passengers, on-ground population in view of e.g. human factors, ATM, airline operations, and deficiencies of the aircraft itself, and development of a safety toolbox.

The major challenge for all concepts involving flights with passengers is the safety.

Expected Results

An increase of non-technical and technical/scientific competence in Europe in the field of suborbital commercial transportation, and the satisfaction of society's needs will result from the project.

A network of potential future partners with leading edge expertise for participation in emerging programmes within and outside Europe will also be a result. The project enables a better positioning in emerging markets, through new research and technological activities which would not be possible for a single beneficiary without the EC support. Concrete services and products, in particular of start-up companies, are prepared, developed and established, rendering them ready in time for new markets.

Young engineers and scientists are educated simultaneously by participating in this attractive research and development work.

Acronym:	FAST20XX
Name of proposal:	Future High-Altitude High-Speed Transport 20XX
Grant Agreement:	233816
Instrument:	CP – FP
Total cost:	7 289 429 €
EU contribution:	5 122 148 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.12.2009
Ending date:	30.11.2012
Duration:	36 months
Technical domain:	Breakthrough and Novel Concepts
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DLR - Deutsches Zentrum für Luft- und Raumfahrt e. V.	DE
Swedish Defence Research Agency	SE
Swedish Space Corporation	SE
AI: Aerospace Innovation GmbH	DE
Astos Solutions GmbH	DE
Technische Universität Berlin	DE
ULB - Université Libre de Bruxelles	BE
CENAERO - Centre de Recherche en Aéronautique ASBL	BE
Astrium GmbH Space Transportation	DE
ONERA - Office National d'Études et de Recherches Aerospatiales	FR
VKI - Von Karman Institute	BE
Faculty of Law, University of Leiden	NL

LAPCAT-II

Long-term Advanced Propulsion Concepts and Technologies II

State of the Art - Background

Lapcat II is a logical follow-up to the previous EC project Lapcat, which had as its objective: to reduce the antipodal flight duration to less than two to four hours. Among the studied vehicles, of which there were several, only two novel aircraft for Mach 5 and 8 flights are retained in the present proposal.

Objectives

Beginning with the available Mach 5 vehicle and its related pre-cooled turboramjet, the assumed performance figures of different components will now be assessed in more detail. Once the performance figures are available, the vehicle's performance will be re-assessed. The outcome will allow a detailed development roadmap to be defined.

Although the cruise flight of the Mach 8 vehicle based on a scramjet seemed feasible, the acceleration phase, which relied on an ejector rocket, did not provide an acceptable performance. A turbo-based engine will replace the former ejector rocket to assure better performance and fuel consumption during acceleration. In addition, the integrated design of airframe and engine throughout the whole trajectory is now the prime focus to guarantee a successful outcome.

Description of Work

The important points to be addressed to achieve these goals are:

- the proper development and validation of engine-airframe integration tools and methodology;
- high-speed air-breathing cycle analysis;

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LAPCAT A2: Mach 5 Vehicle at Take-Off

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LAPCAT-MR1: Mach 8 Vehicle

- off- and on-design behaviour of engine and airframe;
- dedicated experiments to evaluate the design in various operation points.

The development of validated design and analysis tools result in a realistic pre-design of a fully integrated vehicle able to comply with the mission goals. Then a roadmap will be defined outlining the steps to future developments.

For vehicles flying at high speeds and high altitudes, limited expertise is available on the environmental impact. The influence of NO_x and H_2O into the ozone layer and the formation of contrails with its direct and indirect effects will be investigated for both vehicles.

Expected Results

The Mach 5 and Mach 8 vehicles and related propulsion units will be pursued in their conceptual design enabling antipodal range, which includes both the acceleration and cruise part of the trajectory.

This will be unique within Europe and should be considered as a first step towards long-term studies classically performed in the USA, Russia or Japan. The experiments conducted in the frame of this project will complement the database from the preceding project. This project also plays an important role in combining the supersonic/hypersonic research community in Europe. At the end of the project, a detailed technological development roadmap necessary for successive exploration towards vehicle construction and deployment will be available.

Acronym:	LAPCAT-II	
Name of proposal:	Long-term Advanced Propulsion Concepts and Technologies II	
Grant Agreement:	211485	
Instrument:	CP – FP	
Total cost:	10 400 000 €	
EU contribution:	7 400 000 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.10.2008	
Ending date:	30.09.2012	
Duration:	48 months	
Technical domain:	Breakthrough and Novel Concepts	
Website:	http://www.esa.int/techresources/lapcat_II	
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	Société Nationale d'étude et de Construction de Moteurs d'Aviation	FR
	Italian Aerospace Research Center	IT
	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	Office National d'Études et de Recherche Aérospatiales	FR
	Von Karman Institute for Fluid Dynamics	BE
	REL - Reaction Engine Ltd	UK
	GDL - Gas Dynamics Ltd	UK
	Centre of Excellence in Aeronautical Research	BE
	University of Southampton	UK
	University of Stuttgart	DE
	University of Brussels	BE
	University of Rome - La Sapienza	IT
	The Chancellor, Masters and Scholars of the University of Oxford	UK

PLASMAERO
Useful Plasma for Aerodynamic control

Vortices generated by surface plasmas

State of the Art - Background

Active and passive actuators are currently studied, but some could be considered extremely difficult to integrate into the aircraft structure, either because they require complex kinematics or large amounts of power. There is also an inherent de-phasing, a time difference between the execution command and obtaining the desired effect with active actuators. Plasma actuators require only a limited amount of electrical energy. They have no de-phasing and so can be used globally over the aircraft structure or locally in real-time reaction to local phenomena.

Through the combined work of experimental studies and numerical work, the PLASMAERO project will characterise the advantages and limitations of plasma actuators (including humid conditions) in flow control which is a necessary step forward in their studies for future aircraft designs.

Objectives

PLASMAERO seeks to demonstrate how surface and spark discharge plasma actuators can be used to control aircraft aerodynamic flow. This will be achieved through an enhanced understanding of their physical characteristics and an in-depth study of how they may be optimised to influence the air flow properties. The project will run for three years and will show the advantages and notably the ease of implementation that these innovative devices have.

Description of Work

The design of tomorrow's aircraft will be oriented by the need to have more environmentally-friendly aircraft in line with the ACARE 2020 vision. Optimised aerodynamic performance can be one way to achieve this. To move forward towards this objective, it is necessary to study breakthrough and emerging technologies going beyond the limitations of the aircraft's fixed structure and to use efficient actuators to optimise the flow over the airfoil.

The work planned in the PLASMAERO project is structures as follows:
- Understanding, modelling and classifying, through experimental and numerical studies, the most relevant physical characteristics of surface and jet plasma actuators capable of influencing airflow;
- Performing comparative experimental tests and numerical studies of different actuator configurations to select the most promising for further development;
- Demonstrating, through wind tunnel experiments, the ability of plasma devices to significantly improve aircraft aerodynamics in terms of lift, lift/drag and high lift noise in representative airflow conditions (takeoff, cruise and landing);
- Demonstrating the ease of use and installation of these actuators in a reduced size flight platform;
- Providing exhaustive recommendations on future work to be performed in order to implement this technology in the next generation of aircraft programmes.

Expected Results

The project will benchmark and adapt under a single European referential, the most promising innovative plasma actuators which are currently being researched or newly patented. It will demonstrate their ability to be used to control airflow in the most challenging aeronautical configurations.

The recommendations and roadmap for future work will permit European industrial to envisage the further development of this technology base to optimise the aerodynamic performance of aircraft, leading to a reduction in design and manufacturing costs through the simplification of aerodynamic profiles as well as noise and operating costs redutions through improved lift/lift-drag efficiency.

This technology base could also be used for land-based transport such as high speed trains and cars as well other aerodynamic applications such as wind power generators.

Acronym:	PLASMAERO	
Name of proposal:	Useful Plasma for Aerodynamic control	
Grant Agreement:	234201	
Instrument:	CP – FP	
Total cost:	4 988 029 €	
EU contribution:	3 815 410 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.10.2009	
Ending date:	30.09.2012	
Duration:	36 months	
Technical domain:	Breakthrough and Novel Concepts	
Website:	http://www.plasmaero.eu	
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	Centre National de la Recherche Scientifique	FR
	Ecole Polytechnique Fédérale de Lausanne	CH
	Snecma	FR
	Stichting Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	Technische Universität Darmstadt	DE
	The Szewalski Institute of Fluid-Flow Machinery Polish Academy of Sciences	PL
	The University of Nottingham	UK
	University of Southampton	UK

PPlane

Personal Plane: Assessment and Validation of Pioneering Concepts for Personal Air Transport Systems

State of the Art - Background

Today, personal ground transportation consists of on-surface vehicles (cars) limited by low speed, high fuel consumption, major safety hazards and the need for costly maintenance of roads and infrastructure. These factors limit the distance one can live conveniently from work, worsening the core-periphery syndrome in which employment centres become residential centres, and leaving remote areas unexploited for employment or residence.

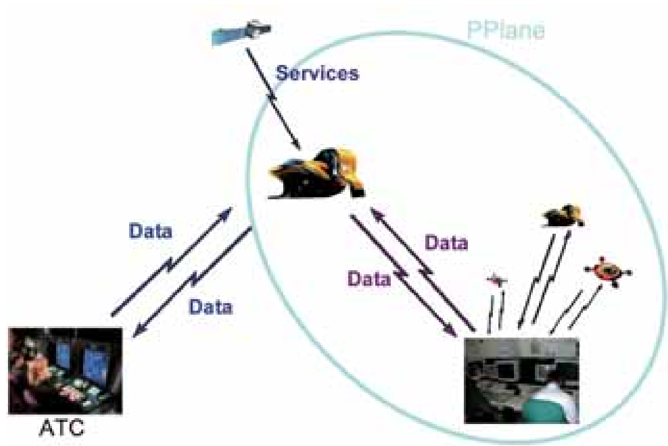
Personal air transport systems are not a near-term system. Considerable progress beyond the current state-of-the-art will have to take place before personal aircraft will be taking off and landing in abundance from airfields only a short distance away from their owner's destination. This technological progress will have to be accompanied by progress in aspects such as regulation, licensing, infrastructure, controlling, synergies with existing forms of transportation (co-modality), etc. But it is clear from the current state of transportation that congestion is worsening and that the situation will quickly becoming unbearable.

The PPlane project is a direct follow-up action to the Out-of-the-Box study, which aimed at identifying potential new concepts and technologies for future air transport. PPlane adopts the recommendation that is listed in the report:

'The proposed set of mechanisms will result in a structured process approach towards creative and innovative technology development in Europe'.

Objectives

On the higher end of what could be considered as 'personal air transport', business aviation is pretty wealthy but, due to its high cost, it can only be used by a very limited



PPlane Potential Concept

number of persons, often called 'the Jet-set'. At the other end of the spectrum, general aviation is more dedicated to leisure/educational training flights and travels.

PPlane aims at developing a system based on aircraft in between these two extreme categories, some 4 to 6 or 8 passenger aircraft. To this end, PPlane implements a systematic approach to propose radical and novel ideas for future Personal Air Transport System (PATS), rather than taking incremental steps.

Starting with the definition of potential PATS new concepts with various automation levels and pilot competency requirements, the project will sort these concepts using an optimisation model and several selection criteria. The main ones include security and safety, automation and control, environmental and human factors. Horizontal areas such as technologies, regulation and affordability are considered in each of the above criteria. The resulting concepts are analysed and compared, resulting in recommendations for implementation across Europe.

Moreover, the definition of the PATS concepts will be built according to the Air Traffic Management (ATM) structure planned in SESAR and will also bring some inputs to its WP-E in the 'full automation' and 4D to the max' research themes.

Description of Work

The project adopts a similar methodology to the one used in the Out-of-the-Box study and is divided in four main phases.

The first one deals with the PPlane system definition, leading to a rough definition of numerous PPlane concepts.

Then a PPlane system selection is made, which purpose is to retain only the most promising ones.

The preferred PPlane systems detailed description follows, deepening the level of detail of the definition of the retained concepts, regarding various technological and societal aspects.

The last phase of the project is dedicated to recommendations, making the synthesis of the detailed concepts, in order to provide insights into possible and viable future PATS.

The PPlane project starts with a work package dedicated to analysing the operational concepts of such a system. Then, a set of issues to design the various components of the system in a proper way are analysed in four work packages dealing with security and safety of the system, automation and control, human factors and environmental concerns. Transverse fields of interest (affordability, social acceptance, regulations and technology) are investigated all along the work performed in these work packages.

The project is concluded by a definition of scenarios in order to verify the main assumptions that have been made.

Two other «conventional work packages» are dedicated to the dissemination and management tasks.

Expected Results

The expected result from the project is a comprehensive view on the possibility to develop such a Personnel Air Transport System, its viability, its structure (components) and its organisation (as a part of the global air transport system, integrated into the air traffic management system).

This PATS will appear to be, or not be, workable through a multicriteria analysis where four topics will be studied in depth.

The first one is affordability as the economic aspect of a personal air transport system is essential.

The second one is technological availability as this is a major enabler for such a system. Social acceptance is also an important topic these days as any significant change in the population's way of life has to be agreed and not imposed.

Last but not least, the regulation issues are not to be underestimated. In aviation, regulations have been built based on more than 100 years of experience, any necessary change to accomodate a PATS in the ATS will have to be fully documented and justified as the introduction of a new system into the already well-regulated air transport system should not compromise the safety and the security of the other airspace users.

Moreover, the dissemination phase of the project will allow to set plans for the future of PATS.

Acronym:	PPlane	
Name of proposal:	Personal Plane: Assessment and Validation of Pioneering Concepts for Personal Air Transport Systems	
Grant Agreement:	233805	
Instrument:	CP – FP	
Total cost:	4 829 041 €	
EU contribution:	3 279 005 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.10.2009	
Ending date:	30.03.2012	
Duration:	30 months	
Technical domain:	Breakthrough and Novel Concepts	
Website:	http:// - still pending until contract signature	
Coordinator:	Mr. Claude Le Tallec	
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	Intergam Communications Ltd	IL
	Warsaw University of Technology	PL
	DLR - Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	INTA - Instituto Nacional de Técnica Aeroespacial	ES
	NLR - Nationaal Lucht- en Ruimtevaartlaboratorium	NL
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AEROCHINA2

Prospecting and Promoting Scientific Co-operation between Europe and China in the Field of Multi-Physics Modelling, Simulation, Experimentation and Design Methods in Aeronautics

State of the Art - Background

Numerous modelling, design optimisation and experimental tools and solvers have been developed and used until recently, both in Europe and in China, and have proven to be of significant value in many industrial applications when not explicitly treating the coupling due to multidisciplinary effects. So far, the correct use of such single discipline codes is limited to a specific range of applications. Despite recent efforts, there is still a lack of initial information on available methods, codes and experiments related to loosely and strongly coupled multidisciplinary problems in aeronautics in Europe and China, involving two or more different fields (such as fluid/structure, fluid/acoustics, fluid/heat transfer, structure/acoustics, pollution flows, composite materials, etc.) and emphasising the importance of human aspects and flexible integration on collaborative environments.

Objectives

The aim of AEROCHINA2 is to foster the co-operation between a number of industry, university and research organisations in the aeronautics sector in Europe and China in the field of multi-physics modelling, computer simulation and code validation, experimental testing and design methods for the solution of multi-physics problems of interest to the aeronautic sector. The multi-physics disciplines considered in AEROCHINA2 which are of interest to European and Chinese partners are aerodynamics, structures and materials, fluid dynamics, aero acoustics, active flow control and aero elasticity.

The general strategic objectives of the project are the following:

1. To identify areas of mutual RTD interest, and to clarify the skills, experiences and capabilities of the Chinese partners in the relevant technological areas of multi-physics analysis and design;

2. To develop concepts of collaboration in those areas between the European and Chinese partners in order to ensure a win-win situation;

3. To prepare specific RTD activities that are mature enough for joint proposals in the EC's Seventh Framework Programme (FP7).

These AEROCHINA2 objectives correspond to a more long-term preparation necessary for a substantial and sustainable win-win co-operation in forthcoming FP7 calls.

Description of Work

The specific project activities are focusing on:

1. Prospective studies on the existing methods for single and multi-physics simulation, experimentation and design tools in Europe and China.

2. The development of a common database incorporating the knowledge of the relevant

multi-physics simulation/validation/design technology in Europe and China.

3. Identification of possible co-operation in RTD areas.
4. The organisation of a workshop (in China) and two database workshops (one in Europe and one in China) in order to interchange and be prepared to share knowledge on the field of multi-physics simulation, validation and design.
5. The organisation of one short course (in Europe) in the multi-physics fields.
6. The dissemination of the project outputs among universities, research centres and industries in the aeronautic sector in Europe and China.

Expected Results

This project offers a wide range of scientific and technological prospects for future co-operation between European and Chinese organisations. Access to state-of-the-art information on RTD activities in China and in Europe on multidisciplinary experimental, mathematical and numerical methods opens many opportunities for the development of new methods aiming to solve complex multi-physics problems in aeronautics.

The technological benefits will derive from the new possibility of advanced design of civil aircraft vehicles, taking into consideration many multidisciplinary effects currently not strongly accounted for in practice. AEROCHINA2 Guidelines will define the strategic lines and methodologies to be developed in the near future for the solution of multidisciplinary problems. These guidelines will provide the basis for setting up new RTD projects.

The AEROCHINA2 data will find application in markets different from the aeronautic sectors that also need the computational multi-physics transport technologies (i.e. rotation machinery, civil construction, naval architecture, automotive industry, etc.). Transfer of the AEROCHINA2 disseminated multi-physics technology to these sectors through adequate training actions will help to create new attractive co-operative RTD scenarios and business opportunities.

Acronym:	AEROCHINA2	
Name of proposal:	Prospecting and Promoting Scientific Co-operation between Europe and China in the Field of Multi-Physics Modelling, Simulation, Experimentation and Design Methods in Aeronautics	
Grant Agreement:	213599	
Instrument:	CSA – SA	
Total cost:	650 000 €	
EU contribution:	500 000 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.10.2007	
Ending date:	30.09.2009	
Duration:	24 months	
Technical domain:	Cross-cutting activities	
Website:	http://www.cimne.com/aerochina2	
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	Université de Provence	FR
	Institut National de Recherche en Informatique et Automatique	FR
	DLR - Deutsches Zentrum für Luft- und Raumfahrt e.V.	DE
	Totalforsvarets Forskningsinstitute T Swedish Defence Research Agency	SE
	NUMECA International S.A.	BE
	University of Birmingham	UK
	University of Sheffield	UK
	Instytut Podstawowych Problemów Techniki Polskiej Akademii Nauk	PL
	Ingeniería Aeron áutica INGENIA, AIE	ES
	Chinese Aeronautical Establishment	CN

AEROPORTAL
Support for European aeronautical SMEs

State of the Art - Background

The European aerospace industry continues to restructure, maintain and improve its global competitiveness. While this affects the whole supply chain, smaller suppliers are particularly exposed, particularly SMEs. AeroPortal is promoting the competitiveness of the SMEs. A tool for achieving this goal and addressing SMEs' needs is networking, which allows aeronautical SMEs to become part of a technical and research community, have access to first-hand information, acquire visibility and thus be involved in EU RTD projects. AeroPortal is built on the expertise and acquired expertise of two successful FP6 Support Actions, respectively AeroSME-Support for European Aeronautical SMEs and SCRATCH-Services for SMEs in CollaboRative Aeronautical TeChnical researcH.

Objectives

The prime objective of AeroPortal is to support aeronautical SMEs in advancing their technology base and their competitiveness through participation in European RTD projects. This is done by creating a single point of reference for information, project opportunities, partner search and by providing a wide-ranging direct support in response to the aeronautical SMEs expressed needs for accessing European RTD funds. A pool of experts in European research and technology funding in aeronautics offers free-of-charge services to SMEs to encourage, facilitate and increase their participation in EU FP7 RTD projects in Aeronautics and Air Transport. The support is offered to SMEs both for the integration in Level 1 and 2 project proposals and for setting up their own project proposals. AeroPortal will provide:

- Information on EU programmes and initiatives;
- An Internet portal to exchange project ideas and request technical skills;
- Electronic newsletters;
- Access to the AeroPortal online database;
- On-site visits by experts analysing SMEs' technical acquisition needs and funding opportunities;
- Free proposal servicing activities: guidance and support in setting up project proposals, proposal writing and partner search;
- Local workshops for SMEs;
- Training activities for SMEs and SME multipliers.

Description of Work

The project is divided into five technical work packages (WP).

WP1 is devoted to awareness-raising activities and networking with industries, SME groups and multipliers. It includes the creation of an Internet portal, an interactive database containing the profiles of SMEs and project ideas, a helpdesk for all inquiries on FP7 research for SMEs, electronic newsletters and participation in national/local information events.

WP2 deals with training and sharing of best practices for SMEs and SME multipliers, providing guidance on RTD-funding mechanisms and help SMEs to become good project leaders or join proposals under preparation.

WP3 creates a list of product-oriented expressed research needs from aeronautical SMEs through visits to SMEs by AeroPortal experts. This technical assessment leads to free support for SMEs in WP4 and WP5. In

WP4 support is given to turn a SME idea into a Level 1 project proposal, build the project consortium with complementary partners and structure the project work plan up to final submission. WP5 is focused on bringing together larger industry partner requirements and SMEs, and on providing information about opportunities for SMEs in the Clean Sky Joint Technology Initiative. The strategy is based upon specific competences and acquired expertise and a working methodology, fine-tuned according to lessons learnt in previous successful projects.

Expected Results

The major deliverables of the project are:

- Technology-acquisition opportunities and RTD-awareness mechanisms offered to a maximum number of SMEs, directly or indirectly involved in the European aerospace supply chain;
- Setting up and maintaining an Internet portal for SMEs, including an interactive SME database;
- Establishing the Multiplier Group open to all aeronautical SME associations and groups as a platform facilitating the communication flow within the sector, in both directions, between large companies and SMEs;
- Free services for SMEs and a public Help-desk on SME-related subjects;
- On-site visits (companies' profiles) for SMEs to structure their corporate research plan and technology needs (about 300);
- Organising and participating in 20 national/regional information days;
- Organising two technology workshops to support the integration of SMEs in large industry-led Level 1 proposals and carrying out matchmaking for Level 2 proposals prior to FP7 calls;
- Information campaign and support for Clean Sky JTI;
- Training for SMEs and SME multipliers (11 training sessions foreseen in CY, RO, HU, CZ, SI, PL, MT, SK, EE, LV, LT, BG);
- To facilitate collaborations between aeronautical SMEs from older EU Member States and newer Member States (CZ, HU, PL, RO);
- To service at least 40 collaborative RTD proposals initiated by SMEs (II and III FP7 Aeronautics Call).

Acronym:	AEROPORTAL	
Name of proposal:	Support for European aeronautical SMEs	
Grant Agreement:	200426	
Instrument:	CSA – SA	
Total cost:	1 500 000 €	
EU contribution:	1 500 000 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.12.2007	
Ending date:	31.05.2010	
Duration:	30 months	
Technical domain:	Cross-cutting activities	
Website:	http://www.aeroportal.eu	
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EC Officer:	Mr. Rémy DENOS	
Partners:	Euro Inter Toulouse	FR
	Innov Support	BE
	Consultores de Automatización y Robótica S.A.	ES
	Euro-Consultants (2006) Ltd	IL
	Alround e.V.	DE
	ISTRAM - Institute of STRuctures and Advanced Materials	GR
	Institute of Structures and Advanced Materials	GR
	Portuguese SME for Aerospace Industry	PT
	Univerzita Tomáše Bati ve Zlíně	CZ
	Slot Consulting Ltd	HU

CEARES

Central European Aeronautical Research Initiative

State of the Art - Background

Although Europe is becoming more integrated on political and economic levels, co-operation is still an issue in terms of aeronautics research. There was progress during the Sixth Framework Programme (FP6) and communication and co-operation between old and new EU Member States are developing.

However the possibilities for this integration are very limited. The reason behind this is that Central and Eastern Europe is itself a fragmented area in terms of research co-operation and organisations in the region know very little about each other's research potential. In Western Europe there is much more co-operation among research centres as it is not easy for research establishments to achieve high quality research results in most disciplines of aeronautics research on their own, mainly because of the need for significant investment in terms of infrastructure and personnel.

The New Member States have the capacity to perform significant research work for European aeronautics, but this capacity is highly underutilised, and the participation of research establishments from this area in FP6 projects was low. The lack of regional events targeted on this topic is obstructing this co-operation.

Objectives

The concept of the CEARES project is to establish a well-coordinated network among the research organisations of the Central European States for sharing expertise, the latest research results and to develop contact with the European aeronautics industry.

This project intends to establish a Central European Research Initiative to foster regional co-operation. The objective aims to bring together research centres and universities from the region and give them the possibility to work together. The main tool is the establishment of a regional network, where key aeronautics research centres and relevant university departments are invited to become 'members'.

The most experienced research establishments of Central Europe were invited to join CEARES. Members are from the following Central European and Baltic states: Austria, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Serbia, Slovakia and Slovenia.

Description of Work

Work package 1: Management and coordination of CEARES. Within this work package, Task 1.1 deals with the actual management of the project: administrative management with a special focus on reporting, and high-level coordination of the project in terms of overall project goals and deliverables. Task 1.2 is the management of the Advisory Board and its support to the consortium.

Work package 2: the workshop arrangement. Three workshops will be held as three separate tasks at the three locations of the project partners. Mainly CEARES members will be present but the workshops are not exclusive, and Advisory Board members and other research organisations are invited on an individual basis.

Work package 3: responsible for the information management of CEARES. Task 3.1 is the creation of the website which will include a section for CEARES members only. Task

3.2 will collect all the relevant information on CEARES members and disseminate it through the members-only part of the website. The CEARES Forum for new common research topics and co-operation will also be in this section. Task 3.3 disseminates information outside of CEARES, mainly through three newsletters to the European aeronautics research community, which will be prepared after each workshop, and also by presentations, mainly through ACARE, AirTN, EASN and EREA.

Expected Results

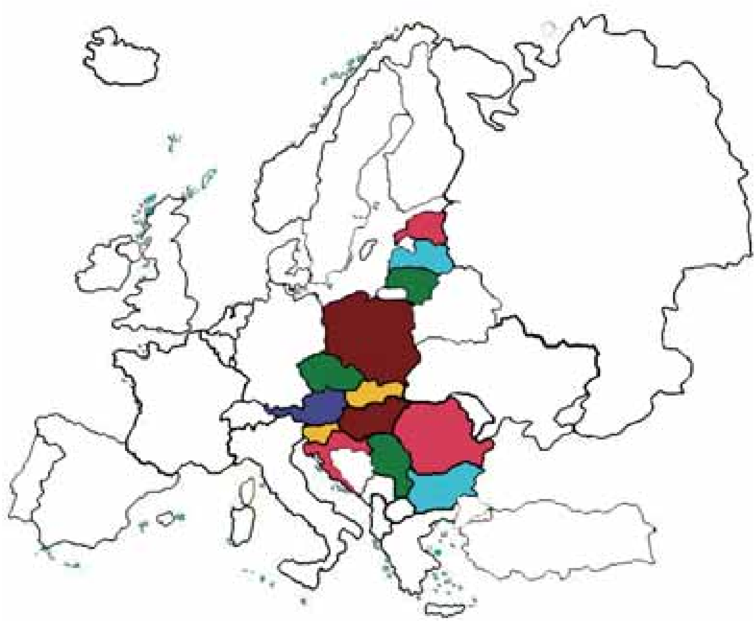
Through the established CEARES Network, members will be informed about the capabilities, research activities and research needs of other members. In addition, advice will be provided by key EU aeronautics associations and entities (e.g. ACARE, AirTN, EASN and EREA) through the Advisory Board.

A first workshop will be held in Budapest, which will include 'Best practices in European co-operation' and Air Traffic Management research. A second workshop, in Zilina, will cover small aircraft, intermodality and coordinated calls by several Member States. A third workshop in Bucharest will include opportunities for the third FP7 aeronautics call.

In addition to networking and co-operation among institutes and universities in the central and eastern part of the European Union, integration to already existing European research networks will be fostered. Co-operation among research establishments can also enhance cross-border education and the training of young researchers.

By helping universities and institutes, CEARES indirectly helps local SMEs which often have contact with these institutions. In turn, these SMEs can also participate, as either partners or subcontractors.

Involvement of regional research organisations in European consortia will help the social cohesion of the European Union and the integration of the newer Member States.



Acronym:	CEARES
Name of proposal:	Central European Aeronautical Research Initiative
Grant Agreement:	213280
Instrument:	CSA – SA
Total cost:	128 458 €
EU contribution:	128 458 €
Call:	FP7-AAT-2007-RTD-1
Starting date:	01.04.2008
Ending date:	31.03.2010
Duration:	24 months
Technical domain:	Cross-cutting activities
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Partners:	EUROCONTROL - Central European Research, Development and Simulation Centre	HU
	Zilina University	SK
	INCAS	RO

CREATE
CREating innovative Air transport Technologies for Europe

State of the Art - Background

The CREATE project originates from the expressed need for air transport to look for potential developments that could initiate step changes and breakthrough technologies. In order to reach the ACARE Goals set for 2020, revolutionary concepts are necessary to meet these ambitious targets.

Based on this analysis, the Out of the Box project, the predecessor of the CREATE project, was designed to collect creative and novel ideas that could lead to step changes and then evaluate these ideas and assess their feasibility.

Building on this approach, CREATE aims to stimulate the development and capture of knowledge and technologies which will enable step changes to be made for sustainable air transport in the second half of this century.

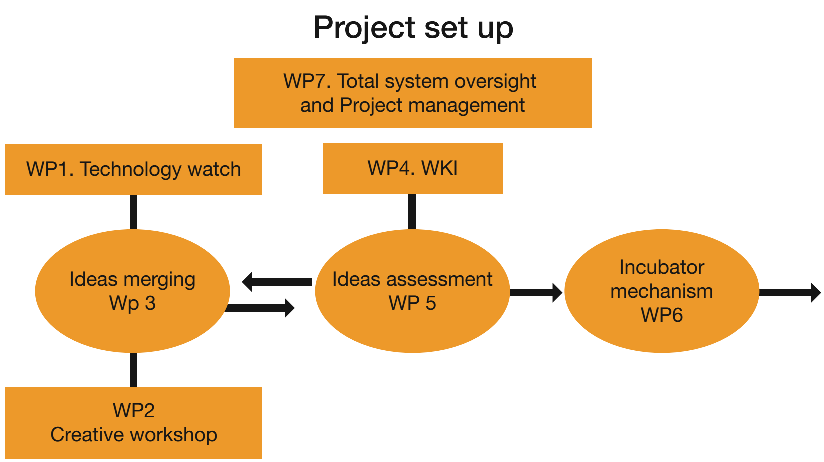
Based on the lessons learned from the Out of the Box project, it was suggested to go beyond the idea-generating workshops and assess the results by adding other elements to the process to foster innovation in the European air transport sector, namely a wiki-type website, a technology watch device, a process of merging ideas and an incubator mechanism.

The CREATE project is designed to identify and test these mechanisms at the different stages of the innovation process and provide recommendations on the best approach to maximise innovation for the future of air transport.

Objectives

The CREATE project aims at setting up a process to identify and enable creative solutions in air transport for 2040 and beyond.

The project develops and implements (as proofs of concept) six types of activities which will build the overall process:
- the technology watch to centralise relevant developments and technologies;
- the idea-generating workshop to create novel ideas;
- merging ideas;



- assessing ideas;
- the Internet-based aeronautical wiki to collect contributions from stakeholders;
- incubating novel ideas.

These activities aim at supporting and strengthening the European air transport system's positioning as a customer-orientated, sustainable and world-leading sector. The ACARE stakeholders, as well as socio-economic experts, will be involved in a number of workshops to ensure that the process is fully aligned with the needs of the sector.

The proposed set of mechanisms will result in a structured approach towards creative and innovative technology development in Europe.

Description of Work

CREATE follows logical steps and has been organised into the following work packages (WP):

WP1 develops the concept of a technology watch mechanism at the European level for the benefits of the air transport stakeholders.

WP2 develops a script for future workshops to assemble creative ideas, based on the experience of similar workshops. A workshop will be organised during the first year of CREATE.

WP3 addresses a methodology for merging different ideas coming from various sources into a structured approach on which the assessment can be based. A workshop will be organised with the air transport stakeholders.

WP4 deals with setting up an Innopedia, a wiki-type website for creative air transport ideas.

WP5 develops a cost-effective assessment procedure. Several options for managing this activity will be evaluated and a workshop will be organised with the air transport stakeholders.

WP6 first deals with an inventory of existing incubation mechanisms. The results of the ACARE institutional observation platform are used. Opportunities for creating continuity and collaboration in long-term research are developed and disseminated during a workshop.

Apart from the project management activities, WP7 is used to disseminate the results of the project.

Expected Results

The final deliverable is a report presenting the recommendations for the implementation of all the mechanisms which are assessed in the project.

All of the separate elements of the CREATE process are vital to this objective and to its delivery. Each has its own impact upon the whole as well as individual value.

Each work package generates detailed reports to collect the 'lessons learnt' from the different workshops, which are organised with the air transport stakeholders throughout the project. A wiki will be operational for the air transport community.

The CREATE mechanism attempts to design a complete innovative system operating on a full transport-sector scale. It is designed to enable a European approach to foster new ideas for the future of air transport and the step changes necessary for air transport in the future.

CREATE will thus provide a vehicle on which the future strategies for aviation may be taken forward, delivering a practical, tested, transparent and effective process that can be applied to many cycles.

Acronym:	CREATE	
Name of proposal:	CREating innovative Air transport Technologies for Europe	
Grant Agreement:	211512	
Instrument:	CSA – SA	
Total cost:	644 635 €	
EU contribution:	632 541 €	
Call:	FP7-AAT-2007-RTD-1	
Starting date:	01.11.2008	
Ending date:	31.10.2010	
Duration:	24 months	
Technical domain:	Cross-cutting activities	
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	Bauhaus Lutfahrt e.V.	DE
	QinetiQ	UK
	NIVR	NL

EUROTURBO 8
Support to Eighth European Conference on Turbomachinery Fluid dynamics and thermodynamics, Graz, March 2009

State of the Art - Background

Following the previous seven successful European Turbomachinery Conferences (ETCs) in Erlangen (DE), 1995, Antwerp (BE) in 1997, London (UK) in 1999, Florence (IT) in 2001, Prague (CZ) in 2003, Lille (FR) in 2005 and Athens (EL) in 2007, the ETC Committee has decided to hold the 2009 Conference in Graz (AT). The ETC-8 Conference is of primary interest to researchers, design engineers, users of turbomachinery components, as well as to students and PhD candidates, allowing them to present and discuss their most recent scientific results.

EUROTURBO 8 is intended to be a primary driver for technology transfer across Europe in this field through the presentation of the latest developments and best practices. It is also intended to enhance knowledge transfer among senior scientists working at the edge of turbomachinery technology, in the attempt to further enhance the actual designs and concepts, and all users who intend to benefit from its progress.

This conference is also seen as an integrating element between Western and Eastern European countries, and as an additional means to foster collaboration in turbomachinery research at a European level. In addition, it is an ideal forum to relate and disseminate the results of research projects funded by the European Commission and therefore benefits from the support by the Commission.

Objectives

This action supports the organisation of the Eighth European Conference on Turbomachinery – Fluid dynamics and thermodynamics, Graz, 23-27 March 2009. The EC support allows to propose reduced fees for students from all over Europe, for all participants from the newly integrated countries and those to be integrated in the future in the European Union. This makes this conference a prime event for European integration in the field of turbomachinery.

Compared to the previous successful conferences, EUROTURBO 8 intends to improve its impact further by the following measures:

1. Dissemination of the newest turbomachinery knowledge;
2. First actions for the harmonisation of disseminating scientific knowledge in the field of aeronautics in co-operation with other European associations (ERCOFTAC, ECCOMAS, CEAS, EUCAS and EUROMECH);
3. Admittance of a Russian turbomachinery expert as a member of the European Turbomachinery Committee in order to increase the visibility in Russia and enhance co-operation;
4. Additional dissemination of the 'Call for Papers' using the National Contact Points from the EU to increase the conference's visibility which resulted in attracting additional abstracts.
5. Special efforts to secure the dissemination in countries which do not have a representative in the organising committee.

Description of Work

In order to organise a successful conference and achieve all the goals mentioned above, the following preparatory work was done:

Title page of the Call for Papers published in January 2008

- publication of conference call and final conference programme;
- advertising the conference;
- seeking conference support from industries and associations;
- maintaining the conference website;
- collecting abstracts and performing an evaluation process;
- collecting draft and final papers;
- organising the paper review process;
- making contact with authors and review organisers;
- organising the conference venue;
- launching a conference website (www.etc8.tugraz.at);
- employing a conference secretary;
- organising the welcome reception and gala dinner;
- layout and printing of the conference proceedings;
- printing of conference CDs;
- organising facility tours;
- regular board meetings;
- online publication of papers for free download.

Expected Results

The conference organisation, as well as the handling of the submitted abstracts and papers, worked very well, so that all goals and deadlines were achieved.

- 281 abstracts were submitted to the conference; 256 were accepted which corresponds to 94%;
- 156 papers were submitted for review;
- 48 review organisers under the guidance of the review organiser (partner 3) arranged for 468 reviews;
- 126 papers were finally accepted for the conference which corresponds to an acceptance rate of 81%. This high number of papers also means an increase of 12% compared to the last ETC conference in Athens, Greece;
- 13 papers, 8% of the submitted papers, were suggested for journal publication.

The papers were published in the conference proceedings (ISBN 978-3-85125-036-7) as well as on a CD-Rom, a copy of which was given to each attendee of the conference. Over the next months the papers will be published on the ETC website for free download to increase the dissemination of the scientific results.

The conference took place at the auditorium of the University of Graz. Four lectures were given by representatives from industry, one at the beginning of each day. The conference was divided into two or three parallel sessions in order to accommodate the total number of selected papers.

Four exhibitors presented their products during the conference meeting hours.

Acronym:	EUROTURBO 8	
Name of proposal:	Support to Eighth European Conference on Turbomachinery Fluid dynamics and thermodynamics, Graz, March 2009	
Grant Agreement:	233666	
Instrument:	CSA – SA	
EU contribution:	15 000 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	08.05.2008	
Ending date:	07.05.2009	
Duration:	12 months	
Technical domain:	Cross-cutting activities	
Website:	http://www.etc8.tugraz.at	
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EC Officer:	Mr. Rémy Dénos	
Partners:	Von Karman Institute for Fluid Dynamics	BE
	Universitá degli Studi di Napoli 'Federico II'	IT

ICOA.10.09

International Conference on Airports, October 2009, Paris

State of the Art - Background

The Académie de l'Air et de l'Espace (Air and Space Academy – AAE) organises a two-day conference on the theme 'Airports and their challenges' in the grand auditorium of the French Aviation Authority DGAC on 7-8 October 2009.

AAE organised a successful conference on the theme 'Airports of the future' in November 1995 in Paris. It is now necessary to take another look at this question so as to take account of changes, decisions and actions that have taken place in the mean time. The major challenges currently facing European aviation, particularly airports, make it crucial to assemble the players involved so as to discuss the future.

Why hold this conference?

Europe needs to develop new transport networks and infrastructure in order to support its industry and promote economic growth. Air transport has increased faster than any other mode of transport in the past 20 years and is expected to double in the next decade, but the problem of air traffic saturation is looming.

Objectives

Airports are an essential element in the function of air transport, the latter being by nature a service activity. Despite the crucial, irreplaceable role airports play within the air transport system, their evolution and future prospects are sources of tension and even conflict between the different economic and political players involved.

Reflection is thus needed on how to guarantee sufficient airport capacity in the enlarged European Union whilst respecting the different constraints of safety, security, environment, customer satisfaction, intermodality, etc.

This conference will aim to achieve a broad, dynamic vision of the evolution of airports in Europe, the different challenges and constraints facing them, and their future prospects within a 15-20 year timeframe. The conference will bring together policy-makers and operators from the European air transport system in order to pool information on the current state of affairs, share new innovative ideas and encourage discussions about the future. AAE will aim to take account of any current research projects impacting on issues under discussion in the conference. Results will be diffused as widely as possible to interested parties in Europe and elsewhere.

Description of Work

AAE has a wide experience in organising conferences and will bring this experience to bear in attracting top-level speakers, and communicating efficiently so as to achieve an international profile, a high level of participation and optimal impact. The central location in the DGAC Paris will ensure high quality facilities: audiovisual means, translating resources, comfort and capacity, and the reception at the Automobile Club will provide a further opportunity for participants to mingle and share experiences and ideas to take back to their respective countries.

Expected Results

By engaging policy-makers and operators from the European air transport system in high quality exchanges, the conference will serve to take stock of the current situation and the issues facing airports, pool ideas as to how to tackle the various challenges and promote innovative ideas for the future. In doing so it will contribute to harmonising and optimising the air transport system on a European level.

The conference sessions are the following:

Session 1: Airports: meetings customers' needs;

Session 2: Airport services;

Session 3: Specific demands of sustainable development;

Session 4: Evolution and innovation.

After the conference, its impact will be maximised with the publication of proceedings and a recommendations booklet, as well as a follow-up on the AAE website.

Acronym:	ICOA.10.09
Name of proposal:	International Conference on Airports, October 2009, Paris
Grant Agreement:	233672
Instrument:	CSA – SA
Total cost:	126 000 €
EU contribution:	56 000 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.11.2008
Ending date:	01.03.2010
Duration:	17 months
Technical domain:	Cross-cutting activities
Website:	http://www.air-space-academy.org
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EC Officer:	Ms. Stéphanie Stoltz-Douchet
Partners:	/

AERO-UKRAINE
Stimulating Ukraine–EU Aeronautics Research Co-operation

State of the Art - Background

Ukraine has a proud heritage in aeronautics dating from the Soviet era. It is one of the few countries to have research, engineering and production capabilities across a wide range of aeronautical technologies. Despite this, the participation of Ukrainian aeronautical actors in the EC's research framework programmes is very low (approximately six contracts won under the Sixth Framework Programme – Aerospace involved Ukrainian organisations).

Objectives

The overall objective is to facilitate research co-operation between aeronautics actors in the EU and Ukraine. The project will achieve its overall objective via three groups of activities:
- assessing and publicising the aeronautics collaboration potential between the EU and Ukraine;
- organising combined awareness-raising, training and networking events about Seventh Framework Programme (FP7) aeronautical collaborative research opportunities;
- supporting Ukrainian aeronautical actors to join consortia preparing FP7 aeronautics research proposals.

Description of Work

WP1: Assessing and publicising the aeronautics collaboration potential between the EU and Ukraine:
- for the Ukrainian aeronautics actors, a short 10-15 page brochure will be prepared describing the opportunities and providing practical advice on how to get involved in FP7 collaborative research projects;
- for the EU aeronautics organisations, a one to two-page profile will be compiled for the 50 strongest Ukrainian actors;
- a White Paper on aeronautics R&D in Ukraine will be produced for EU aeronautical organisations.

WP2: Raising awareness and understanding of EU aeronautics collaborative research

1. Three FP7 aeronautics events will be organised in Ukraine, combining three activities:
   - awareness-raising about FP7 aeronautics research opportunities;
   - training on how to participate in FP7 collaborative research projects;
   - networking with EU aeronautics research organisations.
2. A few Ukrainian aeronautical experts will present AERO-UKRAINE and their aeronautics research at three aeronautics events in the EU.

WP3: Supporting participation in FP7 aeronautics research

1. Help to establish a FP7 Aeronautics NCP for Ukraine.
2. Support some Ukrainian aeronautics actors to join consortia preparing FP7 research proposals through promotional information and introductions to EU aeronautical experts during FP7/aeronautical events in Ukraine and the EU.

Expected Results

The results of this project will be:
- a White Paper on aeronautics R&D in the Ukraine that describes the main Ukrainian aeronautics actors, includes PEST and SWOT analyses of the aeronautics sector, and makes recommendations for future research co-operation. The brochure will be available in English, Russian and Ukrainian via the AERO-UKRAINE web-portal.

- a website will be developed where information on about 50+ aeronautical actors in Ukraine will be available;
- organisation of two awareness-raising/training/networking FP7 aeronautics events in Ukraine;
- participation in three aeronautics networking events in the EU;
- help to establish a FP7 aeronautics NCP in Ukraine;
- support for six or more Ukrainian aeronautical actors to join consortia preparing FP7 research proposals;
- organisation of a final dissemination conference in Kiev.

Acronym:	AERO-UKRAINE	
Name of proposal:	Stimulating Ukraine–EU Aeronautics Research Co-operation	
Grant Agreement:	233640	
Instrument:	CSA – SA	
Total cost:	201 952 €	
EU contribution:	201 952 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.04.2009	
Ending date:	31.03.2011	
Duration:	24 months	
Website:	http://aero-ukraine.eu	
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EC Officer:	Mr. Pablo Pérez Illana	
Partners:	Intelligentsia Consultants Ltd	UK
	University of Patras	GR
	National Aerospace University – Kharkiv Aviation Institute – named by N. Zukovskiy	UA
	Frantsevich Institute for Problems of Materials Science, National Academy of Science of Ukraine	UA
	Zaporozhye Machine-Building Design Bureau Progress State Enterprise named after Academician A.G. Ivchenko	UA
	Antonov Aeronautical Scientific and Technical Complex	UA

AEROAFRICA-EU

Promoting European-South African Research Co-operation in Aeronautics and Air Transport

State of the Art - Background

South Africa's (SA) relationship with the European Union (EU) is a strategic partnership in science and technology, marked by longstanding political, economic and development co-operation ties. Collaborative initiatives in the past have brought about not just the enhancement of the international knowledge base, but real improvement in the quality of lives of both Europeans and South Africans.

Both the EU and SA have recognised the importance of the aeronautics sector as a driver of innovation and competitiveness across the industrial base, and the EU is SA's largest research and development (R&D) partner in the aeronautics and air transport domains.

There are common aims and objectives between both entities and the SA industry is becoming increasingly more integrated with the European aeronautics community.

AeroAfrica-EU aims to promote European and South African research co-operation in aeronautics and air transport. A platform will be created to enhance co-operation between these two entities and the potential for the participation of other African countries will also be explored. The project is supported by the EU's Seventh Framework Programme (FP7) under the Work Programme AAT.2008.7.6 'Stimulating research with international co-operation partner countries'.

Objectives

The overall objectives for AeroAfrica-EU are:
- to explore the potential for enhancing co-operation through an analysis (mapping) of aeronautics and air transport R&D co-operation between the EU and SA, as well as other African countries;
- to develop and enhance networks and partnerships between the EU, SA and other African researchers and organisations in identified technical themes ideally suited for mutually beneficial aeronautics and air transport R&D co-operation;
- to promote SA and African participation in the aeronautics and air transport activities of FP7 through focused information and advisory services;
- to establish an aeronautics and air transport R&D policy dialogue between the EU and SA, as well as other African partners, so as to also support economic and development co-operation.

Description of Work

WP 1: Mapping the aeronautics and air transport landscape: interactions will be collated and analysed in the following categories:
- R&D competences in Africa governmental, research and private sectors;
- collaborations such as FP projects, bilateral initiatives, etc.;
- the 'enabling environment' (co-operation, legislative frameworks, etc.);
- specific SA/African R&D strengths;
- political, economic or development co-operation imperatives;
- Funding mechanisms.

Workshops will be held to discuss the mapping and identify further areas for co-operation. The project website will also facilitate communication and dissemination to a broad audience.

WP 2: Developing and enhancing networks and partnerships: SA researchers and institutions will be actively promoted to their EU counterparts through thematic workshops, awareness sessions, and international aeronautics and air transport conferences.

WP 3: Consolidating and mobilising towards supporting FP7: by encouraging African aeronautics researchers to participate in FP7, achieved through a portal on the project website.

WP 4: Identifying and demonstrating mutual interest and benefit in R&D co-operation: by creating a policy framework to allow stakeholders in the aeronautics and air transport research environment to discuss issues of relevance, identify areas of co-operation and define mechanisms to foster greater collaboration.

Expected Results

The results of this project will be:

- enhanced networking and partnering in the aeronautics R&D community, specifically facilitating external communication and raising awareness. Workshops hosted in Europe and in Africa will be utilised to showcase this project and European/African research projects;
- improved collaboration between EU and SA/African countries. The intention is to prepare a policy paper on the links between aeronautics and air transport R&D co-operation with political, economic and development co-operation between Africa and Europe.
- increased participation in FP7 by SA and African aeronautics researchers. The project will provide assistance and information on the functioning of FP7, and offer access to knowledge and expertise to aid successful participation in FP7;
- leveraged co-operative relationships through the joint identification of needs and priorities.

Acronym:	AEROAFRICA-EU
Name of proposal:	Promoting European-South African Research Co-operation in Aeronautics and Air Transport
Grant Agreement:	234092
Instrument:	CSA – SA
Total cost:	411 312 €
EU contribution:	363 165 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	02.02.2009
Ending date:	31.01.2011
Duration:	24 months
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Partners:	Aerospace Valley	FR
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	Fraunhofer-Gesellschaft zur Förderung der Angewandten Forschung e.V.	DE
	Kungliga Tekniska Högskolan	SE
	Department of Science and Technology	ZA

AirTN-FP7

Air Transport Net (AirTN) as one of the key enablers for the prosperous development of Aeronautics in Europe

State of the Art - Background

The AirTN ERA-Net was established under FP6 as a network of Member and Associated States whose agencies manage public funded national research activities and programmes in Aeronautics and Air Transport. The various Work Packages (WPs) have delivered many of the objectives of the project set out at the start. Its success to date has prompted the network to apply for an additional period of support under the FP7 programme to continue its development and allow for further member state involvement and co-operation.

For Aeronautics and Air Transport, the ERA-Net AirTN has resulted in an excellent network of member states and their agencies. Significant progress has been made towards achieving the main objectives, which are to step up the co-operation and coordination of research activities at national level and to expand the European dimension.

As well as the defined goals, AirTN was able to fully integrate the new member states (NMS). NMS benefited from information exchanges on the system of national programmes, their financing and their organisation. Using examples from the States where the system is well developed enabled the governments and governmental organisations in the NMS to improve their methods and organisation of aeronautical research. As a result of this, ERA-Net AirTN was one of the most effective tools to support non-discriminatory research in the NMS on a partner basis. Given this positive experience, co-operation within the AirTN FP7 will be further enhanced.

Objectives

The AirTN ERA-Net was established under FP6 as a network of Member States whose ministries and agencies manage publicly funded national research activities and programmes in Aeronautics and Air Transport.

Now in its third year, AirTN is set to run until the end of 2008. AirTN in FP6 has completed the first steps of the ERA-NET instrument through the systematic exchange of information mutual learning between Member States and the identification of possible areas for co-operation. The results from these WPs are prerequisites for the implementation of joint activities to enhance co-operation and coordination of national and regional research programmes. The success of the initial steps has prompted the network to apply for an additional period of support under the FP7 programme to continue its development and allow for further member state involvement and support in order to reach its ultimate objectives.

AirTN in FP7 will strengthen this coordination and strive for long lasting co-operation. It will bring added value to the foundation of the European Research Area and the development of a European Research Policy, especially in relation to aeronautics and air transport. The focus will be on the Implementation of Joint Activities step 3 of the ERANET instrument and step 4, the funding of transnational research.

The governing objective of all AirTN activities is to continue strengthening the European Research Area within the framework of the ACARE Strategic Research Agenda.

In particular, the following objectives shall be pursued in this project:
- Increased efficiency, synergy, and avoiding the duplication of research performed on European, national and regional levels;
- Increased complementary research activities within Europe;
- Unlocking the untapped potential of skills and resources in Europe, especially in the new and smaller member states and regions;
- Facilitating the development of a joint strategy for research infrastructures and facilities;
- Identifying successful approaches to ensuring a skilled workforce.

Description of Work

The work plan is as follows.

WP1:
- Point of contact for the Commission and fulfilment of contract obligations;
- Management of the consortium;
- Coordination of activities and fulfilment of objectives;
- Analysis of common strategic issues;
- Consideration of specific target groups' interests with respect to joint activities and briefing of specific target groups with respect to AirTN activities and objectives;
- Maintenance of the virtual laboratory to be used as an electronic means of communication.

WP2:
- Information collection on research programmes;
- Research topics for joint activities;
- Establishment of a catalogue of aeronautical research infrastructures in various EU countries and analysis of corresponding investment policies, priorities and mechanisms.

WP3:
- Development of documentation and processes for implementing joint activities;
- Providing best practise information to member/associated states aiming to set up joint activities/joint research programmes;
- Supporting both modalities of joint activities: Project-by-project basis and structured approach.

WP4:
- Preparing the ERA-Net for Transnational programmes by developing schemes and procedures, and also providing plans and facilities for the network with the possibility of becoming sustainable, post-EC funding;
- These aims will be further supported by multinational pilot actions, joint activities and joint calls on some widely used components and instruments of national and international programmes.

WP5:
- Maintenance of the public website;
- Organisation of thematic fora;
- Organisation of a dissemination conference.

Expected Results

Aeronautics is important to Europe, socially, economically and strategically. AirTN-FP7's role will be to continue strengthening the foundation of European Research in Aeronautics and Air transport.

This will be achieved through further co-operation and coordination of national and regional research programmes, and the development of policies in support of strategic planning.

Ambitions for Europe, set at the highest political level, envisage the development of the European economy towards becoming the most innovative in the world. Aeronautical capability plays a pivotal role in this. Whilst paying attention to issues such as environment, increased Air Transport System capacity, security and safety, AirTN-FP7 will enhance and centralise the European aeronautics focus by increasing the alignment of national programmes, leading to more innovation and hence greater probability of finding solutions to policy-driven challenges.

Acronym:	AirTN-FP7	
Name of proposal:	Air Transport Net (AirTN) as one of the key enablers for the prosperous development of Aeronautics in Europe	
Grant Agreement:	235476 (Under Negotiation at the time of editing)	
Instrument:	CSA – SA	
Total cost:	1 900 000 €	
EU contribution:	1 900 000 €	
Call:	FP7-ERA-2008-RTD	
Starting date:	01.01.2010	
Ending date:	31.12.2013	
Duration:	36 months	
Website:	http://www.airtn.eu	
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EC Officer:	Mr. Dietrich Knoezer	
Partners:	BMWi - Bundesministerium für Wirtschaft und Technologie	DE
	MDPT SR - Ministry of Transport, Posts and Telecommunications	SK
	University of Zilina	SK
	BMVIT - Bundesministerium für Verkehr, Innovation und Technologie	AT
	FFG - Austrian Research Promotion Agency	AT
	CDTI - Centre for the Development of Industrial Technology	ES
	Ministerie van Economische Zaken	NL
	NLR - Nationaal Lucht- en Ruimtevaartlaboratorium	NL
	BELSPO - Belgian Federal Science Policy Office	BE
	S.E.R. Stiftung CH - Foundation for Subjective Experience and Research	CH
	DGAC/ DTA - Direction Générale de l'Aviation	FR
	ONERA - Office National d'Études et de Recherche Aérospatiales	FR
	GSRT - General Secretariat for Research and Technology	GR
	NKTH -National Office for Research and Technology	HU
	Enterprise Ireland	IE
	MIUR - Ministry of University and Research	IT
	CIRA - Centro Italiano Ricerche Aerospaziali S.C.p.A.	IT
	NCBiR - National Centre for Research and Development	PL
	FCT - Foundation for Science and Technology	PT
	ROSA - Romanian Space Agency	RO
	VINNOVA Research and Innovation for Sustainable Growth	SE
	Department for Business, Innovation and Skills (BIS)	UK
	Technology Strategy Board	UK

COOPAIR-LA

Guidelines for Cooperation of Latin American Countries in European Aeronautics and Air Transport Research

State of the Art - Background

There are important gaps in aeronautics research cooperation and communication between Latin America and the European Union. Some International Cooperation projects in fields such as Health, Food and IST have been successfully tackled. However, research in aeronautics is not taking advantage of all the benefits that this collaboration with Latin American could bring.

CoopAIR-LA aims to stimulate and promote cooperation in the field of aeronautics through collaborative research and development initiatives under the European Framework Programme. Rather than just establishing a development programme for Latin American countries in aeronautics, CoopAIR-LA aims to identify the existing potential for participation in Framework Programmes as partners on a medium-term basis. The project seeks to know and integrate the current scientific research, technological innovation and execution activities within the aeronautic research field, building a multinational and multi-stakeholder community involving relevant R&D European and Latin American actors (researchers, policy makers, users).

Objectives

CoopAIR-LA is ambitious and innovative as an action supporting and fostering the cooperation between the European Union (EU) and Latin American countries (LA). It aims to deepen strategic RTD cooperation. Building on what already exists in multinational and multi-stakeholders communities, by identifying common interests and opportunities for cooperative RTD, it will target relevant participants (researchers, companies, policy makers, users) on RTD in Europe and Latin America.

The project will:

1. Build the observation, analysis and forecasting capacity required to identify key R&D issues on which to focus EU-LA cooperation, as well as key actors that will be involved in EU-LA collaboration in the field.
2. Analyze the barriers and troubles found by the potential LA partners when trying to participate in EU R&D programmes, as well as the difficulties encountered while taking part in any project.
3. Consider the findings on what the main obstacles are, and establish effective mechanisms to enhance the participation of the LA partners.
4. Ensure that information on European R&D is promoted to a large number of research, policy and practice actors in LA, therefore also facilitating dialogue among them.
5. Organize several conferences and workshops in LA and Europe, and a final Conference in the EU to identify networking opportunities.

Description of Work

The project is divided into the following Work Packages (WPs):

WP2 is dedicated to identifying actors and analysing the aeronautics field in Latin America, more specifically in Brazil, Chile, Argentina and Mexico. To achieve this, a mapping will be performed to identify the actors involved as well as the existing research programmes and projects in the field of aeronautics research.

WP3 aims to find and analyse the main barriers/difficulties leading to the observed low participation in research projects. One of the main outcomes of this WP is the elaboration of a guide of recommendations to overcome these issues and facilitate participation in the Framework Programme.

WP4 has the objective of identifying synergies between the LA countries R&D capabilities and the needs of the European aeronautics research programme.

The aim of WP5 is to support and stimulate the participation of LA Countries in Framework Programme 7 (FP7). For this purpose, three workshops will be held in LA. The recommendations and guidelines prepared in WP3 will be used for the promotion of the European research programmes in LA and for ideas for further collaboration, with a view to collaborate further with the European stakeholders, and to strengthen capabilities for further projects.

WP6 is devoted to the dissemination of the CoopAIR-LA results that will be performed via the design of a multilingual project flyer and posters, and via CoopAIR-LA's communication platform.

Expected Results

- Enhanced participation of Latin American countries in European aeronautic research, through the promotion of a 'European–LA knowledge scenario';
- The promotion of an active cooperation between European and Latin American countries, through the identification and assessment of mutual interest priorities of future work programmes across the Specific Programmes of FP7, and between LA countries' preferred cooperation areas and Europe;
- Increased visibility and interaction/coordination between the initiatives and activities related to aeronautics which are being carried out at a European and international level, and R&D in aeronautics;
- Contributing to building an air transport system that responds to society's needs, leading in global markets for aircraft, engines and equipment, through the establishment of a network of actors involved which will contribute to potential collaborations;
- Acting as a major mediator and catalyst in Europe's efforts for the reinforcement of its strategic LA partnership in aeronautics research with Brazil, Argentina and Chile, therefore enhancing European competitiveness, acquiring the best competences while facing global competition.

Acronym:	COOPAIR-LA
Name of proposal:	Guidelines for Cooperation of Latin American Countries in European Aeronautics and Air Transport Research
Grant Agreement:	234321
Instrument:	CSA – SA
Total cost:	333 074 €
EU contribution:	333 074 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.04.2009
Ending date:	30.09.2010
Duration:	18 months
Website:	http://www.coopair-la.eu/
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EC Officer:	Mr. Pablo Pérez Illana

Partners:	Ingeniería de Sistemas para la Defensa de España, S.A.	ES
	Universidad Politécnica de Madrid	ES
	AIRBUS S.A.S	FR
	Empresa Brasileira de Aeronáutica, S.A.	BR
	Skysoft Portugal, Software e Tecnologias de Informação, S. A.	PT
	Polish Institue of Aviation	PL
	Ministerio de Ciencia, Tecnología e Innovación Productiva	AR
	Consejo Nacional de Ciencia y Tecnología	MX

E-CAERO
European Collaborative Dissemination of Aeronautical Research and Applications

State of the Art - Background

In the green paper 'The European Research Area: New perspectives', the European Commission recognizes that a fragmentation of the ERA still exists, preventing Europe from fulfilling its research and innovation potential. In particular, effective knowledge-sharing should be achieved at European level.

In the field of aeronautics and air transport, there are many initiatives at European level undertaking the dissemination of scientific knowledge in the different relevant disciplines. Different associations are active with different formats of events such as large conferences, moderate size thematic conferences, symposia, workshops, short courses, etc. In addition to presentations in events, the knowledge is further disseminated under the form of journal publications, proceedings, etc. More and more publications are now electronic which gives them a large potential for easy distribution and allows the use of electronic search facilities.

For this reason, six organisations active in this field (ECCOMAS, the coordinator, CEAS, ERCOFTAC, EUCASS, EUROMECH and EUROTURBO) have decided to unify forces in order to increase their effectiveness. The main objective is harmonizing their activities in the field of aeronautical research.

Objectives

The main objectives of E-CAERO are to:
- reinforce the network of participating organisations by promoting inter-organisational co-operation;
- identify and promote best practices;
- significantly improve the industrial end-users participation in the actions programmed by the member organisations;
- start a new collaborative work culture between the associations.

This intangible benefit is a real necessity in this sector and will result in a much more efficient dissemination of the European research in this field. Eventually, this may lead to the creation of a legal entity that merges the partners' aeronautical interests.

Description of Work

The objectives will be achieved by activities carried out within the five interactive technical Work Packages (WPs). These work packages are the following:
- WP1. Overall Management, technical coordination and specifications;
- WP2: Identification of overlaps and complementaries, both thematic and organisational;
- WP3: New collaborative dissemination tools;
- WP4: New single and clustered events as harmonized dissemination demonstrators: Short Courses, Thematic Conferences, Workshops, etc.;
- WP5: Evaluation of harmonized collaborative dissemination and recommendations and guidelines.

E-CAero proposes a number of joint activities which together represent a systematic endeavour to improve the coordination among the participating organisations and promote deeper co-operation.

An initial step is carrying out a systematic survey in order to construct a detailed picture of the different structures, methodologies, priorities and resources of the participating organisations. The information provided by this survey will have a direct effect on the quality of the events organised.

The E-CAERO activities also aim to establish sustainable contacts and communication between the member associations, the partners and the European Commission. It is through these contacts that the actions undertaken by the participating organisations will become more efficient.

It is also important to improve the interaction with industry, and surveying industrial participants to best appreciate their needs. Organising high quality events is also aiming at attracting industrial participation.

Expected Results

E-CAERO is expected to improve the collaborative dissemination of aeronautical and turbomachinery research in Europe and thus, increase the efficiency and competitiveness of the European aeronautics industry. The clustering of the different associations in the dissemination of their activities and outcomes is expected to produce a transversal diffusion of the information and knowledge, resulting in a better understanding of techniques, experimental knowledge and simulation tools.

Scientific and technical outputs:

a) The E-CAERO web page used to jointly disseminate the activities of the partner associations concerning aeronautical research and providing a unique overview on the calendar of dissemination events in Europe;

b) A web-based E-CAERO repository for publications, possibly including items as proceedings, benchmark tests and experimental results;

c) A conference management IT tool adapted to the needs of the partner associations. This tool is intended to be used in the jointly organized events that will be the project demonstrators;

d) Harmonization and increased visibility of the dissemination events organized jointly;

e) New collaboration culture bewteen the associations.

Logos of the six partners

Acronym:	E-CAERO
Name of proposal:	European Collaborative Dissemination of Aeronautical Research and Applications
Grant Agreement:	234229
Instrument:	CSA – SA
Total cost:	713 487 €
EU contribution:	713 487 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	01.09.2009
Ending date:	31.08.2012
Duration:	36 months
Website:	http://www.e-caero.com
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Partners:	European Research Community on Flow, Turbulence and Combustion	BE
	Council of European Aerospace Societies	ES
	European Conference for Aerospace Sciences	BE
	European Mechanics Society	DE
	Von Karman Institute for Fluid Dynamics	BE

FUSETRA
Future Seaplane Traffic - Transport Technologies for the Future

State of the Art - Background

The annual air traffic growth rate of 5% and higher has been almost constant over the last decade but the IATA forecasts an even higher rate for the coming years. Consequently, the capacity overload of current airports and the demand for point-to-point connections has grown considerably.

The length of coastline and number of islands in Europe were considerably increased when the new Member States joined the EU, creating great potential for an international air traffic system using seaplanes/amphibians. With these vehicles, new traffic routes can be developed with the advantage of short flights, including point-to-point connections to national and international airports using natural landing strips.

At the moment, scheduled commuter seaplane/amphibian operations are only available in very few locations in Europe.

Operators and entrepreneurs interested in starting new seaplane businesses in Europe report a lack of modern airplanes, international standards and rules, and a shortage of expertise.

Based on this preliminary analysis the proposal aims to investigate today's seaplane situation, to evaluate its weaknesses and strengths, and to elaborate a set of concepts and requirements for a future seaplane air transportation system for 'Improving passenger choice in air transportation', including technical requirements for 'new vehicles'.

Objectives

The general objective of the FUSETRA proposal is to demonstrate the needs, and quantify the potential, of seaplane traffic business development, as well as to propose recommendations for the introduction of a new seaplane/amphibian transportation system.

The main objectives are:
- identifying possibilities to improve seamless travel by implementing seaplane transportation systems within the European air and landside transportation infrastructure;
- developing solutions which are ready for implementation by ensuring passenger acceptance (evidence of seamless travel, flight-time reduction, reduced operational cost, operational safety, better access to international air traffic);
- identifying a reduced environmental impact of air transport by developing solutions for point-to-point seaplane operations;
- propositions for enabling a uniform implementation (EU-wide) of the chosen seaplane operational system (regulatory issues, water landing fields, etc.);
- improving the accessibility of regions by serving both business and private passengers;
- identifying the number of seaplanes needed for future operations and technical specifications for new vehicles fulfilling the demand of stakeholders (operators, passengers, etc.);
- improving transnational co-operation by organising international workshops.

Description of Work

There are two major tasks:
- state-of-the-art status of worldwide seaplane/amphibian operation and their effectiveness;
- the definition of future-oriented concepts and requirements for a new European seaplane/amphibian transport system, and its integration into the sea/air/land transport chain and the necessary regulatory issues.

Three workshops will be organised in different maritime locations (Mediterranean, Atlantic and Baltic) for the collection of existing experiences and ideas for better and more effective future traffic concepts. All the important stakeholders will be invited. Besides prepared speeches given by experts, open panel discussions and accompanying working group activities will take place.

Based on these results, the experience of our industrial partners and the research work carried out by the universities, concepts and requirements will be established for a rational seaplane infrastructure, aircraft fleet structure and market-oriented vehicles for a future regional airline network in Europe. Additionally, the integration of seaplane/amphibian operation into the current seamless transport system will be considered, taking into account environmental and air traffic management constraints too.

Additionally, a regulatory roadmap for assuring effective and environmental feasible operations and the development of new infrastructure and vehicles shall be developed.

Expected Results

The following results will be achieved and published:

- current seaplane/amphibian database;
- workshop proceedings summarising the results as experiences, deficiencies, market needs, economical, environmental and regulatory issues;
- a report on the current strengths and weaknesses of existing seaplane/amphibian transport systems, as well as future opportunities for a new seaplane/amphibian transport system;
- a report on the requirements for a new seaplane/amphibian transport system as an integrated part of a future sea/land/air transportation system;
- a roadmap for regulatory issues.

The procedure and results of FUSETRA will have a significant impact on the population. For regional locations with no ideal transport connections, sea parks would support the accessibility and mobility of the population and improve customer satisfaction. Additionally, sea parks would give those regions a better chance for regional economic development.

FUSETRA will also have a direct impact on the strategy of future regulatory issues in its interdisciplinary co-operation between sea, land and air, between local and EU authorities.

Acronym:	FUSETRA	
Name of proposal:	Future Seaplane Traffic - Transport Technologies for the Future	
Grant Agreement:	234052	
Instrument:	CSA – SA	
Total cost:	397 772 €	
EU contribution:	397 772 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.12.2009	
Ending date:	31.05.2010	
Duration:	18 months	
Website:	http://www.fusetra.eu	
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	Dornier Aviation GmbH	DE
	Technische Universität München	DE
	Rzeszow University of Technology	PL
	University of Glasgow	UK

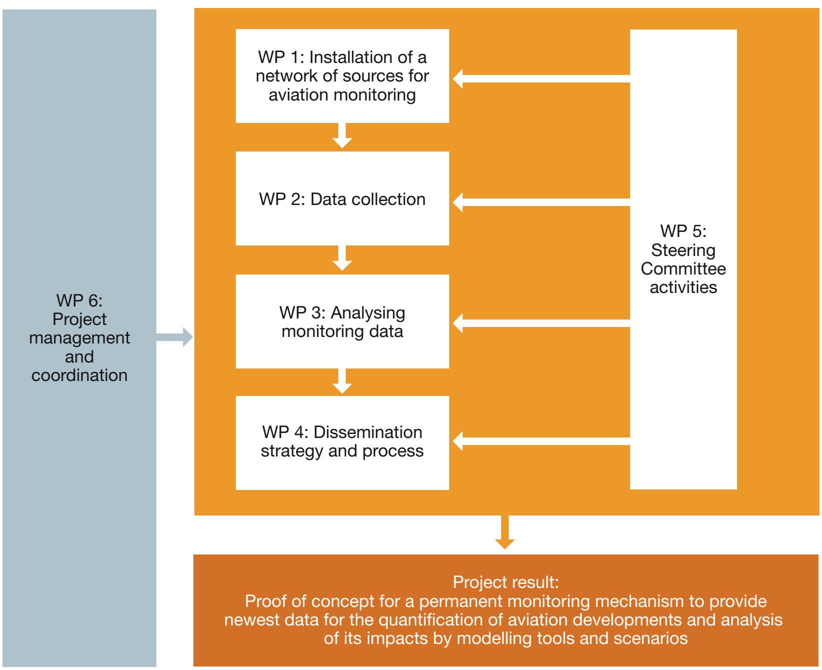
MONITOR
Monitoring System of the Development of Global Aviation

State of the Art - Background

The results of the project CONSAVE 2050, successfully completed in 2005 under the EC Framework Pprogramme 5, have clearly identified the need for scenarios for the aviation community. CONSAVE 2050, addressing long-term aspects of air transport and elaborating on limited alternative futures was well received by air transport stakeholders, particularly for its efforts to quantify effects of different future developments. In this context, a wide variety of stakeholders declared the need for a one-stop solution for their data needs for strategic decision-making and modelling activities. It has been identified that existing data sources were of heterogeneous quality throughout the European Union, difficult to find or to access, and therefore seriously impeding the quality of forecasting and modelling of future air transport scenarios.

Responding to the declared needs of stakeholders for modelling, forecasting and scenario activities, project partners of AERONET and CONSAVE 2050, among others, developed the concept of the MONITOR project for developing a Monitoring System of the

MONITOR – Project Structure



Development of Global Aviation that is able to address these issues and fulfill the requirements of the different aviation stakeholders.

Objectives

The project's main objective is to install a network of reliable sources for a set of key data relevant for scenario and modelling activities and a monitoring system that supports the transportation and related environmental science community, the aviation industry and the policy and regulatory community. Once established, the Monitoring System of the Development of Global Aviation will foster an intensive analysis of new relevant developments for the future of aviation. The project, through intensive contacts to a broad range of experts and aviation organisations, and through the establishment of a Steering Committee of stakeholders, will contribute to a common European understanding of critical issues in aviation developments.

The main socio-economic objectives of the project are:

(i) To strengthen the European aeronautical industry by delivering sound information which can be used to develop in time strategic orientation of the short-, medium-, and long-term planning;

(ii) To improve the competitive position of European air transport stakeholders in the global market for air transport and related services and to support these stakeholders in their efforts to achieve sustainable growth in their particular business activities;

(ii) To ensure sustainable growth of air transportation in general with regard to environmental, social and economic issues, which are important to the overall development of social welfare for the societies in the Member States of the European Union.

Description of Work

The project is subdivided into five work packages (WPs):

- WP1: Installation of a network of sources for aviation monitoring;
- WP2: Data collection ;
- WP3: Analysing monitoring data;
- WP4: Dissemination strategy and process;
- WP5: Steering Committee activities;
- WP6: Project management and co-ordination.

Given these tasks, MONITOR covers the widest possible range of data including environmental, economic, social and technological areas. As well as this method of data collection, an important element of the project will be the development of workflows to harmonise data from different sources and to make this information available to interested stakeholders in a consistent data format. This approach is a unique feature of MONITOR, as the project shall serve as a service provider for all kinds of modelling activities and scenario development. In addition, a Steering Committee will be established to monitor this work and to discuss the results of the project during several meetings and on a stakeholder workshop. Another way to improve the different monitoring activities during the project will be the use of the AERO-MS model (Aviation Emissions and Evaluation of Reduction Options Modelling System) to validate data, conduct sensitivity analyses and to bridge gaps where data is not available or deemed as unreliable. The project is also expected to keep strong contact with other relevant groups (ACARE) and stakeholders not involved directly in the project activities but working on complementary projects in a similar direction. This guarantees fast reaction on new developments in the aviation sector which shall be analyzed as one important outcome of the project.

Expected Results

The expected results of the monitoring system installed by the project and continued after the pilot study will be a one-stop solution for a set of reliable data, meta-data and key features on air transport development. This constitutes the base for decision-making in aviation and regular qualitative and - as far as is possible and necessary - quantified information on new developments of key factors in air transport. The proposed strategy will allow for a periodic updating and possible modification of aviation scenarios, which has been required by stakeholders of the aviation community as an indispensable prerequisite for an effective use of the scenario technique for short-, medium-, and long-term planning. The set of data collected, analysed and effectively disseminated by the Monitoring System will include both internal information on air transport and information on factors and features of those key external fields setting the frame for aviation.

Acronym:	MONITOR	
Name of proposal:	Monitoring System of the Development of Global Aviation	
Grant Agreement:	233999	
Instrument:	CSA – SA	
Total cost:	743 887 €	
EU contribution:	529 011 €	
Call:	FP7–AAT–2008–RTD–1	
Starting date:	01.06.2009	
Ending date:	31.05.2011	
Duration:	24 months	
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REStARTS
Raising European Student Awareness in Aeronautical Research Through School labs

State of the Art - Background

Developments in science and technology have always been an essential part of societal progress. The ever-increasing importance of science has required both young scientists capable of innovation in a competitive knowledge–based society and scientifically literate citizens. However, a gap has gradually built up between scientists and the public, and this has resulted in a decrease in people's interest, particularly youngsters, towards science and technology.

This drop in interest is not without consequences: although Europe is aiming at a leading position in the aeronautical industry, there are major concerns relating to the educational system being able to provide the human resources needed to sustain the actual trend in development.

Current achievements in aeronautical research at EU level have benefited from a generation of engineers with a specific passion and dedication to this domain, formed from a very early stage in their education.

But today's situation is very different. A very limited number of students are attracted towards engineering activities. The implications are that as the number of interested students decreases, the level of European specialists will be reduced, together with less knowledge in key domains, resulting in a need to rely on non-European engineers. This would be a significant step back for European industry in the high technology domains.

Objectives

In order to improve the current situation, specific actions are needed at all levels in the educational process. Joint actions at EU level are necessary in the global context of integration and harmonisation of resources. The project REStARTS creates structures that will link the science-teaching world with the aeronautical research organisations.

The concept of REStARTS is to establish a well coordinated link between research organisations in aeronautical sciences and academia for sharing the knowledge, dedicated research infrastructure and the latest research results in order to improve the education of a new generation of engineers for the European aeronautical industry. The objective is to make a significant impact on the educational process from a very early stage and raise public awareness to the technological challenges in aeronautics.

The focus of the activities is dedicated labs, where young students can benefit best from the research infrastructure and knowledge accumulated in complex research projects.

The partners of REStARTS are research and training establishments in aerospace which have considerable experience in aerodynamics and its related areas. An educational partner, the School of Education at the University of Leicester, will ensure the accessibility and impact of the resulting product for teachers and students.

Description of Work

In this project, the partners of the aeronautical research and training institutes develop informative material about current research topics in aeronautics, including basic aerodynamic fundamentals like 'How does an aeroplane fly?' or special challenges the aeronautical research is facing like 'How to make air transport greener' or 'How to ensure satisfaction, safety and security of the passengers. These demonstrate the direct link between research and society.

Children experimenting with flow visualisation at DLR's school lab

The scientists work in co-operation with a pedagogic team and teachers of local schools to compile understandable teaching material, which also includes simple experiments to demonstrate the physical phenomena being investigated. The school lessons based on this material give a first impression of the challenges of modern aeronautical research. The school labs established at the research institutes provide more sophisticated experiments and enable classes to get hands-on experience in scientific work. Additional visits to the laboratories of the project partners and their industrial partners complete the programme.

This will build bridges between school theory and applied research by delivering an insight into the work of research organisations. The ambition is to stimulate young people's interests in a R&D career in aeronautics and to create a European network of aeronautical school labs.

Expected Results

Initiatives from research centres to communicate with young people and teachers are rare. Few national initiatives exist but a large number of isolated researchers try to communicate through various media. The long-term objective of REStARTS is to establish a European platform based on this pilot experience, which will result in teaching material on aeronautics. Beyond this pilot phase, the aim is to demonstrate the efficiency of school labs to motivate young people, and in particular girls, towards aeronautics.

Deliverables consist of resources of written documentation and protocols for experiments for primary and secondary teachers. The reputation of research and training centres such as CIRA, INCAS, VKI, and DLR in terms of scientific research is already established. The participation of experts in pedagogy will guarantee that the REStARTS project will become the pilot for a process that will generate strong motivation towards aeronautics for a large number of children and students, leading to a better public image.

Acronym:	REStARTS
Name of proposal:	Raising European Student Awareness in Aeronautical Research Through School labs
Grant Agreement:	233973
Instrument:	CSA – SA
Total cost:	357 700 €
EU contribution:	253 501 €
Call:	FP7–AAT–2008–RTD–1
Starting date:	15.03.2009
Ending date:	14.03.2012
Duration:	36 months
Website:	http://www.fp7-restarts.eu
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CP – IP

CSA – CA

CSA – SA

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Aeronautics and Air Transport Research in the Seventh Framework Programme

The aim of this publication is to provide information on more than 80 projects which were selected in the first two FP7 Calls in the field of Aeronautics and Air Transport.

The background, objectives, description of work and expected results of each project are described. The contact details of the project coordinators and the partnerships are also given. Comprehensive index lists by technical discipline, acronym, partner and instrument are also provided to facilitate your search.

Aeronautics and Air Transport Research
7th Framework Programme 2007-2013

Project Synopses – Volume 1
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